

SSN College of Engineering
Department of English
R2018
Course Outcomes

First Year - Theory Courses

Course Code	Course Name	COs	Course Outcomes
UEN1176	Communicative English	CO 1	Apply reading strategies to comprehend articles of a general kind in magazines and newspapers
		CO 2	Comprehend conversations and short talks delivered in English in both formal and informal contexts
		CO 3	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English
		CO 4	Write short essays of a general kind and personal letters and emails in English

Course Code	Course Name	COs	Course Outcomes
UEN1276	Technical English	CO 1	Apply reading strategies to comprehend technical texts and write area- specific texts effortlessly
		CO 2	Listen and comprehend lectures and talks in science and technology.
		CO 3	Speak appropriately and effectively in varied formal and informal contexts.
		CO 4	Write technical documents like reports, emails, resumes and winning job applications.

Higher Semester – Lab Courses

Course Code	Course Name	COs	Course Outcomes
UEN1498	Interpersonal Skills	CO 1	Listen and respond appropriately
		CO 2	Participate in group discussions
		CO 3	Make effective presentations
		CO 4	Participate confidently and appropriately in conversations both formal and informal.
		CO 5	Face campus interviews adequately.

Course Code	Course Name	COs	Course Outcomes
UEN1597	Professional Communication s Lab	CO 1	Make effective presentations
		CO 2	Participate confidently in Group Discussions
		CO 3	Attend job interviews and be successful in them
		CO 4	Develop adequate Soft Skills required for the workplace

SSN College of Engineering, Chennai
Department of English
R2021
Course Outcomes

First Year - Lab cum Theory Courses
First Semester

Course Code	Course Name	COs	Course Outcomes
UEN2176	Technical English	CO 1	To read and comprehend technical texts
		CO 2	To write emails, letters, proposals, reports, and SOPs
		CO 3	To speak effectively for GDs and technical presentations
		CO 4	To listen and comprehend technical texts
		CO 5	To use correct grammatical structures for speaking and writing

Second Semester

Course Code	Course Name	COs	Course Outcomes
UEN2241	LANGUAGE AND COMMUNICATION	CO 1	To improve their communicative competency across all skills of language.
		CO 2	To improve their writing ability in writing for persuasion and convincing someone.
		CO 3	To attend job interviews more confidently,
		CO 4	To improve social communication sensitive to gender and other prejudices.
		CO 5	To do better in the spoken component of the placement tasks

Course Code	Course Name	COs	Course Outcomes
UHS2241	HUMAN RELATIONS AT WORK	CO 1	Enhance their awareness about human relations at work and its relationship with self.
		CO 2	Explain the processes involved in interaction with people at work.
		CO 3	Explain the importance of psychological and physical health in maintaining human relations at work.
		CO 4	Describe the ways and means to improve human relations at work.
		CO 5	Realize the importance of safeguarding themselves from any exploitation.

Course Code	Course Name	COs	Course Outcomes
UHS2242	APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE	CO 1	Raise their awareness on applications of psychology to everyday issues of life,
		CO 2	Deal more efficiently with different issues in society, workplace and human behavior.
		CO 3	Apply principles of psychology in their own personal and professional lives.
		CO 4	Use the psychological principles for their own human development.
		CO 5	Appreciate the impact of Psychology on human life

Course Code	Course Name	COs	Course Outcomes
UHS2243	FILM APPRECIATION	CO 1	Process of the development of film as an art and entertainment form.
		CO 2	Evolution of the language of cinema as it evolved over a century.
		CO 3	Script writing techniques of a film and appreciate the various nuances.
		CO 4	Evolution of film industry from the past to present

		CO 5	How to appreciate all aspects of the film.

Higher Semester

Course Code	Course Name	COs	Course Outcomes
UEN2041	ENGLISH FOR CAREER NEEDS	CO 1	Make informed choices for one's career and pursue in attaining it in the right direction
		CO 2	Acquire professional traits/attributes and soft skills for a rewarding career.
		CO 3	Face Interviews (online/offline) with greater levels of confidence and motivation
		CO 4	Acquire adequate language skills for better performance in GDs
		CO 5	Acquire adequate language skills for making effective presentations

R2018 B.E. Biomedical Engineering

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	UEN1176	Communicative English	C101.1	Apply reading strategies to comprehend articles of a general kind in magazines and newspapers
			C101.2	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English
			C101.3	Comprehend conversations and short talks delivered in English in both formal and informal contexts
			C101.4	Write short essays of a general kind and personal letters and emails in English
C102	UMA1176	Algebra and Calculus	C102.1	Obtain the expansion of trigonometric functions using De-Moivre's theorem.
			C102.2	Determine the Eigen values and Eigen vectors and diagonalize the given matrix.
			C102.3	Evaluate the circle of curvature, evolute and envelope of a given curve.
			C102.4	Find Taylor's expansion for functions of two variables, solve problems using Jacobians and find the extreme points of a function of two variables.
			C102.5	Solve problems using beta and gamma functions and evaluate problems in double integral and triple integral
C103	UPH1176	Engineering Physics	C103.1	Analyze crystal structures and the influence of imperfections on their properties.
			C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
			C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.

			C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.
C104	UCY1176	Engineering Chemistry	C104.1	The knowledge gained on water treatment techniques, polymers, phase rule, fuels and electrochemistry and corrosion will facilitate better understanding of engineering processes and applications for further learning
C105	UGE1176	Problem Solving and Programming in Python	C105.1	Think logically to solve programming problems and write solutions in pseudo code.
			C105.2	Understand and develop simple Python programs using conditionals and loops.
			C105.3	Decompose a program into functions.
			C105.4	Represent compound data using Python lists, tuples, and dictionaries.
			C105.5	Perform input/output with files.
C106	UGE1177	Engineering Graphics	C106.1	Familiarize with the fundamentals and standards of Engineering graphics
			C106.2	Perform freehand sketching of basic geometrical constructions and multiple views of objects.
			C106.3	Project orthographic projections of lines and plane surfaces.
			C106.4	Draw projections and solids and development of surfaces.
			C106.5	Visualize and to project isometric and perspective sections of simple solids.
			C106.6	Read a building drawing
C107	UGE1197	Programming in Python Lab	C107.1	To write, test, and debug simple Python programs.
			C107.2	To implement Python programs with conditionals and loops.
			C107.3	Use functions for structuring Python programs.
			C107.4	Represent compound data using Python lists, tuples, and dictionaries.
			C107.5	Read and write data from/to files in Python.

R2018 B.E. Biomedical Engineering

C108	UGS1197	Physics and Chemistry Lab	C108.1	ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of The physical properties of materials like elasticity, compressibility, and viscosity
			C108.2	ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of The optical properties of materials such as diffraction, interference and Numerical aperture
			C108.3	Ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of Thermal and electrical properties of materials such as conductivity and band gap.
			C108.4	Evaluate the quality of water
			C108.5	Determine the metals and ions present in any given sample using various analytical techniques
			C108.6	Measure properties such as conductance of solutions, redox potentials
C109	UEN1276	Technical English	C109.1	Apply reading strategies to comprehend technical texts and write area- specific texts effortlessly.
			C109.2	Listen and comprehend lectures and talks in science and technology.
			C109.3	Speak appropriately and effectively in varied formal and informal contexts.
			C109.4	Write technical documents like reports, emails, resume and winning job applications.
C110	UMA1276	Complex Functions and Laplace Transforms	C110.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations.
			C110.2	Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function.
			C110.3	Obtain the Laplace Transforms of standard functions.

			C110.4	Solve Differential Equations of Second order and Simultaneous linear equations with constant coefficients of first order using Laplace Transform.
			C110.5	Solve problems using divergence and curl and evaluate line, Surface and Volume integrals
C111	UPH1254	Physics for Biomedical Engineering	C111.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.
			C111.2	Comprehend the basics of semiconductor physics and its application to simple devices like PN junction devices.
			C111.3	Understand magnetic and superconducting phenomena exhibited by materials and their applications to biomedical field.
			C111.4	Exemplify and identify the characteristics and limitations of biomedical imaging techniques based on sound, radiations and nuclear emissions.
			C111.5	Explain the properties and characteristics of biocompatible materials and how they have been tailored to realize different bio-functional devices
C112	UGE1276	Basic Civil and Mechanical Engineering	C112.1	Appreciate the Civil and Mechanical Engineering components
			C112.2	Explain the usage of construction material and proper selection of construction materials.
			C112.3	Measure distances and area by surveying
			C112.4	Identify the components used in power plant cycle.
			C112.5	Demonstrate working principles of petrol and diesel engine.
			C112.6	Elaborate the components of refrigeration and Air conditioning cycle
C113	UBM1202	Electronic Devices and Circuits	C113.1	Understand working principle of PN Junction diode and its application
			C113.2	Understand the construction, modelling and operating BJT (CE, CC, and CB configurations),

R2018 B.E. Biomedical Engineering

			C113.3	Understand the construction, modelling and operating principle of FET and MOSFET
			C113.4	Understand the working and operation of differential, power amplifiers and wave shaping circuits
			C113.5	Understand the working and operation of feedback amplifier and oscillators
C114	UBM1201	Circuit Theory	C114.1	Ability to analyse AC and DC Circuits
			C114.2	Ability to apply circuit theorems
			C114.3	Understand the concept of resonance and design different combination of resonant circuits
			C114.4	Design transient circuit for different types of excitation
			C114.5	Understand two port network and its application
C115	UGE1297	Design Thinking and Engineering Practice Laboratory	C115.1	Ability to fabricate carpentry components
			C115.2	Ability to make the pipe connections including plumbing works.
			C115.3	Ability to use welding equipment's to join the structures.
			C115.4	Ability to fabricate electrical circuits
			C115.5	Ability to fabricate electronics circuits
C116	UBM1211	Electron Devices and Electric circuits Laboratory	C116.1	Learn the characteristics of basic electronic devices
			C116.2	Design RL and RC circuits
			C116.3	Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems
C201	UMA1376	Transform Techniques and Partial Differential Equations	C201.1	Solve engineering problems using Fourier series.
			C201.2	Understand and solve partial differential equations of first and higher order.
			C201.3	Use Fourier series techniques to solve partial differential equations.

			C201.4	Apply Fourier transform techniques to solve some of the physical problems of engineering.
			C201.5	Apply Z - transform techniques to solve some of the physical problems of engineering.
C202	UBM1301	Sensors for Healthcare	C202.1	Illustrate the various characteristics of sensors and measurement system.
			C202.2	Select appropriate passive or active transducers for measurement of displacement, temperature and pressure.
			C202.3	Evaluate the use of photoelectric and piezoelectric sensors for biomedical applications.
			C202.4	Use the chemical and biosensors for measuring glucose and urea.
			C202.5	Assess AC and DC bridges and recorders for appropriate measurement
C203	UIT1351	OOPS and Java Programming	C203.1	Explain the concepts of Object oriented programming.
			C203.2	Write simple applications using C++.
			C203.3	Discuss about inheritance and interfaces.
			C203.4	Create applications using Java.
			C203.5	Implement object oriented programming in real life problems
C204	UBM1302	Fundamentals of Biochemistry	C204.1	Describe the fundamentals of biophysical properties
			C204.2	Illustrate biochemical principles, such as the structure/function of biomolecules.
			C204.3	Depict an understanding of metabolic pathways, and the regulation of biological/biochemical processes
			C204.4	Describe the basic properties and regulation of enzymes
			C204.5	Apply the analytical techniques in biochemistry
C205	UBM1303	Human Anatomy and Physiology	C205.1	Discuss cell biology, reproductive physiology and basic tissue types.
			C205.2	Reproduce the structure and functions of digestive system and excretory system.

R2018 B.E. Biomedical Engineering

			C205.3	Relate the structure and functions of musculoskeletal and respiratory system.
			C205.4	Explain the structure and functioning of cardiovascular system and endocrine organs.
			C205.5	Write about the structure and functions of nervous system and special senses.
C206	UEE1352	Basics of Electrical Engineering	C206.1	Design simple electrical circuits and understand through nodal, mesh analysis about constructing series and parallel configuration of circuits with sources and variable loads.
			C206.2	Explain the concepts of three phase power circuits.
			C206.3	Comprehend the concepts in electrical generators, motors and transformers.
			C206.4	Choose appropriate measuring instruments for given application.
			C206.5	Analyze existing power distribution and hence apply technology in electrical applications.
C207	UBM1311	Biochemistry and Human Physiology Laboratory	C207.1	Depict qualitative test of different biomolecules.
			C207.2	Perform the Biochemical and hematological parameters and their interpretation in clinical sample.
			C207.3	Illustrate the separation technology of proteins and amino acids.
			C207.4	Describe the understanding of physiological parameters
C208	UIT1371	OOPS and Java Programming Laboratory	C208.1	Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
			C208.2	Develop and implement Java programs with array list, exception handling and multithreading.
			C208.3	Design applications using file processing, generic programming and event handling.
C209	UMA1477		C209.1	Identify standard distributions and apply them.

		Probability Theory and Stochastic Processes	C209.2	Solve problems in two dimension random variables and find the correlation between them.
			C209.3	Analyze different types of random processes.
			C209.4	Find the relation between Auto correlation function and Power density spectrum.
			C209.5	Find the response of random inputs to linear time invariant systems.
C210	UBM1401	Pathology and Microbiology	C210.1	Describe the basic nature of disease processes.
			C210.2	Classify diseases and apply knowledge of pathology's role in the diagnosis, staging and management of disease.
			C210.3	Depict theory and practical skills in microscopy and their handling techniques and staining procedures.
			C210.4	Identify common infectious agents and the diseases that they cause.
			C210.5	Illustrate the immunological reactions for the disease diagnosis.
C211	UBM1402	Fundamentals of Signals and Systems	C211.1	Determine if a given system is linear/causal/stable.
			C211.2	Determine the frequency components present in a signal.
			C211.3	Describe LTI systems in the time domain and frequency domain.
			C211.4	Determine the output of an LTI system in the time and frequency domains.
			C211.5	Determine the statistical properties and estimation of power in random signals.
C212	UBM1403	Analog and Digital ICs	C212.1	Summarize the basic building blocks of linear integrated circuits and the linear and non- linear applications of operational amplifiers.
			C212.2	Interpret the concepts of waveform generation and introduce some special function ICs 555 and 565.
			C212.3	Define the theory of active filter, ADC and DAC.
			C212.4	Illustrate the Digital fundamentals, Boolean algebra and its applications in digital systems, and familiarize with the design of various combinational digital circuits using logic gates.

R2018 B.E. Biomedical Engineering

			C212.5	Analyze and design procedures for synchronous and asynchronous sequential circuits.
C213	UBM1404	Analog and Digital Communication	C213.1	Apply analog communication techniques
			C213.2	Utilize pulse communication techniques
			C213.3	Apply keying techniques
			C213.4	Analyze Source and Error control coding
			C213.5	Utilize cellular concept and multiple access techniques
C214	UBM1405	Biomaterials	C214.1	Analyze the different types of Biomaterials and its classification with nanoscale concepts.
			C214.2	Identify the significant gap required to overcome the challenges with respect to metals and ceramics
			C214.3	Illustrates the importance of polymeric materials and its composite.
			C214.4	Value the use of implant materials for tissue replacement.
			C214.5	Explain the different testing procedures used for biomaterial characterization
C215	UBM1411	Pathology and Microbiology Laboratory	C215.1	Illustrate the pathological state of different clinical conditions.
			C215.2	Demonstrate practical experiments on tissue processing.
			C215.3	Describe the staining characteristics of bacteria and differentiate these bacteria according to microscopic morphologies.
			C215.4	Perform antigen antibody reactions.
C216	UBM1412	Analog and Digital Integrated Circuits Laboratory	C216.1	Design of amplifiers, filters and oscillators using operational amplifiers.
			C216.2	Summarize the knowledge of special function IC.
			C216.3	Describes multivibrators, ADC and DAC using Special IC's
			C216.4	Design of combinational and sequential circuits.
			C216.5	Demonstrate the circuit simulation software

C217	UEN1497	Interpersonal Skills/Listening & Speaking	C217.1	Recall the listened phrases and respond appropriately
			C217.2	Prepare and Participate in group discussions
			C217.3	Construct effective presentations
			C217.4	Adapt oneself in conversations both formal and informal
			C217.5	Discuss effectively with the members in a group/public forum
C301	UBM1501	Bio Control systems	C301.1	Interpret the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems
			C301.2	Determine the time response of various systems and discuss the concept of system stability
			C301.3	Examine the frequency response characteristics of various systems using different charts
			C301.4	Appraise the concept of modeling basic physiological systems
			C301.5	Identify the application aspects of time and frequency response analysis in physiological control systems.
C302	UBM1502	Medical Instrumentation	C302.1	Recall the origin of bio potentials and electrodes for its measurement.
			C302.2	Describe the biosignal characteristics and the electrode placement for various physiological recording.
			C302.3	Design bio amplifier for various physiological recording.
			C302.4	Perform various techniques for measuring non electrical parameters.
			C302.5	Summarize the different techniques for biochemical measurements
C303	UBM1503	Radiological Equipment	C303.1	Describe the working principle of X ray machine and its application.
			C303.2	Illustrate the principle computed tomography.
			C303.3	Interpret the technique used for visualizing various sections of the body using MRI
			C303.4	Demonstrate the applications of radio nuclide imaging.
			C303.5	Outline the methods of radiation safety
C304	UBM1504		C304.1	Explain the principles of mechanics.

R2018 B.E. Biomedical Engineering

		Principles of Bio Mechanics	C304.2	Outline the basics of biofluid mechanics.
			C304.3	Provide the mechanical properties of musculoskeletal elements.
			C304.4	Develop the mathematical models of joints and implants.
			C304.5	Apply the knowledge of biomechanics into modelling and ergonomics.
C305	UBM1505	Principles of Digital Signal Processing	C305.1	Apply DFT for the analysis of digital signals and systems.
			C305.2	Design and construct IIR filter using appropriate realization method.
			C305.3	Design and construct FIR filter using appropriate realization method.
			C305.4	Characterize the effects of finite precision representation on digital filters.
			C305.5	Choose and design an optimal filter to remove the artifacts in the physiological signal.
C306a	UBM1521	Hospital management	C306a.1	Explain the basics of Hospital Management.
			C306a.2	Expound their knowledge of Human resource management and marketing for hospitals.
			C306a.3	Apply various Quantitative methods in healthcare management.
			C306a.4	Corroborate their knowledge in Hospital information system and supportive services.
			C306a.5	Elucidate about quality and safety aspects in hospital management.
C306b	UBM1525	Medical Physics	C306b.1	Explain principles underlying non ionising radiation and its biological effects
			C306b.2	Differentiate various types of physical senses in human body
			C306b.3	Distinguish different types of radiation and its effects
			C306b.4	Describe the interaction of Radiation with matter
			C306b.5	Compare various types of radiation detectors

C306c	UBM1526	Tissue engineering and Artificial Organs	C306c.1	Summaries the basics of tissue engineering
			C306c.2	Assess the use of stem cells
			C306c.3	Design, develop, implement, and evaluate the materials for tissue engineering
			C306c.4	Illustrate the application of tissue engineering
			C306c.5	Value the importance of artificial organs.
C307	UBM1511	Biomedical Instrumentation Laboratory	C307.1	Design and implement preamplifiers and signal conditioning circuits for ECG signal acquisition.
			C307.2	Design and implement amplifiers for different bio signals like EEG, EOG, EMG.
			C307.3	Design an optical isolation amplifier.
			C307.4	Acquire various non-electrical parameters using suitable sensors/transducers.
			C307.5	Implement PCB layout for any bio amplifier.
C308	UBM1512	Digital Signal Processing Laboratory	C308.1	Carryout basic signal processing operations.
			C308.2	Demonstrate their abilities towards MATLAB based implementation of various DSP systems.
			C308.3	Analyze the architecture of a DSP Processor.
			C308.4	Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals.
			C308.5	Design a DSP system for various Biomedical Applications.
C309	UBM1601	Medical Image Processing	C309.1	Explain fundamentals of medical image processing techniques.
			C309.2	Identify suitable filtering and intensity transformation technique for given medical applications.
			C309.3	Recognize the Region of Interest and segment the same from given medical image.
			C309.4	Explore current research in registration, visualization, and image understanding.

R2018 B.E. Biomedical Engineering

			C309.5	Discuss various compression methods and perform quality evaluation for the same.
C310	UBM1602	Diagnostic Equipment	C310.1	Describe the working and recording setup of cardiac and neurological equipment.
			C310.2	Discuss the recording and analysis of EMG and different biomechanical measurements.
			C310.3	Explain about measurements of parameters related to respiratory system.
			C310.4	Describe the measurement techniques of sensory responses.
			C310.5	Summarize the principle of ultrasonic, thermography and its applications in medicine.
C311	UBM1603	Microcontroller and Embedded System Design	C311.1	Summarize the basic principles of Embedded systems and understand the architecture of 8 bit microcontroller
			C311.2	Illustrate the programming and interfacing concepts using 8051 microcontroller.
			C311.3	Explain the architecture of PIC microcontroller
			C311.4	Describe the architecture of ARM based microcontroller
			C311.5	Design of microcontroller based an embedded system
C312	UCY1276	Environmental Science	C312.1	Understand the importance of the environment and describe the structure and functions of an ecosystem.
			C312.2	Identify the value and need for conservation of bio-diversity.
			C312.3	Know the importance of natural resources and its equitable use for sustainable life styles.
			C312.4	Explain the causes, effects and control measures of different types of pollution.
			C312.5	Understand various environmentally related social issues and their solutions.

			C312.6	Recall the tools for environmental regulations
			C312.7	Relate the role of environment in human population growth and development
			C312.8	Get knowledge about various techniques used for environmental monitoring and management
C313	UBM1626	Biostatistics	C313.1	Define the new and existing statistical methodology for their research problem.
			C313.2	Explain p- values for different statistical test.
			C313.3	Analyze the biomedical research data and able to report the study results.
			C313.4	Describe problems of human health and disease for the interest of advancing the public's health.
			C313.5	Enumerate the Meta analysis and variance analysis.
C314a	UBM1631	Medical Informatics	C314a.1	Design an information system, which will meet the requirement of hospital using open source software.
			C314a.2	Follow the standards for data capturing, transmission, storage and retrieval.
			C314a.3	Explain the concepts of Radiology information system along with PACS workflow.
			C314a.4	Design and demonstrate the computer aided diagnostic system for disease prediction and classification.
			C314a.5	Use latest tools and techniques to provide quality healthcare.
C314b	UBM1632	Robotics in medicine	C314b.1	Explain the basics of robotics.
			C314b.2	Illustrate kinematics in robotics.
			C314b.3	Explain the robotic sensing vision.
			C314b.4	Plan the robotic control using AI
			C314b.5	Elaborate the application of robotics in medical practice
C315	UBM1611		C315.1	Explain the basic principles of Embedded systems
			C315.2	Illustrate the architecture of 8 bit microcontroller

R2018 B.E. Biomedical Engineering

		Microcontroller and Embedded System Design Laboratory	C315.3	Apply the interfacing concepts
			C315.4	Elaborate the architecture of PIC 16F877 and LPC 2148
			C315.5	Design of simple embedded systems
C316	UBM1612	Medical Image Processing Laboratory	C316.1	Perform enhancing operations on the image using spatial filters and frequency domain filters
			C316.2	Use transforms and analyze the characteristics of the image
			C316.3	Segment the region of interest from the given medical image.
			C316.4	Estimate the efficiency of the compression technique on the images
			C316.5	Apply image processing technique to solve real healthcare problems
C317	UBM1617	Mini Project	C317.1	Analyze and Design a system or process to meet given specifications with realistic engineering constraints.
			C317.2	Identify problem statements and function individually or as a member of an engineering design team.
			C317.3	Utilize technical resources.
			C317.4	Propose technical documents and give technical oral presentations related to design mini project results.
C401	UBM1701	Applied Soft Computing	C401.1	Differentiate biological and artificial neural network.
			C401.2	Construct Association and competition based neural network.
			C401.3	Explain Fuzzy sets, relation between classical and fuzzy sets, membership function.
			C401.4	Describe advanced neural systems and algorithm
			C401.5	Describe different hybrid systems.
C402	UBM1702	Surgical and Critical Care Equipment	C402.1	Discuss the various equipment used in ICU and applications of telemetry.
			C402.2	Explain the types of diathermy and its applications.

			C402.3	Express the basics of critical care equipment's and its application in medicine.
			C402.4	Discuss the various extracorporeal and special diagnostic devices used in hospitals.
			C402.5	Outline the importance of patient safety against electrical hazard.
C403	UBM1703	Rehabilitation Engineering	C403.1	Explain the basic principles of rehabilitation Engineering
			C403.2	Design orthotic and prosthetic devices
			C403.3	Distinguish various types of mobility aids
			C403.4	Enumerate Auditory and speech assist devices
			C403.5	Differentiate sensory augmentation and its substitution
C404a	UBM1723	Brain Computer Interface	C404a.1	Evaluate concept of BCI.
			C404a.2	Describe the different brain activation signals.
			C404a.3	Select appropriate feature extraction methods.
			C404a.4	Use machine learning algorithms for translation.
			C404a.5	Develop high-fidelity BCI prototypes
C404b	UIT1731	Introduction to Deep Learning	C404b.1	Demonstrate the mathematical and computational demands of building neural networks.
			C404b.2	Explain the concept of learning in neural networks
			C404b.3	Design Convolutional Neural Networks
			C404b.4	Implement Sequence Modeling Using Recurrent Nets
			C404b.5	Explain Unsupervised and Deep Reinforcement Learning
C405	UBM1731	Biometrics	C405.1	Demonstrate knowledge engineering principles underlying biometric systems.
			C405.2	Explain fingerprint based biometric system.
			C405.3	Describe the face and voice recognition based biometric system.
			C405.4	Discuss privacy and security implications of biometrics system.

R2018 B.E. Biomedical Engineering

			C405.5	Analyse and design basic multi biometric system
C406	UIT1703	Management Principles and Practices	C406.1	Explain and discuss the elements of effective management.
			C406.2	Apply the planning, organizing, control and decision making processes
			C406.3	Explain various theories related to the development of leadership skills, motivation techniques, team work and effective communication.
			C406.4	Analyze the different control activities of management
			C406.5	Enumerate the forecasting methodologies
C407	UBM1711	Diagnostic and Therapeutic Equipment Laboratory	C407.1	Measure different bioelectrical signals using various methods.
			C407.2	Record various physiological signals using telemetry.
			C407.3	Illustrate various diagnostic and therapeutic techniques.
			C407.4	Examine the electrical safety measurements.
			C407.5	Analyze the different bio signals using suitable tools.
C408	UBM1712	Medical System Design and Modelling Lab	C408.1	Develop ability for programming in LABVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.
			C408.2	Explain the basics of interfacing and programming using related hardware.
			C408.3	Create an environment to acquire, condition, and reduce data collected from biomedical instrumentation.
			C408.4	Explore the concepts, ideas and models to develop the medical systems using AutoCAD.
			C408.5	Develop a medical instrument prototype for critical care solutions using Virtual Instrumentation.
C409	UBM1713	Hospital Training	C409.1	Demonstrate the working of medical equipment.
			C409.2	Formulate the basic preventative maintenance measures.

			C409.3	Communicate effectively with multidisciplinary teams on medical equipment working and safety issues.
			C409.4	Provide opportunity for practical, on-the-job experience.
C410	UBM1822	Assist Devices	C411a.1	Explain the assistive devices used for cardiac functions.
			C411a.2	Summarize the assistive technology used for pulmonary functions
			C411a.3	Describe the types of sensory assist devices
			C411a.4	Define the type of assistive devices for mobilization
			C411a.5	Enumerate the principles of underlying the hemodialyzer machine
C411	UBM1818	Project Work	C411.1	Plan, design and execute an engineering based project for societal needs.
			C411.2	Analyze, discuss and apply the outcome of research based work
			C411.3	Summarize an appropriate list of literature review, analyze previous researchers' work and correlate them to current project
			C411.4	Devise clearly a work plan and methodology
			C411.5	Organize, compile and record all work details in an efficient manner.
			C411.6	Categorize record and accumulate work done throughout the project.

R2018 B.E. Biomedical Engineering**PROGRAM OUTCOMES (POs):**

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental

contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

R2018

PROGRAM SPECIFIC OUTCOMES (PSOs):

1. To design and develop indigenous medical devices that resolves the current societal healthcare problems by applying the concepts of Life sciences, Engineering and Technology.
2. To apply information and communication technologies (ICT) and software skills for innovations and solving challenges in healthcare.

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	PMA2156	Applied Mathematics for Medical Electronics	C101.1	Understand and apply the concepts of fuzzy logic, transform technique and solutions using numerical methods.
			C101.2	Understand the basics of linear space and matrix theory to solve the problems.
			C101.3	Formulate and solve Linear programming problems using simplex method.
			C101.4	Understand the concepts of random processes and its properties to solve problems.
			C101.5	Understand and solve problems in graph theory and its applications in biomedical
C102	PMD2101	Biomedical Equipment	C102.1	Explain special equipments and electrical safety codes and standards
			C102.2	Describe equipments used in cardiac and pulmonary care
			C102.3	Distinguish various types' equipments in physical and Electrotherapy
			C102.4	Categorize equipments used in sensory instrumentation, biofeedback and biotelemetry
			C102.5	Enumerate the application of ultrasound in Medicine
C103	PMD2102	Bio signal Processing	C103.1	Describe the need for a biomedical analysis system.
			C103.2	Use various basic signal processing methods to analyze bio signals.
			C103.3	Apply spectral methods to analyze bio signals.
			C103.4	Assess different filters on biomedical signals and judge filter performance.
			C103.5	Analyze ECG and EEG signals with event detection and time-frequency methods.
C104	MD2103	Applied Medical Instrumentation	C104.1	State the components of a medical instrumentation system.
			C104.2	List the various biosignals and their origin and propagation.
			C104.3	Illustrate the electrode placement for various physiological recordings.
			C104.4	Design bio amplifiers for various physiological recordings and communicate effectively through reports, and presentations.
			C104.5	Explain various techniques for non-electrical physiological measurements.
			C104.6	Demonstrate different biochemical measurement techniques.
C105	PGE2176	Research Methodology and IPR	C105.1	Explain the necessity of research and its types to formulate the research plan.
			C105.2	Categorize and use the different sources of data collection based on application.
			C105.3	Differentiate various data analysis techniques and acquire knowledge for report writing.
			C105.4	Classify the need for IPR and its practices.
			C105.5	Outline the process of patenting and development.

C106	PMD2111	Medical Instrumentation Laboratory	C106.1	Differentiate and analyze the biomedical signal sources.
			C106.2	Elucidate cardiovascular system and related measurements.
			C106.3	Explain the respiratory and nervous systems and related measurements.
			C106.4	Measure non-invasive diagnostic parameters.
			C106.5	Evaluate and assess the obtained results and communicate effectively.
C107	PMD2112	Bio signal Acquisition and Processing Laboratory	C107.1	Acquire physiological signals and model the physiological systems
			C107.2	Apply the signal processing techniques for preprocessing and analysing the biosignals.
C201	PMD2201	Applied Medical Image Processing	C201.1	Expound the image fundamentals and the application of image transform for medical image analysis.
			C201.2	Describe image pre-processing applications that incorporate different concepts for enhancing the medical Images.
			C201.3	Analyze image segmentation methods and feature extraction for medical image analysis.
			C201.4	Explore the knowledge in medical image registration and visualization techniques.
			C201.5	Demonstrate the medical image fusion techniques.
C202	PMD2202	MEDICAL IMAGING AND RADIO THERAPY	C202.1	CO1: Explain different components of X-ray and CT machines.
			C202.2	CO2: Describe various Emission Imaging techniques.
			C202.3	Enumerate MRI Imaging for different applications.
			C202.4	Distinguish the therapeutic applications of Radiation.
			C202.5	Summarize information about radiation safety and protection.
C203	PMD2203	MEDICAL DEVICE DESIGN	C203.1	Explain the medical devices classification, design processes and models.
			C203.2	Apply their ideas by following certain guidelines, procedures, and specifications.
			C203.3	Develop the medical products by following design realization, and calculations.
			C203.4	Estimate the quality of the products by various evaluation methods.
			C203.5	Apply for Intellectual property right for the product and formulate the marketing strategy
C204	PMD2211	Medical Device Design Laboratory	C204.1	Analyze the unmet needs in the healthcare technologies and systems under guidance from clinical collaborators.
			C204.2	Design the hardware and/or software-based medical products by applying appropriate tools.
C205	PMD2212	Applied Medical Image Processing Laboratory	C205.1	Apply image transforms for medical image analysis.
			C205.2	Implement pre-processing techniques that incorporate different concepts of filters for medical Image Processing.

			C205.3	Analyze image segmentation methods to extract the region of interest.
			C205.4	Extract the features of medical images for medical image analysis.
			C205.5	Perform medical image fusion, registration and visualization techniques.
C206	PMD2216	Clinical Immersion (Internship) And Technical Presentation	C206.1	Acquire the knowledge on the use of medical equipment and proper handling of them at various hospital departments.
			C206.2	Relate the testing and calibration of medical devices with their safety norms and certification requirements and formulate the basic preventative maintenance measures.
			C206.3	Explore the opportunity for practical, on-the-job experience.
			C206.4	Ability to study effectively on the working of multidisciplinary teams in a clinical immersed environment
			C206.5	Present the knowledge gained for evaluation.
C207a	PMD2221	Biomedical Optics and Biophotonics	C207a.1	CO1: Explain the various optical properties of tissue.
			C207a.2	Apply the use of instruments used to measure optical properties.
			C207a.3	Illustrate the appropriate use of lasers in surgery.
			C207a.4	Demonstrate the appropriate use of lasers in diagnosis.
			C207a.5	Explain the appropriate use of lasers in therapy.
C207b	PMD2222	Transforms and Applications	C207b.1	Apply the principles of Fourier and Laplace transforms in biomedical applications.
			C207b.2	Discuss the applications of wavelet transform for various biomedical applications.
			C207b.3	Acknowledge the applications of transforms in medical imaging.
			C207b.4	Understand the concepts of multiscale transforms and its applications in medical image analysis.
			C207b.5	Explain the formation of spectrograms using Joint time frequency analysis.
C207d	PMD2223	Biomaterials and Characterization	C207c.1	Analyze different types of Biomaterials and its characteristics for implant applications.
			C207c.2	Identify significant gap required to overcome challenges and further development of metallic and ceramic materials.
			C207c.3	Create combinations of polymeric materials that could be used as a tissue replacement implant.
			C207c.4	Demonstrate different characterization technique for the developed biomaterials
			C207c.5	Analyze the different types of biomaterials testing and standards applied for biomaterials.

C207d	PMD2224	Biomedical Data Analysis	C207d.1	Define the new and existing statistical methodology for their research problem.
			C207d.2	Explain p- values for different statistical tests.
			C207d.3	Analyze the biomedical research data and be able to report the study results.
			C207d.4	Describe problems of human health and disease for the interest of advancing the public's Health.
			C207d.5	Enumerate the Meta analysis and variance analysis.
C207e	PMD2225	Anatomy and physiology	C207e.1	Give an introduction of the human body at cellular and gross level.
			C207e.2	Explain about the musculoskeletal and excretory system.
			C207e.3	Describe respiratory and digestive system.
			C207e.4	Impart the knowledge of cardiovascular and endocrine system.
			C207e.5	Expound the information on nervous system and the special senses.
C207f	PMD2226	Design Thinking in Healthcare	C207f.1	Define key concepts of design thinking.
			C207f.2	Discuss design thinking in all stages of problem solving.
			C207f.3	Explain the different phases of design thinking.
			C207f.4	Discuss the importance of creativity in product development.
			C207f.5	Explore design thinking approach to healthcare problems.
C208a	PMD2227	Bio MEMS and Lab-on-a-Chip	C208a.1	Describe the fundamental principles and concepts of MEMS technology.
			C2108a.2	Elaborate the operation of different types of sensors and actuators at micro scale level.
			C208a.3	Explain the concepts and phenomenon of microfluidics.
			C208a.4	Describe the concepts to the design of different components of micro systems.
			C208a.5	Understand the applications of MEMS and Lab-on-a-chip for medical applications.
C208b	PMD2228	Embedded Systems and IoMT	C208b.1	Explain fundamental embedded systems design paradigms, architectures, possibilities and challenges, both with respect to software and hardware.
			C208b.2	Describe the hardware architecture and features of embedded microcontrollers and peripherals.
			C208b.3	Explain software design tools and embedded system design programming phases.
			C208b.4	Describe IoT Architectures and Build simple IoT Systems using embedded target boards.
			C208b.5	Exhibit understanding of IoMT infrastructure for healthcare applications.
C208c	PMD2229	Speech and Assistive Technology	C208c.1	Identify the various temporal, spectral and cepstral features required for identifying speech units – phoneme, syllable, and word.

			C208c.2	Determine and apply Mel-frequency cepstral coefficients for processing all types of signals.
			C208c.3	Justify the use of formant and concatenative approaches to speech synthesis.
			C208c.4	Delineate major considerations in designing an assistive technology system.
			C208c.5	Describe text-to-speech conversion model.
C208d	PMD2231	Medical Innovation and Entrepreneurship	C208d.1	Distinguish strategy in healthcare innovation
			C208d.2	Describe the role of entrepreneurship
			C208d.3	Identify the skills and traits to be an entrepreneur
			C208d.4	Illustrate business concept and delivery strategy
			C208d.5	Express various types of investors
C208e	PMD2232	Machine Learning for Healthcare	C208e.1	Distinguish between, supervised, unsupervised and semi-supervised learning.
			C208e.2	Explain different Fuzzy methods in decision making.
			C208e.3	Design systems that uses the appropriate graph models of machine learning.
			C208e.4	Modify existing machine learning algorithms to improve classification efficiency.
			C208e.5	Explain different Neuro-Fuzzy model used for classification and regression problems.
C208f	PMD2233	Applied Biomechanics	C208f.1	Interpret the principles of mechanics, kinetics and kinematics in the context of biological systems.
			C208f.2	Appraise the basics of kinetics and kinematics.
			C208f.3	Examine the mechanical properties of musculoskeletal elements.
			C208f.4	Apply the knowledge of biomechanics in joints analysis.
			C208f.5	Evaluate relevance and use of engineering fundamentals in medical Biomechanics to advanced industrial applications or products.
C301	PMD2318	Project Phase I	C301.1	Plan, design and execute an engineering-based project for societal needs
			C301.2	Analyze, discuss and apply the outcome of research-based work
			C301.3	Summarize an appropriate list of literature reviews, analyze previous researchers' work and correlate them to carry out the current project
			C301.4	Devise clearly a work plan and methodology
			C301.5	Organize, compile, record and communicate all work details in an efficient manner
C302a	PMD2321	Applied Artificial Intelligence for Healthcare	C302a.1	Comprehend models of human and artificial intelligence, specifically computational models of intelligence.
			C302a.2	Comprehend a collection of machine learning models (identified and covered in the course), and their applications in medicine and healthcare.

			C302a.3	Identify and apply appropriate intelligent system models and computational tools to specific problems in biomedicine and healthcare.
			C302a.4	Analyze the performance of specific models as applied to biomedical problems, and justify their use and limitations.
			C302a.5	Identify and interpret methods and evidence from artificial intelligence and other relevant literature.
			C302a.6	Communicate and disseminate knowledge in any science or engineering domain in the context of computing, systems, and/or biomedical applications
C302b	PMD2322	Brain Computer Interface	C302b.1	Comprehend and appreciate the significance and role of this course in the present contemporary world.
			C302b.2	Select the appropriate signal source for building BCI applications.
			C302b.3	Select appropriate feature extraction methods.
			C302b.4	Use machine learning algorithms for translation.
			C302b.5	Explore BCIs for different applications and communicate effectively through reports, and presentations.
C302c	PMD2323	Additive Manufacturing of Medical Devices	C302c.1	Demonstrate the basics of Additive manufacturing.
			C302c.2	Design and assembly of various parts for the desired task.
			C302c.3	Explain the process involved in laser and UV based AM.
			C302c.4	Illustrate the process of fused deposition molding and sheet lamination.
			C302c.5	Support design and manufacturing, case studies relevant to the medical field, application of additive manufacturing in the medical industry.
C302d	PMD2324	Hospital and Healthcare Equipment Management	C302d.1	Discuss the functions of hospital organization and management.
			C302d.2	Follow the various medical regulations to make sure patient safety.
			C302d.3	Apprehend the organization structure in hospitals, duties and responsibilities of clinical engineers in hospitals.
			C302d.4	Perform equipment installation, service & calibration needs and Planning activities at health care centers.
			C302d.5	Repair methods for material handling equipment.
C302e	PMD2325	Assist Devices and Implant Technology	C302e.1	Explain the assistive devices used for cardiac functions.
			C302e.2	Summarize the assistive technology used for pulmonary functions.
			C302e.3	Describe the principles of assist devices used for renal functions.

			C302e.4	Specify the types of assistive devices used for mobility of limbs.
			C302e.5	Explain the principles of implant technology and design parameters.
C302f	PMD2326	Computer Vision and Immersive Healthcare Technology	C302f.1	Determine image processing methods for Computer Vision.
			C302f.2	Decipher the use of segmentation and calibration in Computer Vision.
			C302f.3	Explain feature detection and object detection methods.
			C302f.4	Describe Virtual and Augmented Reality methods.
			C302f.5	Explore the applications of immersive technology in healthcare
C303a	PMD2327	Smart wearables in healthcare	C303a.1	Describe the basics of wearable systems.
			C303a.2	Illustrate the use of smart sensors and value various technologies used in wearable devices.
			C303a.3	Explain wireless body area networks.
			C303a.4	Enumerate classification algorithms in data processing of wearable devices.
			C303a.5	Report the design and applications of wireless health platforms as a report.
C303b	PMD2328	Nanomaterials and Implant Devices	C303b.1	Explain the basics of nanoscale science and technology.
			C303b.2	Illustrate the different methods that are used to prepare nanomaterials.
			C303b.3	Demonstrate the different characterization techniques used for characterizing the nanomaterials.
			C303b.4	Describe the functioning of various implantable electronic devices.
			C303b.5	Exhibit their knowledge in orthopedic and dental implants.
C303c	PMD2329	Physiological System Modeling and Simulation	C303c.1	Explain the application of Physiological models.
			C303c.2	Describe the methods and techniques for analysis and synthesis of Linear and dynamic systems.
			C303c.3	Develop differential equations to describe the compartmental physiological model.
			C303c.4	Describe Nonlinear models of physiological systems.
			C303c.5	Illustrate the Simulation of physiological systems.
C303d	PMD2331	Biomedical Informatics	C303d.1	Assess and evaluate the healthcare information systems.
			C303d.2	Express user requirements for information systems in healthcare according to standard methodologies.
			C303d.3	Effectively develop, implement, and evaluate evidence-based approaches to advance the field and systems of healthcare delivery.
			C303d.4	Analyze and synthesize various data related to patient health information.
			C303d.5	Advance the effective use of healthcare information systems to ensure high-quality outcomes.

C303e	PMD2332	Medical Device Regulatory Process	C303e.1	Determine regulatory classification of medical devices.
			C303e.2	Decipher the meaning of ISO standards from a regulatory perspective
			C303e.3	Explain US-FDA, IEC and European regulations.
			C303e.4	Describe regulations in India
			C303e.5	Explain the regulatory aspects of clinical trials and digital alternatives
C303f	PMD2333	Rehabilitation Engineering Technology	C303f.1	Explain the basic principles of rehabilitation Engineering.
			C303f.2	Design orthotic and prosthetic devices.
			C303f.3	Distinguish various types of mobility aids.
			C303f.4	Enumerate Auditory and speech assist devices.
			C303f.5	Differentiate sensory augmentation and its substitution.
C304a	PMD2334	FPGAs in Healthcare	C304a.1	Explain the architecture of FPGA and design flow and emphasize the significant role of FPGA in System design and development.
			C304a.2	Develop program using Hardware Descriptive Language and model digital logic combinational and sequential circuits.
			C304a.3	Describe the Interfacing peripherals, Board Design concepts.
			C304a.4	Design digital hardware systems for biosignal and image processing systems with the help of FPGA tools.
			C304a.5	Apply the knowledge of digitally integrated circuit hardware design for solving healthcare problems.
C304b	PMD2335	Robotics and Automation in Medicine	C304b.1	Give introduction to the basics of Robotics.
			C304b.2	Show proficiency in kinematics applied to robotics.
			C304b.3	Explain the working of robot sensors and machine vision.
			C304b.4	Tell about programming languages used in robotics.
			C304b.5	Elaborate upon examples of applications of robotics in medical practice.
C304c	PMD2336	Telemedicine and Telehealth Technology	C304c.1	Demonstrate the principles, social and legal issues of telemedicine.
			C304c.2	Explain the communication techniques used for telemedicine.
			C304c.3	Outline the protocols behind encryption techniques for the secure transmission of data.
			C304c.4	Extend the healthcare system from e-health to m-health.
			C304c.5	Make use of telemedicine for remote diagnosis.
C304d	PMD2337	Cognitive Neuroscience	C304d.1	Explain the background and methods of cognitive neuroscience.
			C304d.2	Describe the core processes-action & memory.
			C304d.3	Enumerate the concept of core processes-emotion & language.
			C304d.4	Explain the concept of control processes.

			C304d.5	Explain various milestones in cognitive neuroscience.
C304e	PMD2338	Optimization Techniques	C304e.1	Enumerate the principles of Optimization.
			C304e.2	Describe the conventional methods in optimization.
			C304e.3	Implement the Evolutionary Optimization techniques.
			C304e.4	Evaluate dynamic programming in optimization.
			C304e.5	Construct different Optimization algorithms for problems in Biomedical Engineering
C304f	PMD2339	Microfluidic Devices and Medical Applications	C304f.1	Describe the fundamental principles and concepts of microfluidics.
			C304f.2	Explain the different types of materials and fabrication techniques used in developing microfluidic devices.
			C304f.3	Elaborate the design considerations of various microfluidic devices.
			C304f.4	Illustrate the bioanalytical applications of microfluidic devices.
			C304f.5	Elucidate the diagnostic and therapeutic applications of microfluidic devices.
C401	PMD2418	PROJECT PHASE II	C401.1	CO1: Plan, design and execute an engineering based project for societal needs.
			C401.2	Analyze, discuss and apply the outcome of research based work.
			C401.3	Summarize an appropriate list of literature review, analyze previous researchers' work and correlate them to carry out the current project.
			C401.4	Devise clearly a work plan and methodology.
			C401.5	Organize, compile, record and communicate all work details in an efficient manner.

M.E Medical Electronics**R2018**

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	PMA1176	Advanced Applied Mathematics	C101.1	Apply different decomposition techniques in matrix theory, the methods of solving system of linear equations using least square method
			C101.2	Understand the concept of a random process and its classification
			C101.3	Apply the numerical method techniques to solve ordinary differential equations.
			C101.4	Understand the principle of optimality, formulation and computation of dynamic programming problems
			C101.5	Acquire skills in identifying and solving problems in queuing models
C102	PMD1101	Anatomy and Human Physiology	C102.1	Explain the basics of anatomy with an introduction to cell biology and homeostasis.
			C102.2	Tell various components of the musculoskeletal system
			C102.3	Illustrate the structure and functions of the respiratory, digestive and excretory system
			C102.4	Exhibit their knowledge about the cardiovascular and endocrine system.
			C102.5	Discuss the details of the human nervous system.
C103	PMD1102	Bio Signal Processing	C103.1	Design a biomedical system.
			C103.2	Use various methods to acquire bio signals
			C103.3	Assess different filters on biomedical signals and judge filter performance
			C103.4	Analyze ECG and EEG signal with characteristic feature points.
			C103.5	Differentiate bio-signals based on their characteristics.
C104	PMD1103	Applied Medical Instrumentation	C104.1	Demonstrate the different bio potentials and their propagations
			C104.2	Illustrate the electrode placement for various physiological recordings
			C104.3	Design bio amplifier for various physiological recordings.
			C104.4	Explain various techniques for non-electrical physiological measurements.
			C104.5	Demonstrate different biochemical measurement techniques.
C105	PMD1104	Biomedical Equipment	C105.1	Describe equipment used in cardiac and pulmonary care
			C105.2	Distinguish various types equipment in physical and Electrotherapy

			C105.3	Categorize equipment used in sensory instrumentation
			C105.4	Enumerate the application of ultrasound in Medicine
			C105.5	Explain special equipment and electrical safety
C106a	PMD1121	Biomedical Optics	C106a.1	Explain the various optical properties of tissue
			C106a.2	Apply the use of instruments used to measure optical properties
			C106a.3	Illustrate the appropriate use of lasers in surgery
			C106a.4	Demonstrate the appropriate use of lasers in diagnosis
			C106a.5	Explain the appropriate use of lasers in therapy
C106b	PMD1122	Health Care and Hospital Equipment Management	C106b.1	Apprehend the health organization structure of India, and types of hospitals
			C106b.2	Summarize the different aspects of management of hospital organization
			C106b.3	Describe the duties of clinical engineer in hospitals
			C106b.4	Summarize the regulatory requirements needed for hospitals.
			C106b.5	Develop different procedures for equipment maintenance management
C106c	PMD1123	Biomedical Informatics	C106c.1	Assess and evaluate the healthcare information systems.
			C106c.2	Express user requirements for information systems in healthcare according to standard methodologies
			C106c.3	Effectively develop, implement, and evaluate evidence-based approaches to advance the field and systems of healthcare delivery
			C106c.4	Analyze and synthesize various data related to patient health information.
			C106c.5	Advance the effective use of healthcare information systems to ensure high-quality outcomes
C106d	PMD1124	Rehabilitation Engineering Technology	C106d.1	Explain the basic principles of rehabilitation Engineering
			C106d.2	Design orthotic and prosthetic devices
			C106d.3	Distinguish various types of mobility aids
			C106d.4	Enumerate Auditory and speech assist devices
			C106d.5	Differentiate sensory augmentation and its substitution
C106e	PMD1125	Biomaterials and its Characterization	C106e.1	Describe different approaches to biomaterials engineering
			C106e.2	Identify the significant gap required to overcome challenges and further development
			C106e.3	Develop critical analyses of biomaterials through proposal writing and review
			C106e.4	Demonstrate different characterization techniques for the developed biomaterials
			C106e.5	Differentiate the use and advantage of In vitro and In vivo testing of biomaterials,
C107	PMD1111		C107.1	Differentiate and analyse the biomedical signal sources.
			C107.2	Elucidate cardiovascular system and related measurements

		Medical Instrumentation Laboratory	C107.3	Explain the respiratory and nervous systems and related measurements Measure non-invasive diagnostic parameters
C108	PMD1201	Applied Medical Image Processing	C108.1	Interpret the basics of image models, digitization of images and the transformations of images
			C108.2	Experiment with various filtering techniques for noise reduction and enhancement in images
			C108.3	Analyze segmentation techniques to extract the regions of interest and determine features that are more significant for image analysis
			C108.4	Compare the classification protocols and identify the optimal algorithm based on the images
			C108.5	Explain the significance of registration of various imaging modalities and appraise the concepts of image visualization in healthcare
C109	PMD1202	Medical Imaging and Radio Therapy	C109.1	Explain different components of X-ray and CT machines
			C109.2	Describe various Emission Imaging techniques
			C109.3	Enumerate MRI Imaging for different applications
			C109.4	Distinguish the therapeutic applications of Radiation
			C109.5	Summarize information about radiation safety and protection
C110	PMD1203	Biomechanics	C110.1	Tell the applications of mechanics in medicine and basics of biomechanics
			C110.2	Explain the mechanical properties of blood and the mechanics of human circulatory system
			C110.3	State the mechanical properties of skeletal system
			C110.4	Review the basics of structural analysis of joints, gait and medical implants.
			C110.5	Apply the technique of finite element method and manufacturing of medical implants.
C111a	PMD1221	Bio MEMS and its Applications	C111a.1	Elaborate the operation of different types of sensors and actuators at micro scale level
			C111a.2	Illustrate the design issues at micro scale level
			C111a.3	Explain about different materials used for MEMS applications
			C111a.4	Describe the concepts to the design of different types of micro systems
			C111a.5	Demonstrate the CAD tools for MEMS design
C111b	PMD1222	Cognitive Neuro Science	C111b.1	Explain the basic of the cognitive neuroscience.
			C111b.2	Describe the concept of learning.
			C111b.3	Enumerate the concept of brain perception
			C111b.4	Explain the concept of high level brain functions

			C111b.5	Explain various the neuroimaging techniques
C111c	PMD1223	Pattern Recognition and Its Applications	C111c.1	Explain the fundamentals of pattern recognition
			C111c.2	Enumerate parametric PR system
			C111c.3	Demonstrate non-parametric PR system
			C111c.4	Apply the concepts of unsupervised learning methods
			C111c.5	Analyse various graphical methods in PR systems
C111d	PMD1224	Machine Learning Techniques	C111d.1	Distinguish between, supervised, unsupervised and semi-supervised learning
			C111d.2	Explain different Fuzzy methods in decision making
			C111d.3	Design systems that uses the appropriate graph models of machine learning
			C111d.4	Modify existing machine learning algorithms to improve classification efficiency
			C111d.5	Explain different Neuro-Fuzzy models used for classification and regression problems.
C111e	PMD1225	Telemedicine and Telehealth Technology	C111e.1	Technologies applied in multimedia using telemedicine.
			C111e.2	Protocols behind encryption techniques for secure transmission of data.
			C111e.3	Applications of telehealth in healthcare.
C112a	PMD1226	Computer Based Medical Instrumentation	C112a.1	Expose to PC hardware as well as various microprocessor family
			C112a.2	Understand the hardware behind data acquisition
			C112a.3	Develop healthcare device based on user memory requirement and interfacing
			C112a.4	Understand the Scope of virtual reality in healthcare
			C112a.5	Develop an insight knowledge about the biometrics and network security
C112b	PMD1227	Optimization Techniques	C112b.1	Enumerate the principles of Optimization
			C112b.2	Describe the conventional methods in optimization
			C112b.3	Implement the Evolutionary Optimization techniques
			C112b.4	Evaluate dynamic programming in optimization.
			C112b.5	Construct different Optimization algorithm for problems in Biomedical Engineering.
C112c	PMD1228	Real Time Embedded Systems	C112c.1	Summarize the basics of embedded Systems
			C112c.2	Illustrate assembly language program for ARM processors
			C112c.3	Explain computing platform and design analysis
			C112c.4	Demonstrate multiple tasks and multi processes
			C112c.5	Describe embedded system design concepts in various applications
C112d	PMD1229		C112d.1	Demonstrate ethical sensitivity in clinical and research situations

		Ethics and Standards in Health care	C112d.2	Demonstrate theoretical knowledge and apply it in clinical and research situations when there is an ethical dilemma
			C112d.3	Analyse policies and comment on the ethics of the policies.
			C112d.4	Demonstrate ethical sensitivity in clinical and research situations.
			C112d.5	Explain the guidelines to obtain medical standards in hospitals.
C112e	PMD1231	Brain Computer Interfaces and its Application	C112e.1	Describe on how to acquire the brain signal in the format required for the specific application
			C112e.2	Explain the pre-process step for signal enhancement
			C112e.3	Extract the dominant and required features
			C112e.4	Classify the signal for applications
			C112e.5	Demonstrate the ability to build the BCI applications
C113	PMD1211	Data Acquisition and Processing Laboratory	C113.1	Acquire and analyse any physiological signal and model the physiological systems.
			C113.2	Apply the techniques of medical image analysis and providing security to medical data.
C114	PMD1117	Mini Project	C114.1	Formulate a real world problem, identify the requirement and develop the design solutions.
			C114.2	Express the technical ideas, strategies and methodologies.
			C114.3	Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
			C114.4	Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
			C114.5	Prepare the report and present the oral demonstrations.
C201	PMD1301	Assist Devices and Implant Technology	C201.1	Explain the assistive devices used for cardiac functions
			C201.2	Summarize the assistive technology used for pulmonary functions
			C201.3	Describe the principle of renal system assist devices.
			C201.4	Specify the type of assistive devices for mobility of limbs
			C201.5	Explain the principles of implant technology and its design parameter.
C202a	PMD1321	Advanced Neural Computing	C202a.1	Describe the principles of Neural Networks and their areas of application.
			C202a.2	Analyse the behaviour of simple linear neural networks.
			C202a.3	Demonstrate neural network to solve real-world problems.
			C202a.4	Explain the uses of Advance Neural computing algorithms
			C202a.5	Explain some advance methods in Bio-Signal and Imaging Applications.
C202b	PMD1322		C202b.1	Infer the basics of soft chemical processes

		Nanostructured Materials and Processing	C202b.2	Explain the different synthesis methods of chemical processes
			C202b.3	Explain the different synthesis methods of physical processes
			C202b.4	Illustrates the different biological synthesis methods of nanostructures
			C202b.5	Utilize the use of different characterisation techniques on nanostructures
C202c	PMD1323	Physiological System Modelling and Simulation	C202c.1	Explain the application of Physiological models
			C202c.2	Describe the methods and techniques for analysis and synthesis of Linear and dynamic system
			C202c.3	Develop differential equations to describe the compartmental physiological model
			C202c.4	Describe Nonlinear models of physiological systems
			C202c.5	Illustrate the Simulation of physiological systems
C202d	PMD1324	Biomedical Research Techniques	C202d.1	Apply the understanding of feasibility and practicality of research methodology for a proposed project
			C202d.2	Analyse research methodologies identified in existing literature
			C202d.3	Demonstrate the ability to independently use common statistics software for data analysis
			C202d.4	Describe the aspects of research ethics on animals
			C202d.5	Demonstrate a good understanding of how to write a research report
C202e	PMD1325	Wearable Devices and Technologies	C202e.1	Describe the basics of wearable system
			C202c.2	Illustrate the use of smart sensors to monitor vital parameters
			C202e.3	Value various technologies used in wearable device
			C202e.4	Explain wireless body area networks
			C202e.5	Enumerate classification algorithms in data processing
C203	PMD1318	Project Work Phase I	C203.1	Plan, design and execute an engineering based project for societal needs
			C203.2	Analyze, discuss and apply the outcome of research based work
			C203.3	Summarize an appropriate list of literature review, analyze previous researchers' work and correlate them to current project
			C203.4	Devise clearly a work plan and methodology
			C203.5	Organize, compile and record all work details in an efficient manner
C204	PMD1316	Hospital Training	C204.1	Associate the use of medical equipment and proper handling of them at various hospital departments.
			C204.2	Formulate the basic preventative maintenance measures.
			C204.3	Communicate effectively with multidisciplinary teams on medical equipment working and safety issues.
			C204.4	Provided with the opportunity for practical, on-the-job experience.
			C204.5	Relate the testing and calibration of medical devices with their safety norms and certification requirements.

C205	PMD1418	Project Work Phase II	C205.1	Plan, design and execute an engineering based project for societal needs
			C205.2	Analyze, discuss and apply the outcome of research based work
			C205.3	Summarize an appropriate list of literature review, analyze previous researchers' work and correlate them to current project
			C205.4	Devise clearly a work plan and methodology
			C205.5	Organize, compile and record all work details in an efficient manner

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	UEN1176	Communicative English	C101.1	Apply reading strategies to comprehend articles of a general kind in magazines and newspapers
			C101.2	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English
			C101.3	Comprehend conversations and short talks delivered in English in both formal and informal contexts
			C101.4	Write short essays of a general kind and personal letters and emails in English
C102	UMA1176	Algebra and Calculus	C102.1	Obtain the expansion of trigonometric functions using De-Moivre's theorem.
			C102.2	Determine the Eigen values and Eigen vectors and diagonalize the given matrix.
			C102.3	Evaluate the circle of curvature, evolute and envelope of a given curve.
			C102.4	Find Taylor's expansion for functions of two variables, solve problems using Jacobians and find the extreme points of a function of two variables.
			C102.5	Solve problems using beta and gamma functions and evaluate problems in double integral and triple integral
C103	UPH1176	Engineering Physics	C103.1	Analyze crystal structures and the influence of imperfections on their properties.
			C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
			C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
			C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.
C104	UCY1176	Engineering Chemistry	C104.1	The knowledge gained on water treatment techniques, polymers, phase rule, fuels and electrochemistry and corrosion will facilitate better understanding of engineering processes and applications for further learning
C105	UGE1176	Problem Solving and Programming in Python	C105.1	Think logically to solve programming problems and write solutions in pseudo code.
			C105.2	Understand and develop simple Python programs using conditionals and loops.
			C105.3	Decompose a program into functions.
			C105.4	Represent compound data using Python lists, tuples, and dictionaries.
			C105.5	Perform input/output with files.
C106	UGE1177	Engineering Graphics	C106.1	Familiarize with the fundamentals and standards of Engineering graphics
			C106.2	Perform freehand sketching of basic geometrical constructions and multiple views of objects.
			C106.3	Project orthographic projections of lines and plane surfaces.
			C106.4	Draw projections and solids and development of surfaces.
			C106.5	Visualize and to project isometric and perspective sections of simple solids.

			C106.6	Read a building drawing
C107	UGE1197	Programming in Python Lab	C107.1	To write, test, and debug simple Python programs.
			C107.2	To implement Python programs with conditionals and loops.
			C107.3	Use functions for structuring Python programs.
			C107.4	Represent compound data using Python lists, tuples, and dictionaries.
			C107.5	Read and write data from/to files in Python.
C108	UGS1197	Physics and Chemistry Lab	C108.1	ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of The physical properties of materials like elasticity, compressibility, and viscosity
			C108.2	ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of The optical properties of materials such as diffraction, interference and Numerical aperture
			C108.3	Ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of Thermal and electrical properties of materials such as conductivity and band gap.
			C108.4	Evaluate the quality of water
			C108.5	Determine the metals and ions present in any given sample using various analytical techniques
			C108.6	Measure properties such as conductance of solutions, redox potentials
C109	UEN1276	Technical English	C109.1	Apply reading strategies to comprehend technical texts and write area- specific texts effortlessly.
			C109.2	Listen and comprehend lectures and talks in science and technology.
			C109.3	Speak appropriately and effectively in varied formal and informal contexts.
			C109.4	Write technical documents like reports, emails, resume and winning job applications.
C110	UMA1276	Complex Functions and Laplace Transforms	C110.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations.
			C110.2	Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function.
			C110.3	Obtain the Laplace Transforms of standard functions.
			C110.4	Solve Differential Equations of Second order and Simultaneous linear equations with constant coefficients of first order using Laplace Transform.
			C110.5	Solve problems using divergence and curl and evaluate line, Surface and Volume integrals
C111	UPH1254	Physics for Biomedical Engineering	C111.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.
			C111.2	Comprehend the basics of semiconductor physics and its application to simple devices like PN junction devices.
			C111.3	Understand magnetic and superconducting phenomena exhibited by materials and their applications to biomedical field.

			C111.4	Exemplify and identify the characteristics and limitations of biomedical imaging techniques based on sound, radiations and nuclear emissions.
			C111.5	Explain the properties and characteristics of biocompatible materials and how they have been tailored to realize different bio-functional devices
C112	UGE1276	Basic Civil and Mechanical Engineering	C112.1	Appreciate the Civil and Mechanical Engineering components
			C112.2	Explain the usage of construction material and proper selection of construction materials.
			C112.3	Measure distances and area by surveying
			C112.4	Identify the components used in power plant cycle.
			C112.5	Demonstrate working principles of petrol and diesel engine.
			C112.6	Elaborate the components of refrigeration and Air conditioning cycle
C113	UBM1202	Electronic Devices and Circuits	C113.1	Understand working principle of PN Junction diode and its application
			C113.2	Understand the construction, modelling and operating BJT (CE, CC, and CB configurations),
			C113.3	Understand the construction, modelling and operating principle of FET and MOSFET
			C113.4	Understand the working and operation of differential, power amplifiers and wave shaping circuits
			C113.5	Understand the working and operation of feedback amplifier and oscillators
C114	UBM1201	Circuit Theory	C114.1	Ability to analyse AC and DC Circuits
			C114.2	Ability to apply circuit theorems
			C114.3	Understand the concept of resonance and design different combination of resonant circuits
			C114.4	Design transient circuit for different types of excitation
			C114.5	Understand two port network and its application
C115	UGE1297	Design Thinking and Engineering Practice Laboratory	C115.1	Ability to fabricate carpentry components
			C115.2	Ability to make the pipe connections including plumbing works.
			C115.3	Ability to use welding equipment's to join the structures.
			C115.4	Ability to fabricate electrical circuits
			C115.5	Ability to fabricate electronics circuits
C116	UBM1211	Electron Devices and Electric circuits Laboratory	C116.1	Learn the characteristics of basic electronic devices
			C116.2	Design RL and RC circuits
			C116.3	Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems
C201	UMA1376	Transform Techniques and Partial Differential Equations	C201.1	Solve engineering problems using Fourier series.
			C201.2	Understand and solve partial differential equations of first and higher order.
			C201.3	Use Fourier series techniques to solve partial differential equations.
			C201.4	Apply Fourier transform techniques to solve some of the physical problems of engineering.
			C201.5	Apply Z - transform techniques to solve some of the physical problems of engineering.
C202	UBM1301	Sensors for Healthcare	C202.1	Illustrate the various characteristics of sensors and measurement system.
			C202.2	Select appropriate passive or active transducers for measurement of displacement, temperature and pressure.

			C202.3	Evaluate the use of photoelectric and piezoelectric sensors for biomedical applications.
			C202.4	Use the chemical and biosensors for measuring glucose and urea.
			C202.5	Assess AC and DC bridges and recorders for appropriate measurement
C203	UIT1351	OOPS and Java Programming	C203.1	Explain the concepts of Object oriented programming.
			C203.2	Write simple applications using C++.
			C203.3	Discuss about inheritance and interfaces.
			C203.4	Create applications using Java.
			C203.5	Implement object oriented programming in real life problems
C204	UBM1302	Fundamentals of Biochemistry	C204.1	Describe the fundamentals of biophysical properties
			C204.2	Illustrate biochemical principles, such as the structure/function of biomolecules.
			C204.3	Depict an understanding of metabolic pathways, and the regulation of biological/biochemical processes
			C204.4	Describe the basic properties and regulation of enzymes
			C204.5	Apply the analytical techniques in biochemistry
C205	UBM1303	Human Anatomy and Physiology	C205.1	Discuss cell biology, reproductive physiology and basic tissue types.
			C205.2	Reproduce the structure and functions of digestive system and excretory system.
			C205.3	Relate the structure and functions of musculoskeletal and respiratory system.
			C205.4	Explain the structure and functioning of cardiovascular system and endocrine organs.
			C205.5	Write about the structure and functions of nervous system and special senses.
C206	UEE1352	Basics of Electrical Engineering	C206.1	Design simple electrical circuits and understand through nodal, mesh analysis about constructing series and parallel configuration of circuits with sources and variable loads.
			C206.2	Explain the concepts of three phase power circuits.
			C206.3	Comprehend the concepts in electrical generators, motors and transformers.
			C206.4	Choose appropriate measuring instruments for given application.
			C206.5	Analyze existing power distribution and hence apply technology in electrical applications.
C207	UBM1311	Biochemistry and Human Physiology Laboratory	C207.1	Depict qualitative test of different biomolecules.
			C207.2	Perform the Biochemical and hematological parameters and their interpretation in clinical sample.
			C207.3	Illustrate the separation technology of proteins and amino acids.
			C207.4	Describe the understanding of physiological parameters
C208	UIT1371	OOPS and Java Programming Laboratory	C208.1	Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
			C208.2	Develop and implement Java programs with array list, exception handling and multithreading.
			C208.3	Design applications using file processing, generic programming and event handling.
C209	UMA1477	Probability Theory and Stochastic Processes	C209.1	Identify standard distributions and apply them.
			C209.2	Solve problems in two dimension random variables and find the correlation between them.
			C209.3	Analyze different types of random processes.

			C209.4	Find the relation between Auto correlation function and Power density spectrum.
			C209.5	Find the response of random inputs to linear time invariant systems.
C210	UBM1401	Pathology and Microbiology	C210.1	Describe the basic nature of disease processes.
			C210.2	Classify diseases and apply knowledge of pathology's role in the diagnosis, staging and management of disease.
			C210.3	Depict theory and practical skills in microscopy and their handling techniques and staining procedures.
			C210.4	Identify common infectious agents and the diseases that they cause.
			C210.5	Illustrate the immunological reactions for the disease diagnosis.
C211	UBM1402	Fundamentals of Signals and Systems	C211.1	Determine if a given system is linear/causal/stable.
			C211.2	Determine the frequency components present in a signal.
			C211.3	Describe LTI systems in the time domain and frequency domain.
			C211.4	Determine the output of an LTI system in the time and frequency domains.
			C211.5	Determine the statistical properties and estimation of power in random signals.
C212	UBM1403	Analog and Digital ICs	C212.1	Summarize the basic building blocks of linear integrated circuits and the linear and non- linear applications of operational amplifiers.
			C212.2	Interpret the concepts of waveform generation and introduce some special function ICs 555 and 565.
			C212.3	Define the theory of active filter, ADC and DAC.
			C212.4	Illustrate the Digital fundamentals, Boolean algebra and its applications in digital systems, and familiarize with the design of various combinational digital circuits using logic gates.
			C212.5	Analyze and design procedures for synchronous and asynchronous sequential circuits.
C213	UBM1404	Analog and Digital Communication	C213.1	Apply analog communication techniques
			C213.2	Utilize pulse communication techniques
			C213.3	Apply keying techniques
			C213.4	Analyze Source and Error control coding
			C213.5	Utilize cellular concept and multiple access techniques
C214	UBM1405	Biomaterials	C214.1	Analyze the different types of Biomaterials and its classification with nanoscale concepts.
			C214.2	Identify the significant gap required to overcome the challenges with respect to metals and ceramics
			C214.3	Illustrates the importance of polymeric materials and its composite.
			C214.4	Value the use of implant materials for tissue replacement.
			C214.5	Explain the different testing procedures used for biomaterial characterization
C215	UBM1411	Pathology and Microbiology Laboratory	C215.1	Illustrate the pathological state of different clinical conditions.
			C215.2	Demonstrate practical experiments on tissue processing.
			C215.3	Describe the staining characteristics of bacteria and differentiate these bacteria according to microscopic morphologies.

			C215.4	Perform antigen antibody reactions.
C216	UBM1412	Analog and Digital Integrated Circuits Laboratory	C216.1	Design of amplifiers, filters and oscillators using operational amplifiers.
			C216.2	Summarize the knowledge of special function IC.
			C216.3	Describes multivibrators, ADC and DAC using Special IC's
			C216.4	Design of combinational and sequential circuits.
			C216.5	Demonstrate the circuit simulation software
C217	UEN1497	Interpersonal Skills/Listening & Speaking	C217.1	Recall the listened phrases and respond appropriately
			C217.2	Prepare and Participate in group discussions
			C217.3	Construct effective presentations
			C217.4	Adapt oneself in conversations both formal and informal
			C217.5	Discuss effectively with the members in a group/public forum
C301	UBM1501	Bio Control systems	C301.1	Interpret the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems
			C301.2	Determine the time response of various systems and discuss the concept of system stability
			C301.3	Examine the frequency response characteristics of various systems using different charts
			C301.4	Appraise the concept of modeling basic physiological systems
			C301.5	Identify the application aspects of time and frequency response analysis in physiological control systems.
C302	UBM1502	Medical Instrumentation	C302.1	Recall the origin of bio potentials and electrodes for its measurement.
			C302.2	Describe the biosignal characteristics and the electrode placement for various physiological recording.
			C302.3	Design bio amplifier for various physiological recording.
			C302.4	Perform various techniques for measuring non electrical parameters.
			C302.5	Summarize the different techniques for biochemical measurements
C303	UBM1503	Radiological Equipment	C303.1	Describe the working principle of X ray machine and its application.
			C303.2	Illustrate the principle computed tomography.
			C303.3	Interpret the technique used for visualizing various sections of the body using MRI
			C303.4	Demonstrate the applications of radio nuclide imaging.
			C303.5	Outline the methods of radiation safety
C304	UBM1504	Principles of Bio Mechanics	C304.1	Explain the principles of mechanics.
			C304.2	Outline the basics of biofluid mechanics.
			C304.3	Provide the mechanical properties of musculoskeletal elements.
			C304.4	Develop the mathematical models of joints and implants.
			C304.5	Apply the knowledge of biomechanics into modelling and ergonomics.
C305	UBM1505	Principles of Digital Signal Processing	C305.1	Apply DFT for the analysis of digital signals and systems.
			C305.2	Design and construct IIR filter using appropriate realization method.
			C305.3	Design and construct FIR filter using appropriate realization method.

			C305.4	Characterize the effects of finite precision representation on digital filters.
			C305.5	Choose and design an optimal filter to remove the artifacts in the physiological signal.
C306a	UBM1521	Hospital management	C306a.1	Explain the basics of Hospital Management.
			C306a.2	Expound their knowledge of Human resource management and marketing for hospitals.
			C306a.3	Apply various Quantitative methods in healthcare management.
			C306a.4	Corroborate their knowledge in Hospital information system and supportive services.
			C306a.5	Elucidate about quality and safety aspects in hospital management.
C306b	UBM1525	Medical Physics	C306b.1	Explain principles underlying non ionising radiation and its biological effects
			C306b.2	Differentiate various types of physical senses in human body
			C306b.3	Distinguish different types of radiation and its effects
			C306b.4	Describe the interaction of Radiation with matter
			C306b.5	Compare various types of radiation detectors
C306c	UBM1526	Tissue engineering and Artificial Organs	C306c.1	Summaries the basics of tissue engineering
			C306c.2	Assess the use of stem cells
			C306c.3	Design, develop, implement, and evaluate the materials for tissue engineering
			C306c.4	Illustrate the application of tissue engineering
			C306c.5	Value the importance of artificial organs.
C307	UBM1511	Biomedical Instrumentation Laboratory	C307.1	Design and implement preamplifiers and signal conditioning circuits for ECG signal acquisition.
			C307.2	Design and implement amplifiers for different bio signals like EEG, EOG, EMG.
			C307.3	Design an optical isolation amplifier.
			C307.4	Acquire various non-electrical parameters using suitable sensors/transducers.
			C307.5	Implement PCB layout for any bio amplifier.
C308	UBM1512	Digital Signal Processing Laboratory	C308.1	Carryout basic signal processing operations.
			C308.2	Demonstrate their abilities towards MATLAB based implementation of various DSP systems.
			C308.3	Analyze the architecture of a DSP Processor.
			C308.4	Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals.
			C308.5	Design a DSP system for various Biomedical Applications.
C309	UBM1601	Medical Image Processing	C309.1	Explain fundamentals of medical image processing techniques.
			C309.2	Identify suitable filtering and intensity transformation technique for given medical applications.
			C309.3	Recognize the Region of Interest and segment the same from given medical image.
			C309.4	Explore current research in registration, visualization, and image understanding.
			C309.5	Discuss various compression methods and perform quality evaluation for the same.
C310	UBM1602	Diagnostic Equipment	C310.1	Describe the working and recording setup of cardiac and neurological equipment.

			C310.2	Discuss the recording and analysis of EMG and different biomechanical measurements.
			C310.3	Explain about measurements of parameters related to respiratory system.
			C310.4	Describe the measurement techniques of sensory responses.
			C310.5	Summarize the principle of ultrasonic, thermography and its applications in medicine.
C311	UBM1603	Microcontroller and Embedded System Design	C311.1	Summarize the basic principles of Embedded systems and understand the architecture of 8 bit microcontroller
			C311.2	Illustrate the programming and interfacing concepts using 8051 microcontroller.
			C311.3	Explain the architecture of PIC microcontroller
			C311.4	Describe the architecture of ARM based microcontroller
			C311.5	Design of microcontroller based an embedded system
C312	UCY1276	Environmental Science	C312.1	Understand the importance of the environment and describe the structure and functions of an ecosystem.
			C312.2	Identify the value and need for conservation of bio-diversity.
			C312.3	Know the importance of natural resources and its equitable use for sustainable life styles.
			C312.4	Explain the causes, effects and control measures of different types of pollution.
			C312.5	Understand various environmentally related social issues and their solutions.
			C312.6	Recall the tools for environmental regulations
			C312.7	Relate the role of environment in human population growth and development
			C312.8	Get knowledge about various techniques used for environmental monitoring and management
C313	UBM1626	Biostatistics	C313.1	Define the new and existing statistical methodology for their research problem.
			C313.2	Explain p- values for different statistical test.
			C313.3	Analyze the biomedical research data and able to report the study results.
			C313.4	Describe problems of human health and disease for the interest of advancing the public's health.
			C313.5	Enumerate the Meta analysis and variance analysis.
C314a	UBM1631	Medical Informatics	C314a.1	Design an information system, which will meet the requirement of hospital using open source software.
			C314a.2	Follow the standards for data capturing, transmission, storage and retrieval.
			C314a.3	Explain the concepts of Radiology information system along with PACS workflow.
			C314a.4	Design and demonstrate the computer aided diagnostic system for disease prediction and classification.
			C314a.5	Use latest tools and techniques to provide quality healthcare.
C314b	UBM1632	Robotics in medicine	C314b.1	Explain the basics of robotics.
			C314b.2	Illustrate kinematics in robotics.
			C314b.3	Explain the robotic sensing vision.
			C314b.4	Plan the robotic control using AI
			C314b.5	Elaborate the application of robotics in medical practice

C315	UBM1611	Microcontroller and Embedded System Design Laboratory	C315.1	Explain the basic principles of Embedded systems
			C315.2	Illustrate the architecture of 8 bit microcontroller
			C315.3	Apply the interfacing concepts
			C315.4	Elaborate the architecture of PIC 16F877 and LPC 2148
			C315.5	Design of simple embedded systems
C316	UBM1612	Medical Image Processing Laboratory	C316.1	Perform enhancing operations on the image using spatial filters and frequency domain filters
			C316.2	Use transforms and analyze the characteristics of the image
			C316.3	Segment the region of interest from the given medical image.
			C316.4	Estimate the efficiency of the compression technique on the images
			C316.5	Apply image processing technique to solve real healthcare problems
C317	UBM1617	Mini Project	C317.1	Analyze and Design a system or process to meet given specifications with realistic engineering constraints.
			C317.2	Identify problem statements and function individually or as a member of an engineering design team.
			C317.3	Utilize technical resources.
			C317.4	Propose technical documents and give technical oral presentations related to design mini project results.
C401	UBM1701	Applied Soft Computing	C401.1	Differentiate biological and artificial neural network.
			C401.2	Construct Association and competition based neural network.
			C401.3	Explain Fuzzy sets, relation between classical and fuzzy sets, membership function.
			C401.4	Describe advanced neural systems and algorithm
			C401.5	Describe different hybrid systems.
C402	UBM1702	Surgical and Critical Care Equipment	C402.1	Discuss the various equipment used in ICU and applications of telemetry.
			C402.2	Explain the types of diathermy and its applications.
			C402.3	Express the basics of critical care equipment's and its application in medicine.
			C402.4	Discuss the various extracorporeal and special diagnostic devices used in hospitals.
			C402.5	Outline the importance of patient safety against electrical hazard.
C403	UBM1703	Rehabilitation Engineering	C403.1	Explain the basic principles of rehabilitation Engineering
			C403.2	Design orthotic and prosthetic devices
			C403.3	Distinguish various types of mobility aids
			C403.4	Enumerate Auditory and speech assist devices
			C403.5	Differentiate sensory augmentation and its substitution
C404a	UBM1723	Brain Computer Interface	C404a.1	Evaluate concept of BCI.
			C404a.2	Describe the different brain activation signals.
			C404a.3	Select appropriate feature extraction methods.
			C404a.4	Use machine learning algorithms for translation.
			C404a.5	Develop high-fidelity BCI prototypes

C404b	UIT1731	Introduction to Deep Learning	C404b.1	Demonstrate the mathematical and computational demands of building neural networks.
			C404b.2	Explain the concept of learning in neural networks
			C404b.3	Design Convolutional Neural Networks
			C404b.4	Implement Sequence Modeling Using Recurrent Nets
			C404b.5	Explain Unsupervised and Deep Reinforcement Learning
C405	UBM1731	Biometrics	C405.1	Demonstrate knowledge engineering principles underlying biometric systems.
			C405.2	Explain fingerprint based biometric system.
			C405.3	Describe the face and voice recognition based biometric system.
			C405.4	Discuss privacy and security implications of biometrics system.
			C405.5	Analyse and design basic multi biometric system
C406	UIT1703	Management Principles and Practices	C406.1	Explain and discuss the elements of effective management.
			C406.2	Apply the planning, organizing, control and decision making processes
			C406.3	Explain various theories related to the development of leadership skills, motivation techniques, team work and effective communication.
			C406.4	Analyze the different control activities of management
			C406.5	Enumerate the forecasting methodologies
C407	UBM1711	Diagnostic and Therapeutic Equipment Laboratory	C407.1	Measure different bioelectrical signals using various methods.
			C407.2	Record various physiological signals using telemetry.
			C407.3	Illustrate various diagnostic and therapeutic techniques.
			C407.4	Examine the electrical safety measurements.
			C407.5	Analyze the different bio signals using suitable tools.
C408	UBM1712	Medical System Design and Modelling Lab	C408.1	Develop ability for programming in LABVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.
			C408.2	Explain the basics of interfacing and programming using related hardware.
			C408.3	Create an environment to acquire, condition, and reduce data collected from biomedical instrumentation.
			C408.4	Explore the concepts, ideas and models to develop the medical systems using AutoCAD.
			C408.5	Develop a medical instrument prototype for critical care solutions using Virtual Instrumentation.
C409	UBM1713	Hospital Training	C409.1	Demonstrate the working of medical equipment.
			C409.2	Formulate the basic preventative maintenance measures.
			C409.3	Communicate effectively with multidisciplinary teams on medical equipment working and safety issues.
			C409.4	Provide opportunity for practical, on-the-job experience.
C410	UBM1822	Assist Devices	C411a.1	Explain the assistive devices used for cardiac functions.
			C411a.2	Summarize the assistive technology used for pulmonary functions
			C411a.3	Describe the types of sensory assist devices

			C411a.4	Define the type of assistive devices for mobilization
			C411a.5	Enumerate the principles of underlying the hemodialyzer machine
C411	UBM1818	Project Work	C411.1	Plan, design and execute an engineering based project for societal needs.
			C411.2	Analyze, discuss and apply the outcome of research based work
			C411.3	Summarize an appropriate list of literature review, analyze previous researchers' work and correlate them to current project
			C411.4	Devise clearly a work plan and methodology
			C411.5	Organize, compile and record all work details in an efficient manner.
			C411.6	Categorize record and accumulate work done throughout the project.

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	UEN1176	Communicative English	C101.1	Apply reading strategies to comprehend articles of a general kind in magazines and newspapers
			C101.2	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English
			C101.3	Comprehend conversations and short talks delivered in English in both formal and informal contexts
			C101.4	Write short essays of a general kind and personal letters and emails in English
C102	UMA1176	Algebra and Calculus	C102.1	Obtain the expansion of trigonometric functions using De-Moivre's theorem.
			C102.2	Determine the Eigen values and Eigen vectors and diagonalize the given matrix.
			C102.3	Evaluate the circle of curvature, evolute and envelope of a given curve.
			C102.4	Find Taylor's expansion for functions of two variables, solve problems using Jacobians and find the extreme points of a function of two variables.
			C102.5	Solve problems using beta and gamma functions and evaluate problems in double integral and triple integral
C103	UPH1176	Engineering Physics	C103.1	Analyze crystal structures and the influence of imperfections on their properties.
			C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
			C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
			C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.
C104	UCY1176	Engineering Chemistry	C104.1	The knowledge gained on water treatment techniques, polymers, phase rule, fuels and electrochemistry and corrosion will facilitate better understanding of engineering processes and applications for further learning
C105	UGE1176	Problem Solving and Programming in Python	C105.1	Think logically to solve programming problems and write solutions in pseudo code.
			C105.2	Understand and develop simple Python programs using conditionals and loops.
			C105.3	Decompose a program into functions.
			C105.4	Represent compound data using Python lists, tuples, and dictionaries.
			C105.5	Perform input/output with files.
C106	UGE1177	Engineering Graphics	C106.1	Familiarize with the fundamentals and standards of Engineering graphics
			C106.2	Perform freehand sketching of basic geometrical constructions and multiple views of objects.
			C106.3	Project orthographic projections of lines and plane surfaces.
			C106.4	Draw projections and solids and development of surfaces.
			C106.5	Visualize and to project isometric and perspective sections of simple solids.
			C106.6	Read a building drawing

C107	UGE1197	Programming in Python Lab	C107.1	To write, test, and debug simple Python programs.
			C107.2	To implement Python programs with conditionals and loops.
			C107.3	Use functions for structuring Python programs.
			C107.4	Represent compound data using Python lists, tuples, and dictionaries.
			C107.5	Read and write data from/to files in Python.
C108	UGS1197	Physics and Chemistry Lab	C108.1	ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of The physical properties of materials like elasticity, compressibility, and viscosity
			C108.2	ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of The optical properties of materials such as diffraction, interference and Numerical aperture
			C108.3	Ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of Thermal and electrical properties of materials such as conductivity and band gap.
			C108.4	Evaluate the quality of water
			C108.5	Determine the metals and ions present in any given sample using various analytical techniques
			C108.6	Measure properties such as conductance of solutions, redox potentials
C109	UEN1276	Technical English	C109.1	Apply reading strategies to comprehend technical texts and write area- specific texts effortlessly.
			C109.2	Listen and comprehend lectures and talks in science and technology.
			C109.3	Speak appropriately and effectively in varied formal and informal contexts.
			C109.4	Write technical documents like reports, emails, resume and winning job applications.
C110	UMA1276	Complex Functions and Laplace Transforms	C110.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations.
			C110.2	Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function.
			C110.3	Obtain the Laplace Transforms of standard functions.
			C110.4	Solve Differential Equations of Second order and Simultaneous linear equations with constant coefficients of first order using Laplace Transform.
			C110.5	Solve problems using divergence and curl and evaluate line, Surface and Volume integrals
C111	UPH1254	Physics for Biomedical Engineering	C111.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.
			C111.2	Comprehend the basics of semiconductor physics and its application to simple devices like PN junction devices.
			C111.3	Understand magnetic and superconducting phenomena exhibited by materials and their applications to biomedical field.
			C111.4	Exemplify and identify the characteristics and limitations of biomedical imaging techniques based on sound, radiations and nuclear emissions.

			C111.5	Explain the properties and characteristics of biocompatible materials and how they have been tailored to realize different bio-functional devices
C112	UGE1276	Basic Civil and Mechanical Engineering	C112.1	Appreciate the Civil and Mechanical Engineering components
			C112.2	Explain the usage of construction material and proper selection of construction materials.
			C112.3	Measure distances and area by surveying
			C112.4	Identify the components used in power plant cycle.
			C112.5	Demonstrate working principles of petrol and diesel engine.
			C112.6	Elaborate the components of refrigeration and Air conditioning cycle
C113	UBM1202	Electronic Devices and Circuits	C113.1	Understand working principle of PN Junction diode and its application
			C113.2	Understand the construction, modelling and operating BJT (CE, CC, and CB configurations),
			C113.3	Understand the construction, modelling and operating principle of FET and MOSFET
			C113.4	Understand the working and operation of differential, power amplifiers and wave shaping circuits
			C113.5	Understand the working and operation of feedback amplifier and oscillators
C114	UBM1201	Circuit Theory	C114.1	Ability to analyse AC and DC Circuits
			C114.2	Ability to apply circuit theorems
			C114.3	Understand the concept of resonance and design different combination of resonant circuits
			C114.4	Design transient circuit for different types of excitation
			C114.5	Understand two port network and its application
C115	UGE1297	Design Thinking and Engineering Practice Laboratory	C115.1	Ability to fabricate carpentry components
			C115.2	Ability to make the pipe connections including plumbing works.
			C115.3	Ability to use welding equipment's to join the structures.
			C115.4	Ability to fabricate electrical circuits
			C115.5	Ability to fabricate electronics circuits
C116	UBM1211	Electron Devices and Electric circuits Laboratory	C116.1	Learn the characteristics of basic electronic devices
			C116.2	Design RL and RC circuits
			C116.3	Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems
C201	UMA1376	Transform Techniques and Partial Differential Equations	C201.1	Solve engineering problems using Fourier series.
			C201.2	Understand and solve partial differential equations of first and higher order.
			C201.3	Use Fourier series techniques to solve partial differential equations.
			C201.4	Apply Fourier transform techniques to solve some of the physical problems of engineering.
			C201.5	Apply Z - transform techniques to solve some of the physical problems of engineering.
C202	UBM1301	Sensors for Healthcare	C202.1	Illustrate the various characteristics of sensors and measurement system.
			C202.2	Select appropriate passive or active transducers for measurement of displacement, temperature and pressure.
			C202.3	Evaluate the use of photoelectric and piezoelectric sensors for biomedical applications.
			C202.4	Use the chemical and biosensors for measuring glucose and urea.

			C202.5	Assess AC and DC bridges and recorders for appropriate measurement
C203	UIT1351	OOPS and Java Programming	C203.1	Explain the concepts of Object oriented programming.
			C203.2	Write simple applications using C++.
			C203.3	Discuss about inheritance and interfaces.
			C203.4	Create applications using Java.
			C203.5	Implement object oriented programming in real life problems
C204	UBM1302	Fundamentals of Biochemistry	C204.1	Describe the fundamentals of biophysical properties
			C204.2	Illustrate biochemical principles, such as the structure/function of biomolecules.
			C204.3	Depict an understanding of metabolic pathways, and the regulation of biological/biochemical processes
			C204.4	Describe the basic properties and regulation of enzymes
			C204.5	Apply the analytical techniques in biochemistry
C205	UBM1303	Human Anatomy and Physiology	C205.1	Discuss cell biology, reproductive physiology and basic tissue types.
			C205.2	Reproduce the structure and functions of digestive system and excretory system.
			C205.3	Relate the structure and functions of musculoskeletal and respiratory system.
			C205.4	Explain the structure and functioning of cardiovascular system and endocrine organs.
			C205.5	Write about the structure and functions of nervous system and special senses.
C206	UEE1352	Basics of Electrical Engineering	C206.1	Design simple electrical circuits and understand through nodal, mesh analysis about constructing series and parallel configuration of circuits with sources and variable loads.
			C206.2	Explain the concepts of three phase power circuits.
			C206.3	Comprehend the concepts in electrical generators, motors and transformers.
			C206.4	Choose appropriate measuring instruments for given application.
			C206.5	Analyze existing power distribution and hence apply technology in electrical applications.
C207	UBM1311	Biochemistry and Human Physiology Laboratory	C207.1	Depict qualitative test of different biomolecules.
			C207.2	Perform the Biochemical and hematological parameters and their interpretation in clinical sample.
			C207.3	Illustrate the separation technology of proteins and amino acids.
			C207.4	Describe the understanding of physiological parameters
C208	UIT1371	OOPS and Java Programming Laboratory	C208.1	Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
			C208.2	Develop and implement Java programs with array list, exception handling and multithreading.
			C208.3	Design applications using file processing, generic programming and event handling.
C209	UMA1477	Probability Theory and Stochastic Processes	C209.1	Identify standard distributions and apply them.
			C209.2	Solve problems in two dimension random variables and find the correlation between them.
			C209.3	Analyze different types of random processes.
			C209.4	Find the relation between Auto correlation function and Power density spectrum.
			C209.5	Find the response of random inputs to linear time invariant systems.

C210	UBM1401	Pathology and Microbiology	C210.1	Describe the basic nature of disease processes.
			C210.2	Classify diseases and apply knowledge of pathology's role in the diagnosis, staging and management of disease.
			C210.3	Depict theory and practical skills in microscopy and their handling techniques and staining procedures.
			C210.4	Identify common infectious agents and the diseases that they cause.
			C210.5	Illustrate the immunological reactions for the disease diagnosis.
C211	UBM1402	Fundamentals of Signals and Systems	C211.1	Determine if a given system is linear/causal/stable.
			C211.2	Determine the frequency components present in a signal.
			C211.3	Describe LTI systems in the time domain and frequency domain.
			C211.4	Determine the output of an LTI system in the time and frequency domains.
			C211.5	Determine the statistical properties and estimation of power in random signals.
C212	UBM1403	Analog and Digital ICs	C212.1	Summarize the basic building blocks of linear integrated circuits and the linear and non- linear applications of operational amplifiers.
			C212.2	Interpret the concepts of waveform generation and introduce some special function ICs 555 and 565.
			C212.3	Define the theory of active filter, ADC and DAC.
			C212.4	Illustrate the Digital fundamentals, Boolean algebra and its applications in digital systems, and familiarize with the design of various combinational digital circuits using logic gates.
			C212.5	Analyze and design procedures for synchronous and asynchronous sequential circuits.
C213	UBM1404	Analog and Digital Communication	C213.1	Apply analog communication techniques
			C213.2	Utilize pulse communication techniques
			C213.3	Apply keying techniques
			C213.4	Analyze Source and Error control coding
			C213.5	Utilize cellular concept and multiple access techniques
C214	UBM1405	Biomaterials	C214.1	Analyze the different types of Biomaterials and its classification with nanoscale concepts.
			C214.2	Identify the significant gap required to overcome the challenges with respect to metals and ceramics
			C214.3	Illustrates the importance of polymeric materials and its composite.
			C214.4	Value the use of implant materials for tissue replacement.
			C214.5	Explain the different testing procedures used for biomaterial characterization
C215	UBM1411	Pathology and Microbiology Laboratory	C215.1	Illustrate the pathological state of different clinical conditions.
			C215.2	Demonstrate practical experiments on tissue processing.
			C215.3	Describe the staining characteristics of bacteria and differentiate these bacteria according to microscopic morphologies.
			C215.4	Perform antigen antibody reactions.
C216	UBM1412		C216.1	Design of amplifiers, filters and oscillators using operational amplifiers.

		Analog and Digital Integrated Circuits Laboratory	C216.2	Summarize the knowledge of special function IC.
			C216.3	Describes multivibrators, ADC and DAC using Special IC's
			C216.4	Design of combinational and sequential circuits.
			C216.5	Demonstrate the circuit simulation software
C217	UEN1497	Interpersonal Skills/Listening & Speaking	C217.1	Recall the listened phrases and respond appropriately
			C217.2	Prepare and Participate in group discussions
			C217.3	Construct effective presentations
			C217.4	Adapt oneself in conversations both formal and informal
			C217.5	Discuss effectively with the members in a group/public forum
C301	UBM1501	Bio Control systems	C301.1	Interpret the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems
			C301.2	Determine the time response of various systems and discuss the concept of system stability
			C301.3	Examine the frequency response characteristics of various systems using different charts
			C301.4	Appraise the concept of modeling basic physiological systems
			C301.5	Identify the application aspects of time and frequency response analysis in physiological control systems.
C302	UBM1502	Medical Instrumentation	C302.1	Recall the origin of bio potentials and electrodes for its measurement.
			C302.2	Describe the biosignal characteristics and the electrode placement for various physiological recording.
			C302.3	Design bio amplifier for various physiological recording.
			C302.4	Perform various techniques for measuring non electrical parameters.
			C302.5	Summarize the different techniques for biochemical measurements
C303	UBM1503	Radiological Equipment	C303.1	Describe the working principle of X ray machine and its application.
			C303.2	Illustrate the principle computed tomography.
			C303.3	Interpret the technique used for visualizing various sections of the body using MRI
			C303.4	Demonstrate the applications of radio nuclide imaging.
			C303.5	Outline the methods of radiation safety
C304	UBM1504	Principles of Bio Mechanics	C304.1	Explain the principles of mechanics.
			C304.2	Outline the basics of biofluid mechanics.
			C304.3	Provide the mechanical properties of musculoskeletal elements.
			C304.4	Develop the mathematical models of joints and implants.
			C304.5	Apply the knowledge of biomechanics into modelling and ergonomics.
C305	UBM1505	Principles of Digital Signal Processing	C305.1	Apply DFT for the analysis of digital signals and systems.
			C305.2	Design and construct IIR filter using appropriate realization method.
			C305.3	Design and construct FIR filter using appropriate realization method.
			C305.4	Characterize the effects of finite precision representation on digital filters.
			C305.5	Choose and design an optimal filter to remove the artifacts in the physiological signal.

C306a	UBM1521	Hospital management	C306a.1	Explain the basics of Hospital Management.
			C306a.2	Expound their knowledge of Human resource management and marketing for hospitals.
			C306a.3	Apply various Quantitative methods in healthcare management.
			C306a.4	Corroborate their knowledge in Hospital information system and supportive services.
			C306a.5	Elucidate about quality and safety aspects in hospital management.
C306b	UBM1525	Medical Physics	C306b.1	Explain principles underlying non ionising radiation and its biological effects
			C306b.2	Differentiate various types of physical senses in human body
			C306b.3	Distinguish different types of radiation and its effects
			C306b.4	Describe the interaction of Radiation with matter
			C306b.5	Compare various types of radiation detectors
C306c	UBM1526	Tissue engineering and Artificial Organs	C306c.1	Summaries the basics of tissue engineering
			C306c.2	Assess the use of stem cells
			C306c.3	Design, develop, implement, and evaluate the materials for tissue engineering
			C306c.4	Illustrate the application of tissue engineering
			C306c.5	Value the importance of artificial organs.
C307	UBM1511	Biomedical Instrumentation Laboratory	C307.1	Design and implement preamplifiers and signal conditioning circuits for ECG signal acquisition.
			C307.2	Design and implement amplifiers for different bio signals like EEG, EOG, EMG.
			C307.3	Design an optical isolation amplifier.
			C307.4	Acquire various non-electrical parameters using suitable sensors/transducers.
			C307.5	Implement PCB layout for any bio amplifier.
C308	UBM1512	Digital Signal Processing Laboratory	C308.1	Carryout basic signal processing operations.
			C308.2	Demonstrate their abilities towards MATLAB based implementation of various DSP systems.
			C308.3	Analyze the architecture of a DSP Processor.
			C308.4	Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals.
			C308.5	Design a DSP system for various Biomedical Applications.
C309	UBM1601	Medical Image Processing	C309.1	Explain fundamentals of medical image processing techniques.
			C309.2	Identify suitable filtering and intensity transformation technique for given medical applications.
			C309.3	Recognize the Region of Interest and segment the same from given medical image.
			C309.4	Explore current research in registration, visualization, and image understanding.
			C309.5	Discuss various compression methods and perform quality evaluation for the same.
C310	UBM1602	Diagnostic Equipment	C310.1	Describe the working and recording setup of cardiac and neurological equipment.
			C310.2	Discuss the recording and analysis of EMG and different biomechanical measurements.
			C310.3	Explain about measurements of parameters related to respiratory system.

			C310.4	Describe the measurement techniques of sensory responses.
			C310.5	Summarize the principle of ultrasonic, thermography and its applications in medicine.
C311	UBM1603	Microcontroller and Embedded System Design	C311.1	Summarize the basic principles of Embedded systems and understand the architecture of 8 bit microcontroller
			C311.2	Illustrate the programming and interfacing concepts using 8051 microcontroller.
			C311.3	Explain the architecture of PIC microcontroller
			C311.4	Describe the architecture of ARM based microcontroller
			C311.5	Design of microcontroller based an embedded system
C312	UCY1276	Environmental Science	C312.1	Understand the importance of the environment and describe the structure and functions of an ecosystem.
			C312.2	Identify the value and need for conservation of bio-diversity.
			C312.3	Know the importance of natural resources and its equitable use for sustainable life styles.
			C312.4	Explain the causes, effects and control measures of different types of pollution.
			C312.5	Understand various environmentally related social issues and their solutions.
			C312.6	Recall the tools for environmental regulations
			C312.7	Relate the role of environment in human population growth and development
			C312.8	Get knowledge about various techniques used for environmental monitoring and management
C313	UBM1626	Biostatistics	C313.1	Define the new and existing statistical methodology for their research problem.
			C313.2	Explain p- values for different statistical test.
			C313.3	Analyze the biomedical research data and able to report the study results.
			C313.4	Describe problems of human health and disease for the interest of advancing the public's health.
			C313.5	Enumerate the Meta analysis and variance analysis.
C314a	UBM1631	Medical Informatics	C314a.1	Design an information system, which will meet the requirement of hospital using open source software.
			C314a.2	Follow the standards for data capturing, transmission, storage and retrieval.
			C314a.3	Explain the concepts of Radiology information system along with PACS workflow.
			C314a.4	Design and demonstrate the computer aided diagnostic system for disease prediction and classification.
			C314a.5	Use latest tools and techniques to provide quality healthcare.
C314b	UBM1632	Robotics in medicine	C314b.1	Explain the basics of robotics.
			C314b.2	Illustrate kinematics in robotics.
			C314b.3	Explain the robotic sensing vision.
			C314b.4	Plan the robotic control using AI
			C314b.5	Elaborate the application of robotics in medical practice
C315	UBM1611		C315.1	Explain the basic principles of Embedded systems
			C315.2	Illustrate the architecture of 8 bit microcontroller

		Microcontroller and Embedded System Design Laboratory	C315.3	Apply the interfacing concepts
			C315.4	Elaborate the architecture of PIC 16F877 and LPC 2148
			C315.5	Design of simple embedded systems
C316	UBM1612	Medical Image Processing Laboratory	C316.1	Perform enhancing operations on the image using spatial filters and frequency domain filters
			C316.2	Use transforms and analyze the characteristics of the image
			C316.3	Segment the region of interest from the given medical image.
			C316.4	Estimate the efficiency of the compression technique on the images
			C316.5	Apply image processing technique to solve real healthcare problems
C317	UBM1617	Mini Project	C317.1	Analyze and Design a system or process to meet given specifications with realistic engineering constraints.
			C317.2	Identify problem statements and function individually or as a member of an engineering design team.
			C317.3	Utilize technical resources.
			C317.4	Propose technical documents and give technical oral presentations related to design mini project results.
C401	UBM1701	Applied Soft Computing	C401.1	Differentiate biological and artificial neural network.
			C401.2	Construct Association and competition based neural network.
			C401.3	Explain Fuzzy sets, relation between classical and fuzzy sets, membership function.
			C401.4	Describe advanced neural systems and algorithm
			C401.5	Describe different hybrid systems.
C402	UBM1702	Surgical and Critical Care Equipment	C402.1	Discuss the various equipment used in ICU and applications of telemetry.
			C402.2	Explain the types of diathermy and its applications.
			C402.3	Express the basics of critical care equipment's and its application in medicine.
			C402.4	Discuss the various extracorporeal and special diagnostic devices used in hospitals.
			C402.5	Outline the importance of patient safety against electrical hazard.
C403	UBM1703	Rehabilitation Engineering	C403.1	Explain the basic principles of rehabilitation Engineering
			C403.2	Design orthotic and prosthetic devices
			C403.3	Distinguish various types of mobility aids
			C403.4	Enumerate Auditory and speech assist devices
			C403.5	Differentiate sensory augmentation and its substitution
C404a	UBM1723	Brain Computer Interface	C404a.1	Evaluate concept of BCI.
			C404a.2	Describe the different brain activation signals.
			C404a.3	Select appropriate feature extraction methods.
			C404a.4	Use machine learning algorithms for translation.
			C404a.5	Develop high-fidelity BCI prototypes
C404b	UIT1731	Introduction to Deep Learning	C404b.1	Demonstrate the mathematical and computational demands of building neural networks.
			C404b.2	Explain the concept of learning in neural networks

			C404b.3	Design Convolutional Neural Networks
			C404b.4	Implement Sequence Modeling Using Recurrent Nets
			C404b.5	Explain Unsupervised and Deep Reinforcement Learning
C405	UBM1731	Biometrics	C405.1	Demonstrate knowledge engineering principles underlying biometric systems.
			C405.2	Explain fingerprint based biometric system.
			C405.3	Describe the face and voice recognition based biometric system.
			C405.4	Discuss privacy and security implications of biometrics system.
			C405.5	Analyse and design basic multi biometric system
C406	UIT1703	Management Principles and Practices	C406.1	Explain and discuss the elements of effective management.
			C406.2	Apply the planning, organizing, control and decision making processes
			C406.3	Explain various theories related to the development of leadership skills, motivation techniques, team work and effective communication.
			C406.4	Analyze the different control activities of management
			C406.5	Enumerate the forecasting methodologies
C407	UBM1711	Diagnostic and Therapeutic Equipment Laboratory	C407.1	Measure different bioelectrical signals using various methods.
			C407.2	Record various physiological signals using telemetry.
			C407.3	Illustrate various diagnostic and therapeutic techniques.
			C407.4	Examine the electrical safety measurements.
			C407.5	Analyze the different bio signals using suitable tools.
C408	UBM1712	Medical System Design and Modelling Lab	C408.1	Develop ability for programming in LABVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.
			C408.2	Explain the basics of interfacing and programming using related hardware.
			C408.3	Create an environment to acquire, condition, and reduce data collected from biomedical instrumentation.
			C408.4	Explore the concepts, ideas and models to develop the medical systems using AutoCAD.
			C408.5	Develop a medical instrument prototype for critical care solutions using Virtual Instrumentation.
C409	UBM1713	Hospital Training	C409.1	Demonstrate the working of medical equipment.
			C409.2	Formulate the basic preventative maintenance measures.
			C409.3	Communicate effectively with multidisciplinary teams on medical equipment working and safety issues.
			C409.4	Provide opportunity for practical, on-the-job experience.
C410	UBM1822	Assist Devices	C411a.1	Explain the assistive devices used for cardiac functions.
			C411a.2	Summarize the assistive technology used for pulmonary functions
			C411a.3	Describe the types of sensory assist devices
			C411a.4	Define the type of assistive devices for mobilization
			C411a.5	Enumerate the principles of underlying the hemodialyzer machine

C411	UBM1818	Project Work	C411.1	Plan, design and execute an engineering based project for societal needs.
			C411.2	Analyze, discuss and apply the outcome of research based work
			C411.3	Summarize an appropriate list of literature review, analyze previous researchers' work and correlate them to current project
			C411.4	Devise clearly a work plan and methodology
			C411.5	Organize, compile and record all work details in an efficient manner.
			C411.6	Categorize record and accumulate work done throughout the project.

Sri Sivasubramaniya Nadar College of Engineering
(An Autonomous Institution, Affiliated to Anna University, Chennai)
Rajiv Gandhi Salai (OMR), Kalavakkam – 603110

Curriculum and Syllabus

Master of Technology **Environmental Science & Technology**

Regulations 2018
Choice Based Credit System (CBCS)



Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603 110
(An Autonomous Institution Affiliated to Anna University Chennai)

Rajiv Gandhi Salai (OMR), Kalavakkam – 603110

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

- I. To provide the engineering graduates with technical expertise in environmental science and technology which will enable them to have a career and professional accomplishment in the public or private sector, to pursue higher studies or may start up their own business.
- II. Address the complexities of real life environmental problems related to domestic and industrial waste management, environmental impact assessment, industrial pollution prevention and control.
- III. Identify, formulate, analyse, develop processes and technologies to meet desired environmental protection needs of society and formulate solutions that are technically sound and economically feasible.

PROGRAMME OUTCOMES (POs):

By the time of their graduation, the students are expected:

- PO 1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, and engineering fundamentals, to solve the complex environmental technology problems.
- PO 2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex environmental problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- PO 3. **Design/development of solutions:** Design solutions for complex environmental problems and design system components or process that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.
- PO 4. **Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, simulating complex problems and synthesis of the information to proceed valid conclusions.
- PO 5. **Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction, modeling and simulating the complex technology activities with an understanding of the limitations.
- PO 6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional environmental technology practice.
- PO 7. **Environment and sustainability:** Understand the impact of the professional environmental technology solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
- PO 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the environmental technology practice.

- PO 9. **Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO 10. **Communication:** Communicate effectively on complex environmental science and technology activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO 11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO 12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes in environmental science and technology.

Program Specific Outcomes (PSOs)

- PO 13. **Ethos:** Possess a great spirit of an innovative environmental technologist and passionate towards solving the environmental science and technology problems and design.
- PO 14. **Contemporary Issues:** Aware of contemporary issues like climate change, environmental pollution and energy crisis and foresee a suitable solution for the issues related these problems.

Programme Educational Objectives	Programme Outcomes													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PO13	PO14
I	3	3	3	3	2	1	3	2	3	3	3	2	3	3
II	3	3	3	3	2	2	3	2	1	2	1	3	3	3
III	3	3	3	3	3	3	3	2	1	2	1	3	3	2

			PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14
YEAR 1	SEM I	Environmental Impact Assessment			3	3		3	3		1	3	3			3
		Biological Wastewater Treatment	3	3	3	3				1				2	2	
		Environmental Chemistry	3	2	2	3			2							3
		Unit Operations and Unit Processes in Environmental Technology	3	2	3	3			2	1				2	3	
		Professional Elective I														
		Professional Elective II														
		Environmental Engineering Laboratory	2	3	2	3	3									
	SEM 2	Air Pollution and Control Engineering	3	3	3	3		2	1						3	3
		Advanced Numerical Methods	3	3	2	3	3									
		Separation Processes in Environmental Applications	3	2	3	3			2					2	3	
		Solid and Hazardous Waste Management	2	2	3				3					2	3	3
		Professional Elective III														
		Professional Elective IV														
		Seminar									3	2		3	2	

YEAR II	SEM 3	Modeling of Environmental Systems	3	2	2	5	5							2		
		Professional Elective V														
		Professional Elective VI														
		Internship									3	2		3	2	
		Project Work Phase-I	3	3	3	3	2	1	2	3	3	3	3	3	3	3
	SEM 4	Project Work Phase-II	3	3	3	3	2	1	2	3	3	3	3	3	3	3

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603 110
 (An Autonomous Institution Affiliated to Anna University Chennai)
Rajiv Gandhi Salai (OMR), Kalavakkam – 603110

REGULATIONS 2018

CHOICE BASED CREDIT SYSTEM

M. TECH. - ENVIRONMENTAL SCIENCE & TECHNOLOGY

CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	PES1101	Environmental Impact Assessment	PC	3	3	0	0	3
2	PES1102	Biological Wastewater Treatment	PC	3	3	0	0	3
3	PES1103	Environmental Chemistry	FC	3	3	0	0	3
4	PES1104	Unit Operations and Unit Processes in Environmental Technology	PC	5	3	2	0	4
5		Professional Elective I	PE	3	3	0	0	3
6		Professional Elective II	PE	3	3	0	0	3
PRACTICALS								
7	PES1111	Environmental Engineering Laboratory	PC	4	0	0	4	2
Total				24	18	2	4	21

SEMESTER II

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	PES1201	Air Pollution and Control Engineering	PC	3	3	0	0	3
2	PMA1276	Advanced Numerical Methods	FC	5	3	2	0	4
3	PES1202	Separation Processes in Environmental Applications	PC	5	3	0	0	3
4	PES1203	Solid and Hazardous Waste Management	PC	3	3	0	0	3
5		Professional Elective III	PE	3	3	0	0	3
6		Professional Elective IV	PE	3	3	0	0	3

PRACTICALS								
7	PES1215	Seminar	EEC	4	0	0	4	2
Total				24	18	2	4	21

SEMESTER III

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	PES1301	Modeling of Environmental Systems	PC	5	3	2	0	4
2		Professional Elective V	PE	3	3	0	0	3
3		Professional Elective VI	PE	3	3	0	0	3
PRACTICALS								
4	PES1316	Internship	EEC	2	0	0	2	1
5	PES1318	Project Work Phase-I	EEC	12	0	0	12	6
Total				25	9	2	14	17

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
PRACTICALS								
1	PES1418	Project Work Phase-II	EEC	24	0	0	24	12

TOTAL CREDITS = 71

PROFESSIONAL ELECTIVES

SEMESTER I

PROFESSIONAL ELECTIVE –I

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES1121	Safety and Hazard Control	PE	3	3	0	0	3
2	PES1122	Environmental Policies and Legislation	PE	3	3	0	0	3
3	PES1123	Environmental Sustainability	PE	3	3	0	0	3
4	PES1124	Ecology and Environment	PE	3	3	0	0	3
5	PES1125	Energy Management	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE –II

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES1126	Marine Pollution and Control	PE	3	3	0	0	3
2	PES1127	Environmental Risk Assessment	PE	3	3	0	0	3
3	PES1128	Wastewater Engineering	PE	3	3	0	0	3
4	PES1129	Industrial Pollution Prevention	PE	3	3	0	0	3
5	PES1131	Climate Change and Adaptation	PE	3	3	0	0	3

PROFESSIONAL ELECTIVES

SEMESTER II

PROFESSIONAL ELECTIVE – III

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES1221	Membrane Technologies for Water and Wastewater Treatment	PE	3	3	0	0	3
2	PES1222	Environmental Reaction Engineering	PE	3	3	0	0	3
3	PES1223	Advanced Oxidation Processes and Technology	PE	3	3	0	0	3
4	PES1224	Pollution Abatement	PE	3	3	0	0	3
5	PES1225	Corrosion Engineering	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – IV

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES1226	Environmental Biotechnology	PE	3	3	0	0	3
2	PES1227	Soil Pollution Engineering	PE	3	3	0	0	3
3	PES1228	Environment, Health and Safety in Industries	PE	3	3	0	0	3
4	PES1229	Remote Sensing and GIS Applications in Environmental Management	PE	3	3	0	0	3
5	PES1231	Hydrogen and Fuel Cells	PE	3	3	0	0	3

PROFESSIONAL ELECTIVES**SEMESTER III****PROFESSIONAL ELECTIVE – V**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES1321	Waste Management and Energy Recovery	PE	3	3	0	0	3
2	PES1322	Bio-Energy Conversion Techniques	PE	3	3	0	0	3
3	PES1323	Electrochemical Environmental Technology	PE	3	3	0	0	3
4	PES1324	Electronic Waste Management	PE	3	3	0	0	3
5	PES1325	Environmental Transport Processes	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – VI

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES1326	Principles of Green Chemistry and Engineering	PE	3	3	0	0	3
2	PES1327	Plastic Waste Management	PE	3	3	0	0	3
3	PES1328	Agricultural Waste Management	PE	3	3	0	0	3
4	PES1329	Monitoring of Air Pollutants	PE	3	3	0	0	3
5	PES1331	Carbon Capture and Storage	PE	3	3	0	0	3

COURSE CODE	COURSE TITLE	L	T	P	C
PES1101	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3

Course Outcomes

1. Understanding the main components of EIA, EIS and ERA and their limitations and legal regulatory aspects in India.
2. Understanding the EIA's important components of impact prediction and mitigation measures
3. Understanding the recent trends in EIA's practices.
4. Understanding the monitoring aspects of EIA component.
5. Understanding the EIA practices for different industries through case studies.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1102	BIOLOGICAL WASTEWATER TREATMENT	3	0	0	3

Course Outcomes

1. Understanding of importance of biological operations in wastewater treatment and kinetic studies.
2. Ability to design aerobic treatment of wastewater for simple and complex systems
3. Knowledge on the design of anaerobic treatment of wastewater
4. Ability to design sludge treatment and disposal.
5. Design, construction, operations and maintenance aspects of wastewater treatment facility.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1103	ENVIRONMENTAL CHEMISTRY	3	0	0	3

Course Outcomes

1. Demonstrate knowledge of microbial and enzymatic action in wastewater.
2. Apply basic concepts of chemical thermodynamics in environmental problems.
3. Apply basic concepts of electrochemistry in environmental problems.
4. Acquire broad knowledge of colloids and electrical properties of surfaces.
5. Develop skills in sampling and characterization of wastewater

COURSE CODE	COURSE TITLE	L	T	P	C
PES1104	UNIT OPERATIONS AND UNIT PROCESSES IN ENVIRONMENTAL TECHNOLOGY	3	2	0	4

Course Outcomes

1. Apply the concepts of unit operations and unit processes for wastewater treatment and to choose the different reactors. (K3)
2. Analyze the primary sedimentation tank and flotation unit for wastewater treatment. (K4)
3. Evaluate the various filtration methods in wastewater treatment and its design. (K5)
4. Assess the tertiary wastewater treatment and the design of disinfection units. (K5)
5. Analyse the biological wastewater treatment techniques and its design. (K4)

COURSE CODE	COURSE TITLE	L	T	P	C
PES1111	ENVIRONMENTAL ENGINEERING LAB	0	0	4	2

Course Outcomes

1. Analyze the various standard protocols used in environmental monitoring (K4)
2. Assess the appropriate experiments for available water/wastewater quality (K5)

COURSE CODE	COURSE TITLE	L	T	P	C
PES1201	AIR POLLUTION AND CONTROL ENGINEERING	3	0	0	3

Course Outcomes

1. Understand the air quality, properties, sources and effects of the atmospheric pollutants
2. Understand meteorology and air pollution modelling
3. Gain knowledge on indoor air quality, measurement and control
4. Understand particulate emission and control
5. Understand gaseous emission and control

COURSE CODE	COURSE TITLE	L	T	P	C
PMA1276	ADVANCED NUMERICAL METHODS	3	0	2	4

Course Outcomes

1. Understand the basic concepts and techniques of solving algebraic and Transcendental equations and also solving algebraic system of equations.
2. Understand the knowledge of various techniques and methods for solving first and higher order Initial and Boundary Value Problems
3. To gain the Knowledge of addressing Time dependent Partial Differential Equations using Finite Difference Methods.
4. To gain the Knowledge of addressing Time Independent Partial Differential Equations using Finite Difference Methods.
5. To solve Boundary Value Problems using Finite Element Methods.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1202	SEPARATION PROCESSES IN ENVIRONMENTAL APPLICATIONS	3	0	0	3

Course Outcomes

1. Examine the various pollution sources and the different types of separation processes for environmental applications. (K3)
2. Assess the various types of distillation processes and its analysis. (K5)
3. Analyze the extraction and absorption processes for environmental applications. (K4)
4. Analyze the adsorption and ion exchange processes for environmental applications and its design considerations. (K4)
5. Outline the various membrane processes for environmental applications. (K4)

COURSE CODE	COURSE TITLE	L	T	P	C
PES1203	SOLID AND HAZARDOUS WASTE MANAGEMENT	3	0	0	3

Course Outcomes

1. Understand various sources, types and handling of solid wastes.
2. Understand and to analyze the waste collection systems and waste management facilities.
3. Identify the hazardous wastes and to understand the design and operation of facilities for physical, chemical and thermal treatment of hazardous wastes.
4. Understand and apply the principles of hazardous waste treatment technologies.
5. Apply the principles to do sampling and characterization of solid wastes.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1215	SEMINAR	0	0	4	2

OUTCOME

1. Reflect on the ways of making effective presentations
2. Examine the presentation skills on the specific topic for improvement.
3. Integrate their presentation, written and oral skills.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1301	MODELING OF ENVIRONMENTAL SYSTEMS	3	2	0	4

Course Outcomes

1. Develop a basic model equation for any process.
2. Identify various ecological models.
3. Apply reactor kinetics and models.
4. Recognize pollutant and nutrient dynamics.
5. Acquire fundamentals of microbial dynamics.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1318	Project Work Phase-I	0	0	12	6

OUTCOME

- CO1: Examine the literature survey for any type of environmental problems.
- CO2: Summarize the problem statement clearly.
- CO3: Identify the methodology.
- CO4: Interpret the research results.
- CO5: Show the report preparation, presentation and publication.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1418	Project Work Phase-II	0	0	24	12

OUTCOME

CO1: Examine the literature survey for any type of environmental problems.

CO2: Summarize the problem statement clearly.

CO3: Identify the methodology.

CO4: Interpret the research results.

CO5: Show the report preparation, presentation and publication.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1121	SAFETY AND HAZARD CONTROL	3	0	0	3

Course Outcomes

1. Understand the concept of safety and hazards and how to identify hazards in process industries.
2. Gain knowledge on each fatality or serious injury there are thousands of risk behaviours and unidentified hazards that contributed to incident
3. Assess to manage the risk that is associated in process industries.
4. Adopt safety measures in storage and handling of chemicals in process industries using various personnel protective equipments.
5. Plan for the case of any disaster and emergency preparedness.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1122	ENVIRONMENTAL POLICIES AND LEGISLATION	3	0	0	3

OUTCOME

- On completion of the course, the students are expected to be familiar in environmental policies and legislation pertaining to industries.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1123	ENVIRONMENTAL SUSTAINABILITY	3	0	0	3

OUTCOMES

- Students will analyze the role of environmental sustainability in the promotion of comprehensive justice and equity.
- They will apply critical thinking skills to provide sustainable solutions and build resilient communities.
- They will utilize the appropriate methodological tools to analyze and address specific research questions.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1124	ECOLOGY AND ENVIRONMENT	3	0	0	3

OUTCOMES

- Students will be able to interpret, synthesize, and apply a wide range of scientific literature in the ecological and environmental sciences, particularly dealing with both climate change and global change.
- They will be able to interpret environmental, resource management, and sustainability conflicts from multiple perspectives.
- They will be able to effectively analyze and integrate the social and natural sciences to understand diverse environmental and sustainability challenges ranging from local issues to global environments.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1125	ENERGY MANAGEMENT	3	0	0	3

OUTCOME

- By the end of the course student will be in a position to understand: the current scenario of energy demand supply, energy production technologies, energy conservation ideas, for managing energy and environmental resources.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1126	MARINE POLLUTION AND CONTROL	3	0	0	3

OUTCOMES

- Ability to know about marine environment. And learnt the physical concepts lying behind the oceanic currents and natural processes of various activities happening over the marine environment.
- Acquired knowledge on the marine pollution and the effect of the same on the ecology.
- Should have gained knowledge on remote sensing and various other techniques for measuring and monitoring oceanic environment parameters.
- Should have acquired knowledge on control of marine pollution and sustainable development.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1127	ENVIRONMENTAL RISK ASSESSMENT	3	0	0	3

OUTCOMES

- Students will gain the knowledge and understanding of the methods and processes employed in environmental health and risk assessment.
- They will use different tools to aid the risk assessment analysis.
- They will gain the knowledge on environmental laws and regulations to develop guidelines,

procedures and processes for health and safety issues.

- They will use epidemiological data and to analyze the various methods of risk assessment.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1128	WASTE WATER ENGINEERING	3	0	0	3

OUTCOMES

- Students will be able to provide the suitable wastewater treatment unit to particular kind of wastewater.
- They will apply the basic sciences to solve the wastewater treatment problems.
- They will design the wastewater treatment units for specific wastewater.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1129	INDUSTRIAL POLLUTION PREVENTION	3	0	0	3

OUTCOMES

- Understand the different types of wastes generated in an industry, their environmental regulatory legislations and standards.
- Understand about the quantification and analysis of wastewater treatment, atmospheric dispersion of air pollutants, and air pollution control devices.
- Understand about analysis and quantification of hazardous and nonhazardous solid waste wastes, treatment and disposal

COURSE CODE	COURSE TITLE	L	T	P	C
PES1131	CLIMATE CHANGE AND ADAPTATION	3	0	0	3

OUTCOMES

- The students can understand the concept of climate change and its consequences.
- The students can adopt the methodologies in finding the changes in climate

COURSE CODE	COURSE TITLE	L	T	P	C
PES1221	MEMBRANE TECHNOLOGIES FOR WATER AND WASTEWATER TREATMENT	3	0	0	3

OUTCOMES

- Students will be able to apply various transport models for the calculation of membrane fluxes and the extent of separation for various membrane systems
- They will identify the types of experimental data needed for the calculation of membrane parameters.
- They will select a membrane process and design components to carry out a specific

separation.

- They will make advancements in membrane techniques to solve environmental problems.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1222	ENVIRONMENTAL REACTION ENGINEERING	3	0	0	3

OUTCOMES

- Students will have an ability to analyze reactors and reaction systems.
- They will analyze the reactors and interpret the kinetic data.
- They will have an ability to solve problems of mass transfer with reaction in fluid-solid reactions.
- They will design and sizing of industrial scale reactor on the basis of kinetic data obtained at lab scale

COURSE CODE	COURSE TITLE	L	T	P	C
PES1223	ADVANCED OXIDATION PROCESSES AND TECHNOLOGY	3	0	0	3

OUTCOMES

- After completion of this course, the students can explain the theoretical basis of advanced oxidation techniques used for pollution control
- The students can classify and evaluate the effectiveness of advanced oxidation technology used for pollution control and environmental protection.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1224	POLLUTION ABATEMENT	3	0	0	3

OUTCOMES

- Understand the different types of wastes being generated from the different industries and their environmental regulatory legislations and standards.
- Understand the different types of pollution control techniques.
- Understand the proper disposal of different kinds of pollutants after the treatment.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1225	CORROSION ENGINEERING	3	0	0	3

OUTCOME

- Students learn about the types of corrosion, protection methods, corrosion in specific environments, corrosion in specific cases and control.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1226	ENVIRONMENTAL BIOTECHNOLOGY	3	0	0	3

OUTCOMES

- Students will be able to differentiate between different environmental pollutants.
- Distinguish between different pollutants and identify the appropriate waste treatment to the relevant problem

COURSE CODE	COURSE TITLE	L	T	P	C
PES1227	SOIL POLLUTION ENGINEERING	3	0	0	3

OUTCOMES

- Understand the nature of the soil and its characteristics.
- Analyze the different contaminant transport mechanisms in the soil systems.
- Understand the different kinds of soil remediation techniques.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1228	ENVIRONMENT HEALTH AND SAFETY INDUSTRIES	3	0	0	3

OUTCOME

- On completion of the course, the students are expected to be familiar with accident prevention techniques, hazard analysis techniques and legislations pertaining to safety in chemical industries.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1229	REMOTE SENSING AND GIS APPLICATIONS IN ENVIRONMENTAL MANAGEMENT	3	0	0	3

OUTCOME

- The students will apply remote sensing and GIS to solve problems pertaining to environmental engineering.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1231	HYDROGEN AND FUEL CELLS	3	0	0	3

OUTCOMES

After completing the course, student should have learnt

- Basics and working principles of the Fuel cell technology.
- Selection the suitable materials for electrode, catalyst, membrane for the fuel cells.
- The mass transfer process such as pressure drop and velocity distribution in single cell as well as stack.
- Design and stack making process for real field applications

COURSE CODE	COURSE TITLE	L	T	P	C
PES1321	WASTE MANAGEMENT AND ENERGY RECOVERY	3	0	0	3

OUTCOME

- Understand the solid waste remedial measures and their importance.
- Understand the legislations pertaining to solid waste management.
- Understand the different kinds of energy generation techniques for different kinds of solid wastes.
- Understand the proper disposal methods for the different kinds of solid wastes.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1322	BIO-ENERGY CONVERSION TECHNIQUES	3	0	0	3

OUTCOME

- Understand the available feed stocks to prepare the different quality of fuels.
- Understand to develop energy efficient systems.
- Focussed on the conservation of energy while developing industrial processes.

COURSE CODE	COURSE TITLE	L	T	P	C

PES1323	ELECTROCHEMICAL ENVIRONMENTAL TECHNOLOGY	3	0	0	3

OUTCOME

- Detailed knowledge on types and sources of pollutants and how to monitor the environmental pollutants.
- Understand different conventional techniques for monitoring and controlling pollutants.
- Understand the electrochemical and photochemical methods for controlling pollutants.
- The students will develop different types of electrodes that can be used for large scale for controlling pollutants.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1324	ELECTRONIC WASTE MANAGEMENT	3	0	0	3

OUTCOME

- The students will develop the recycling and recovery process of the materials used in the manufacture of electrical and electronic products.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1325	ENVIRONMENTAL TRANSPORT PROCESS	3	0	0	3

OUTCOME

- The environmental engineers can able to learn the good understanding of chemical properties and transport in an environmental system.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1326	PRINCIPLES OF GREEN CHEMISTRY AND ENGINEERING	3	0	0	3

OUTCOME

- Upon completion of this course, the students would understand the fundamentals of green chemistry and engineering
- Application of these principles during the design, retrofit and management of chemical processes for a more sustainable chemical manufacturing

COURSE CODE	COURSE TITLE	L	T	P	C
PES1327	PLASTIC WASTE MANAGEMENT	3	0	0	3

OUTCOME

The students completing the course will be able to

- Understand the impact of plastic waste on environment
- Recycle of both commercial and engineering plastics.
- Knowing the policies related to environmental issues of plastics waste.
- Know legislations related to environmental issues of plastic waste.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1328	AGRICULTURAL WASTE MANAGEMENT	3	0	0	3

OUTCOME

At the end of the course student will be able to understand

- Various eco-friendly methods for agricultural waste management.
- Nutritive value and energy production potential of agro wastes.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1329	MONITORING OF AIR POLLUTANTS	3	0	0	3

OUTCOME

The students completing the course will have

- An understanding of the nature and characteristics of air pollutants, and basic concepts of air quality management
- Ability to identify, formulate and solve air pollution problems
- Ability to design stacks and particulate air pollution control devices to meet applicable standards.

COURSE CODE	COURSE TITLE	L	T	P	C
PES1331	Carbon Capture and Storage (CCS)	3	0	0	3

OUTCOMES

- Able to discover the importance and challenges in CCS.
- Able to develop the new solvents and solvent regeneration techniques for CCS.
- Able to develop the suitable sorbents and membrane technology for CCS.
- Able to develop the biological method of CCS technology.
- Able to find an effective way for CO₂ conversion, utilization and storage
- Able to demonstrate the existing CCS technologies and challenges in large-scale implementation.

Sri Sivasubramaniya Nadar College of Engineering

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Rajiv Gandhi Salai (OMR), Kalavakkam – 603110

Curriculum and Syllabus

Master of Technology Environmental Science & Technology

**Regulations 2022
Choice Based Credit System (CBCS)**



Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603 110
(An Autonomous Institution Affiliated to Anna University Chennai)

Rajiv Gandhi Salai (OMR), Kalavakkam – 603110

Vision and Mission of the Department

Vision

- To be a globally recognized Chemical Engineering department with excellence in teaching, research and consultancy services.

Mission

- To prepare our students to become successful professional Chemical Engineers capable of undertaking advanced studies and life-long learning.
- To produce Chemical Engineers who will contribute to the process industries worldwide.
- To provide the students a strong fundamental technical education that makes them capable of catering to the needs of a changing technological environment and the society.
- To nurture the innovative capabilities of students by providing them with a research platform and exposure to current technologies.

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603 110
(An Autonomous Institution Affiliated to Anna University Chennai)

Rajiv Gandhi Salai (OMR), Kalavakkam – 603110

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

- I. To provide the engineering graduates with technical expertise in environmental science and technology which will enable them to have a career and professional accomplishment in the public or private sector, to pursue higher studies or may start up their own business.
- II. Address the complexities of real-life environmental problems related to domestic and industrial waste management, environmental impact assessment, industrial pollution prevention and control.
- III. Identify, formulate, analyse, develop processes and technologies to meet desired environmental protection needs of society and formulate solutions that are technically sound and economically feasible.

PROGRAMME OUTCOMES (POs):

By the time of their graduation, the students are expected:

- PO 1. An ability to independently carry out research /investigation and development work to solve practical problems.
- PO 2. An ability to write and present a substantial technical report/document.
- PO 3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
- PO 4. An ability to select/design the treatment units to mitigate the environmental pollution.

PEOs mapping with POs

PEO	PO1	PO2	PO3	PO4
I	3	1	3	3
II	3	2	3	3
III	3	3	3	3

COURSE - PO MAPPING

Semester	Course Name	Programme Outcomes			
		PO1	PO2	PO3	PO4
I	Applied Mathematics for Environmental Engineering			3	2
	Environmental Chemistry			3	1
	Unit Operations and Unit Processes in Environmental Technology		3	3	3
	Biological Wastewater Treatment	2		3	2
	Research Methodology & IPR	3	3		
	Program Elective I				
	Environmental Engineering Laboratory	3	3	3	3
	Analytical Instrumentation Laboratory for Environmental applications	3	3	3	3
II	Air Pollution and Control Engineering	1	3	3	2
	Separation Processes in Environmental Applications		3	3	3
	Solid and Hazardous Waste Management		1	3	2
	Program Elective II				
	Program Elective III				
	Separation Processes in Environmental Applications Laboratory	3	3	3	3
	Computational Simulation in Environmental Engineering Laboratory	1	3	3	3
	Internship & Seminar	3	3	3	3
III	Program Elective IV				
	Program Elective V				
	Open Elective				
	Project Phase I	3	3	3	3
IV	Project Phase II	3	3	3	3
Program Electives	Safety and Hazard Control		1	2	1
	Environmental Policies and Legislation		1	2	1
	Environmental Sustainability		2	2	
	Ecology and Environment	1		2	2
	Industrial Pollution Prevention			2	2
	Modeling of Environmental Systems	2	3	3	3
	Environmental Impact Assessment	2	2	3	2
	Environmental Risk Assessment	1		2	2
	Wastewater Engineering			3	1
	Marine Pollution and Control		3	3	2
	Membrane Technologies for Water and Wastewater Treatment	2	2	2	2
	Environmental Reaction Engineering	2	3	3	2
	Advanced Oxidation Processes and Technology	2	3	3	2
	Electrochemical Environmental Technology		3	3	2
	Principles of Green Chemistry and Engineering			3	1
	Carbon Capture and Storage	1	3	3	
	Climate Change and Adaptation		2	3	
	Environmental Biotechnology	1		2	

	Remote Sensing and GIS Applications in Environmental Management		3	3	
	Soil Pollution Engineering			3	2
	Bio-Energy Conversion Techniques		2	3	
	Waste Management and Energy Recovery		2	3	
	Electronic Waste Management		3	3	2
	Plastic Waste Management		2	3	2
	Agricultural Waste Management		1	3	
Open Electives	Business analytics	1			1
	Industrial safety	1		2	
	Operations Research	2	2		
	Cost Management of Engineering Projects	2	1		
	Composite Materials	2	1		
	Waste to Energy	2		2	
	Introduction to Data Science	2			2

I TO IV SEMESTERS CURRICULUM -R2022 (CBCS)

SEMESTER I								
Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	PMA2151	Applied Mathematics for Environmental Engineering	FC	4	3	1	0	4
2	PES2101	Environmental Chemistry	FC	3	3	0	0	3
3	PES2102	Unit Operations and Unit Processes in Environmental Technology	PC	3	3	0	0	3
4	PES2103	Biological Wastewater Treatment	PC	3	3	0	0	3
5	PGE2176	Research Methodology & IPR	MLC [#]	2	2	0	0	2
6		Program Elective I	PE	3	3	0	0	3
PRACTICALS								
7	PES2111	Environmental Engineering Laboratory	PC	4	0	0	4	2
8	PES2112	Analytical Instrumentation Laboratory for Environmental Applications	PC	4	0	0	4	2
TOTAL				26	17	1	8	22

#Mandatory Learning Course

SEMESTER II								
Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	PES2201	Air Pollution and Control Engineering	PC	3	3	0	0	3
2	PES2202	Separation Processes in Environmental Applications	PC	3	3	0	0	3
3	PES2203	Solid and Hazardous Waste Management	PC	3	3	0	0	3
4		Program Elective II	PE	3	3	0	0	3
5		Program Elective III	PE	3	3	0	0	3
6		Audit Course*	AC	2	2	0	0	0
PRACTICALS								
7	PES2211	Separation Processes in Environmental Applications Laboratory	PC	4	0	0	4	2
8	PES2212	Computational Simulation in Environmental Engineering Laboratory	PC	4	0	0	4	2
9	PES2216	Internship with Seminar	EEC	2	0	0	2	2
TOTAL				27	17	0	10	21
*No credit & Optional								

SEMESTER III								
Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Program Elective IV	PE	3	3	0	0	3
2		Program Elective V	PE	3	3	0	0	3
3		Open Elective	OE	3	3	0	0	3
PRACTICALS								
5	PES2318	Project Phase I	EEC	12	0	0	12	6
TOTAL				21	9	0	12	15

SEMESTER IV								
Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1	PES2418	Project Phase II	EEC	24	0	0	24	12
TOTAL				24	0	0	24	12

Total Credits: 70

PROGRAM ELECTIVES**SEMESTER I****PROGRAM ELECTIVE –I**

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES2121	Safety and Hazard Control	PE	3	3	0	0	3
2	PES2122	Environmental Policies and Legislation	PE	3	3	0	0	3
3	PES2123	Environmental Sustainability	PE	3	3	0	0	3
4	PES2124	Ecology and Environment	PE	3	3	0	0	3
5	PES2125	Industrial Pollution Prevention	PE	3	3	0	0	3

SEMESTER II**PROGRAM ELECTIVE –II**

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES2221	Modeling of Environmental Systems	PE	3	3	0	0	3
2	PES2222	Environmental Impact Assessment	PE	3	3	0	0	3
3	PES2223	Environmental Risk Assessment	PE	3	3	0	0	3
4	PES2224	Wastewater Engineering	PE	3	3	0	0	3
5	PES2225	Marine Pollution and Control	PE	3	3	0	0	3

PROGRAM ELECTIVE –III

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES2226	Membrane Technologies for Water and Wastewater Treatment	PE	3	3	0	0	3
2	PES2227	Environmental Reaction Engineering	PE	3	3	0	0	3
3	PES2228	Advanced Oxidation Processes and Technology	PE	3	3	0	0	3
4	PES2229	Electrochemical Environmental Technology	PE	3	3	0	0	3
5	PES2231	Principles of Green Chemistry and Engineering	PE	3	3	0	0	3

SEMESTER III**PROGRAM ELECTIVE –IV**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES2321	Carbon Capture and Storage	PE	3	3	0	0	3
2	PES2322	Climate Change and Adaptation	PE	3	3	0	0	3
3	PES2323	Environmental Biotechnology	PE	3	3	0	0	3
4	PES2324	Remote Sensing and GIS Applications in Environmental Management	PE	3	3	0	0	3
5	PES2325	Soil Pollution Engineering	PE	3	3	0	0	3

PROGRAM ELECTIVE –V

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PES2326	Bio-Energy Conversion Techniques	PE	3	3	0	0	3
2	PES2327	Waste Management and Energy Recovery	PE	3	3	0	0	3
3	PES2328	Electronic Waste Management	PE	3	3	0	0	3
4	PES2329	Plastic Waste Management	PE	3	3	0	0	3
5	PES2331	Agricultural Waste Management	PE	3	3	0	0	3

SEMESTER II**AUDIT COURSES**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	AGE2001	English for Research Paper Writing	AC	2	2	0	0	0
2	AGE2002	Disaster Management	AC	2	2	0	0	0
3	AGE2003	Value Education	AC	2	2	0	0	0
4	AGE2004	Pedagogy Studies	AC	2	2	0	0	0
5	AGE2005	Personality Development Through Life Enlightenment Skills	AC	2	2	0	0	0
6	AGE2006	Constitution of India	AC	2	2	0	0	0

SEMESTER III**OPEN ELECTIVE COURSES**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	PGE2941	Business Analytics	OE	3	3	0	0	3
2	PGE2942	Industrial Safety	OE	3	3	0	0	3
3	PGE2943	Operations Research	OE	3	3	0	0	3
4	PGE2944	Cost Management of Engineering Projects	OE	3	3	0	0	3
5	PGE2945	Composite Materials	OE	3	3	0	0	3
6	PGE2946	Waste to Energy	OE	3	3	0	0	3
7	PGE2947	Introduction to Data Science	OE	3	3	0	0	3

COURSE CODE	COURSE TITLE	L	T	P	C
PMA2151	APPLIED MATHEMATICS FOR ENVIRONMENTAL ENGINEERING	3	1	0	4

OUTCOMES

On successful completion of this course, students will be able to:

CO1: Apply the numerical techniques to solve algebraic equations.

CO2: Analyze the consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation.

CO3: Formulate and solve Linear Programming problems.

CO4: Identify and solve problems in one-dimension random variables.

CO5: Solve linear differential equations of first order.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2101	ENVIRONMENTAL CHEMISTRY	3	0	0	3

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Summarize the importance of environmental chemistry for wastewater engineering.

CO2: Discuss the basic concepts of chemical thermodynamics in environmental problems.

CO3: Apply the concepts of electrochemistry in environmental problems.

CO4: Analyze the principles of colloids and electrical properties of surfaces.

CO5: Examine the various water and air analysis techniques.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2102	UNIT OPERATIONS AND UNIT PROCESSES IN ENVIRONMENTAL TECHNOLOGY	3	0	0	3

OUTCOMES:

On successful completion of this course, students will be able to:

CO1: Apply the concepts of unit operations and unit processes for wastewater treatment and to choose the different reactors.

CO2: Analyze the primary sedimentation tank and flotation unit for wastewater treatment.

CO3: Evaluate the various filtration methods in wastewater treatment and its design.

CO4: Assess the tertiary wastewater treatment and the design of disinfection units.

CO5: Analyze the biological wastewater treatment techniques and its design.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2103	BIOLOGICAL WASTEWATER TREATMENT	3	0	0	3

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Summarize the concepts and fundamentals of biological processes used in wastewater treatment

CO2: Apply the design procedures for aerobic wastewater treatment units.

CO3: Outline the design of anaerobic wastewater treatment units.

CO4: Examine the design of sludge management facilities.

CO5: Analyze the mathematical model for suspended growth and attached growth reactors.

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2176	RESEARCH METHODOLOGY & IPR	2	0	0	2

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Formulate research problem

CO2: Carry out research analysis

CO3: Follow research ethics

CO4: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

CO5: Understand about IPR and filing patents in R & D.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2111	ENVIRONMENTAL ENGINEERING LABORATORY	0	0	4	2

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Analyze the various standard protocols used in environmental monitoring.

CO2: Summarize the water and wastewater sampling procedures and sample preservations.

CO3: Analyze the composition of solid waste.

CO4: Predict the appropriate experiments for available water/wastewater quality.

CO5: Analyze and interpret laboratorial results.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2112	ANALYTICAL INSTRUMENTATION LABORATORY FOR ENVIRONMENTAL APPLICATIONS	0	0	4	2

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Analyze and experiment the dye wastewater using UV-Vis Spectrophotometer.

CO2: Analyze and experiment the various heavy metals using AAS.

CO3: Analyze the water/wastewater quality.

CO4: Analyze the solid samples using FTIR.

CO5: Interpret the analytical reports.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2201	AIR POLLUTION AND CONTROL ENGINEERING	3	0	0	3

OUTCOMES

On successful completion of this course, the students will be able to:

- CO1 Summarize the air quality, properties, sources and effects of the atmospheric pollutants
- CO2 Examine the meteorology and air pollution modeling
- CO3 Illustrate the indoor air quality, measurement and control
- CO4 Analyze the particulate pollutants and control
- CO5 Outline the gaseous pollutants and control

COURSE CODE	COURSE TITLE	L	T	P	C
PES2202	SEPARATION PROCESSES IN ENVIRONMENTAL APPLICATIONS	3	0	0	3

OUTCOMES

On successful completion of this course, students will be able to:

- CO1: Examine the various pollution sources and the different types of separation processes for environmental applications.
- CO2: Assess the various types of distillation processes and its analysis.
- CO3: Analyze the extraction and absorption processes for environmental applications.
- CO4: Analyze the adsorption and ion exchange processes for environmental applications and its design considerations.
- CO5: Outline the various membrane processes for environmental applications.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2203	SOLID AND HAZARDOUS WASTE MANAGEMENT	3	0	0	3

OUTCOMES

On successful completion of this course, the student will be able to

- CO1: Describe the various sources, types and handling of solid wastes.
- CO2: Analyze the waste collection and transportation systems.
- CO3: Identify the hazardous wastes and its appropriate treatment methods.
- CO4: Discuss the various solid waste treatment technologies to recover energy.
- CO5: Apply the various techniques for effective solid waste disposal.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2211	SEPARATION PROCESSES IN ENVIRONMENTAL APPLICATIONS LABORATORY	0	0	4	2

OUTCOMES:

On successful completion of this course, the student will be able to

- CO1: Determine the distillation parameters for various distillation operation.
- CO2: Determine Extraction parameters for different extraction operation.
- CO3: Estimate the Adsorption/Absorption parameters.

CO4: Analyse and perform separation using Ion-Exchange and filtration operations.
 CO5: Experiment the sieve analysis and to analyse the drying characteristics of a dryer

COURSE CODE	COURSE TITLE	L	T	P	C
PES2212	COMPUTATIONAL SIMULATION IN ENVIRONMENTAL ENGINEERING LABORATORY	0	0	4	2

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Evaluate the specific volume of component using equation of state in ASPEN PLUS.

CO2: Design the heat transfer systems using ASPEN PLUS.

CO3: Design the mass transfer systems using ASPEN PLUS.

CO4: Design the separation/ bio-separation systems using ASPEN PLUS.

CO5: Evaluate the wastewater treatment process using BioWin/ GPS-x/SIMPA/WEST.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2216	INTERNSHIP with SEMINAR	0	0	2	2

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Summarize the latest improvements in their field of expertise.

CO2: Analyze the various literature for the selected and suitable topic.

CO3: Outline the salient features of the area of study.

CO4: Examine the presentation skills on the specific topic for improvement.

CO5: Integrate their presentation in written and oral skills.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2318	PROJECT PHASE I	0	0	12	6

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Examine the literature survey for any type of environmental problems.

CO2: Summarize the problem statement clearly.

CO3: Identify the methodology.

CO4: Interpret the research results.

CO5: Show the report preparation, presentation and publication.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2418	PROJECT PHASE II	0	0	24	12

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Experiment the procedures to carry out the project work.

CO2: Interpret the research results.

CO3: Show the report preparation, presentation and publication.

CO4: Design the pilot plant system based on the observed research results.

CO5: Identify the cause and solutions to any environmental pollution related problems.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2121	SAFETY AND HAZARD CONTROL	3	0	0	3

OUTCOMES

On successful completion of this course, students will be able to:

CO 1: Summarize the basics of industrial safety

CO 2: Analyze the various risk survey techniques and past accidents

CO 3: Summarize the risk management in industries

CO 4: Interpret the safety measures in handling and storage of chemicals and PPE

CO 5: Examine the Disaster mitigation and Emergency Preparedness plans

COURSE CODE	COURSE TITLE	L	T	P	C
PES2122	ENVIRONMENTAL POLICIES AND LEGISLATION	3	0	0	3

OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Summarize the national environmental legislation and policies.

CO2: Describe the laws and analytical techniques involved in water pollution control.

CO3: Describe the laws and analytical techniques involved in air pollution control.

CO4: Describe the Environmental Protection Act 1986.

CO5: Explain how the environmental laws are enforced.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2123	ENVIRONMENTAL SUSTAINABILITY	3	0	0	3

OUTCOMES

On successful completion of this course, the students will be able to:

CO1: Summarize the environment values.

CO2: Outline the concept for sustainable development for environmental systems.

CO3: Discuss the concept of biodiversity and environmental problems.

CO4: Examine different types of pollution.

CO5: Predict the environment's future vision and its economics.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2124	ECOLOGY AND ENVIRONMENT	3	0	0	3

OUTCOME

On successful completion of this course, the student will be able to

CO1: Summarize the fundamentals of ecological systems and their relation with engineering and environment.

CO2: Describe the principles in the modeling of environmental systems and design of

ecological economic systems.

CO3: Demonstrate engineering studies based on ecological criteria.

CO4: Describe the principles and applications in the marine ecosystem.

CO5: Apply the concept to find the solutions to problems pertaining to environmental issues.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2125	INDUSTRIAL POLLUTION PREVENTION	3	0	0	3

OUTCOMES

On successful completion of this course, the student will be able to

CO1: Summarize the environmental laws with penal code.

CO2: Describe the fundamental rights and act.

CO3: Apply the pollution abatement regulations to industries.

CO4: Outline the water & air act.

CO5: Analyze the best management and waste handling techniques.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2221	MODELING OF ENVIRONMENTAL SYSTEMS	3	0	0	3

OUTCOMES

On successful completion of this course, the students will be able to:

CO1: Develop a basic model equation for any process.

CO2: Identify the various ecological models.

CO3: Apply the various models for different reactors.

CO4: Analyze the river self-purification mechanism.

CO5: Examine the microbial dynamics and energetics.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2222	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3

OUTCOMES

On successful completion of this course, students will be able to:

CO1: Perceive the importance of Environmental Impact Assessment and the issues in EIA

CO2: Calculate the Environmental impacts by applying different EIA methods

CO3: Interpret the importance of environmental monitoring using Remote sensing and GIS

CO4: Predict the impacts for various environment and its mitigation measures

CO5: Apply the concept of EIA on various developmental projects

COURSE CODE	COURSE TITLE	L	T	P	C
PES2223	ENVIRONMENTAL RISK ASSESSMENT	3	0	0	3

OUTCOMES

On successful completion of this course, students will be able to:

CO1: Identify various methods which results in reduction of hazards and incidents.
 CO2: Acquire the probability of sequence of events to minimize the damage.
 CO3: Prevent reactive chemical accidents through proper control methods
 CO4: Use Consequence Analysis procedure for various incidents.
 CO5: Apply the concept of risk assessment for the various case histories involving accidents for improving the safety of process.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2224	WASTEWATER ENGINEERING	3	0	0	3

OUTCOMES

On successful completion of this course, the students will be able to:

CO 1: Summarize the general scenario of industrial wastewater generation and their regulatory requirement.
 CO 2: Examine the various industrial waste water treatment techniques.
 CO 3: Categorize the various advanced industrial waste water treatment techniques
 CO 4: Outline the residuals management of industrial wastewater
 CO 5: Apply greater insight about industrial manufacturing process through various case studies promote environmentally sound and sustainable development by identifying appropriate measures.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2225	MARINE POLLUTION AND CONTROL	3	0	0	3

OUTCOMES

On successful completion of this course, students will be able to:

CO1: Summarize the different components of marine and coastal environment.
 CO2: Interpret the physical concepts lying behind the tides, waves, and oceanic currents and natural processes of various activities happening over the marine environment.
 CO3: Identify and measure the marine pollution levels and effects.
 CO4: Apply the knowledge of remote sensing and GIS for monitoring marine environment water quality.
 CO5: Outline the various marine pollution control measures.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2226	MEMBRANE TECHNOLOGIES FOR WATER AND WASTEWATER TREATMENT	3	0	0	3

OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Summarize the principle and working of filtration using different types of membrane modules.
 CO2: Describe the design principles of membrane systems for various industrial applications.
 CO3: Examine the membrane bioreactor for treating industrial wastewater.
 CO4: Outline the pre-treatment methods and strategies followed to control membrane fouling.

CO5: Apply the principles involved in membrane-based systems for water and wastewater treatment.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2227	ENVIRONMENTAL REACTION ENGINEERING	3	0	0	3

OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Summarize the fundamentals of reaction engineering principles related to environmental systems.

CO2: Examine the various ideal reactors.

CO3: Analyze the design and modeling of non-ideal reactors.

CO4: Solve the problems of mass transfer with reaction in fluid-solid reactions.

CO5: Analyze the kinetics of biological reaction and design of bioreactors.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2228	ADVANCED OXIDATION PROCESSES AND TECHNOLOGY	3	0	0	3

OUTCOMES

On successful completion of this course, the students will be able to:

CO1 Summarize the fundamentals of advanced oxidation process.

CO2 Describe the various AOP processes.

CO3 Apply the knowledge on photo induced processes for water and wastewater treatment.

CO4 Examine the implementation of AOPs in environmental applications.

CO5 Apply AOPs for controlling aqueous and gaseous organic pollutants.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2229	ELECTROCHEMICAL ENVIRONMENTAL TECHNOLOGY	3	0	0	3

OUTCOMES

On successful completion of this course, the students will be able to:

CO1: Illustrate the types, sources and monitoring of environmental pollutants.

CO2: Examine the different conventional techniques for monitoring and controlling the pollutants.

CO3: Interpret the various electrochemical treatment methods for pollution control.

CO4: Predict the suitable photo electrochemical method for pollutant treatment.

CO5: Determine the different types of electrodes and electrochemical reactors used in controlling pollution.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2231	PRINCIPLES OF GREEN CHEMISTRY AND ENGINEERING	3	0	0	3

OUTCOMES

On successful completion of this course, the student will be able to

- CO1: Summarize the global environmental issues and risk assessment techniques.
 CO2: Discuss the pollution prevention-based concepts and terminology.
 CO3: Apply the green chemistry principles and methodologies towards best pollution preventions.
 CO4: Analyze the process energy integration methods towards the minimization of emissions and waste.
 CO5: Describe the cost analysis and life cycle assessment techniques.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2321	CARBON CAPTURE AND STORAGE	3	0	0	3

OUTCOMES

- On successful completion of this course, the students will be able to:
 CO1: Describe the importance and challenges in the CCS process.
 CO2: Examine the novel solvents and its regeneration techniques for CCS process.
 CO3: Articulate the novel sorbents and membranes for CCS process.
 CO4: Categorize the biological methods of CCS process.
 CO5: Devise the suitable CO₂ conversion, utilization, and storage techniques.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2322	CLIMATE CHANGE AND ADAPTATION	3	0	0	3

OUTCOMES

- On successful completion of this course, the students will be able to:
 CO1: Discuss the Earth's climate system.
 CO2: Illustrate climate changes and its causes.
 CO3: Summarize the impacts of climate change on various sectors.
 CO4: Articulate the climate change adaptation and mitigation strategies in various sectors.
 CO5: Examine the clean and renewable energy technology.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2323	ENVIRONMENTAL BIOTECHNOLOGY	3	0	0	3

OUTCOMES

- On successful completion of this course, the student will be able to
 CO1: Apply the concept of environmental biotechnology and the different types of microbes used.
 CO2: Describe the different pollutants and identify the appropriate control strategy.
 CO3: Examine the nature of solid waste pollutants and recognize their remediation through environmental biotechnology techniques.
 CO4: Summarize the biotechnological strategies for decontamination and detoxification of environmental systems
 CO5: Outline the knowledge on producing value added products and environmental monitoring.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2324	REMOTE SENSING AND GIS APPLICATIONS IN ENVIRONMENTAL MANAGEMENT	3	0	0	3

OUTCOMES

On successful completion of this course, the students will be able to:

CO1: Describe the basic principles in remote sensing.

CO2: Examine the classification of remote sensing systems and technology involved in it.

CO3: Evaluate the characteristics of remote sensing data.

CO4: Discuss the concept of geographical information system

CO5: Apply the principles of remote sensing and GIS for the monitoring and management of environment.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2325	SOIL POLLUTION ENGINEERING	3	0	0	3

OUTCOMES

On successful completion of this course students will be able to:

CO 1: Summarize the physics and chemistry of soils.

CO 2: Indicate inorganic and organic geochemistry

CO 3: Show the contaminant fate and transport in soil

CO 4: Predict the ground improvement techniques in waste management

CO 5: Analyze the different kinds of soil remediation techniques.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2326	BIO-ENERGY CONVERSION TECHNIQUES	3	0	0	3

OUTCOMES

On successful completion of this course, the students will be able to:

CO1: Estimate the availability and characterisation of biomass for energy applications.

CO2: Describe the key aspects of bio-methanation process.

CO3: Summarize the key aspects of biomass combustion aspects.

CO4: Use the techniques of biomass gasification, pyrolysis, and carbonization.

CO5: Predict the suitable feedstocks and conversion methods and usage of bioethanol and biodiesel.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2327	WASTE MANAGEMENT AND ENERGY RECOVERY	3	0	0	3

OUTCOMES

On successful completion of this course, the students will be able to:

CO1: Summarize the characteristics of solid waste, and legal regulations

CO2: Describe the methods of solid waste collection and segregation techniques.
 CO3: Illustrate the different kinds of energy generation techniques from different types of solid wastes.
 CO4: Describe the practices for managing hazardous wastes.
 CO5: Examine the final disposal methods for wastes.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2328	ELECTRONIC WASTE MANAGEMENT	3	0	0	3

OUTCOME

On successful completion of this course, the student will be able to

CO1: Describe the generation and composition aspects of E-waste.
 CO2: Examine the various treatment methods of E-waste.
 CO3: Develop recycling and recovery process of the materials used in the manufacture of electrical and electronic products.
 CO4: Summarize the rules and regulations for E-waste management.
 CO5: Articulate on sustainable electronic product design.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2329	PLASTIC WASTE MANAGEMENT	3	0	0	3

OUTCOME

On successful completion of this course, the student will be able to

CO1: Identify various sources of plastics waste generation and separation techniques.
 CO2: Describe the segregation methods for recycling the waste plastics.
 CO3: Examine the recycling of Polyolefins, PET &PVC.
 CO4: Discuss the recycling of engineering thermoplastics.
 CO5: Analyse the primary recycling techniques of thermoset composites.

COURSE CODE	COURSE TITLE	L	T	P	C
PES2331	AGRICULTURAL WASTE MANAGEMENT	3	0	0	3

OUTCOMES

On successful completion of this course, the student will be able to

CO1: Describe the different types of agriculture wastes, its characteristics and handling.
 CO2: Summarize the various methods of composting.
 CO3: Examine the technologies involved in biomass briquetting and its applications.
 CO4: Illustrate the methods of biochar production and its characterization.
 CO5: Predict the suitable methods for biogas and bioethanol production.

AUDIT COURSES

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2001	ENGLISH FOR RESEARCH PAPER WRITING	2	0	0	0

OUTCOMES

On successful completion of this course, students will be able to:

CO1: Understand that how to improve your writing skills and level of readability

CO2: Learn about what to write in each section

CO3: Understand the skills needed when writing a Title

CO4: Understand the skills needed when writing the Conclusion

CO5: Ensure the good quality of paper at very first-time submission

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2002	DISASTER MANAGEMENT	2	0	0	0

OUTCOMES

On successful completion of this course, students will be able to:

CO1: Ability to summarize basics of disaster.

CO2: Ability to explain critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5: Ability to develop the strengths and weaknesses of disaster management approaches

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2003	VALUE EDUCATION	2	0	0	0

OUTCOMES

On successful completion of this course, students will be able to:

CO1: Knowledge of self-development.

CO2: Learn the importance of Human values.

CO3: Developing the overall personality.

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2004	PEDAGOGY STUDIES	2	0	0	0

OUTCOMES

On successful completion of this course, students will be able to:

CO1: What pedagogical practices are being used by teachers in formal and in formal class rooms in developing countries?

CO2: What is the evidence on the effectiveness of the pedagogical practices, in what conditions, and with what population of learners?

CO3: How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2005	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	2	0	0	0

OUTCOMES

On successful completion of this course, students will be able to:

CO1: Study of Shrimad- Bhagwad- Geeta will help the student in developing his personality and achieve the highest goal in life.

CO2: The person who has studied Geeta will lead the nation and mankind to peace and prosperity.

CO3: Study of Neetishatakam will help in developing versatile personality of students.

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2006	CONSTITUTION OF INDIA	2	0	0	0

OUTCOMES

On successful completion of this course, students will be able to:

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the frame work of argument that informed the conceptualization of social reform sliding to revolution in India.

CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO4: Discuss the passage of the Hindu Code Bill of 1956.

OPEN ELECTIVES COURSES

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2941	BUSINESS ANALYTICS	3	0	0	3

OUTCOMES:

On completion of the course, the student will be able to:

CO1: Identify the real world business problems and model with analytical solutions.

CO2: Solve analytical problem with relevant mathematics background knowledge.

CO3: Convert any real world decision making problem to hypothesis and apply suitable statistical testing.

CO4: Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce

CO5: Use open source frameworks for modeling and storing data.

CO6: Apply suitable visualization technique using R for visualizing voluminous data.

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2942	INDUSTRIAL SAFETY	3	0	0	3

OUTCOMES:

On completion of the course, the student will be able to:

CO1: Summarize basics of industrial safety

CO2: Describe fundamentals of maintenance engineering

CO3: Explain wear and corrosion

CO4: Illustrate fault tracing

CO5: Identify preventive and periodic maintenance

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2943	OPERATIONS RESEARCH	3	0	0	3

OUTCOMES:

On completion of the course, the student will be able to:

CO1: Formulate linear programming problem and solve using graphical method.

CO2: Solve LPP using simplex method

CO3: Formulate and solve transportation, assignment problems

CO4: Solve project management problems.

CO5: Solve scheduling problems.

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2944	COST MANAGEMENT OF ENGINEERING PROJECTS	3	0	0	3

OUTCOMES

On completion of the course, the student will be able to:

CO1: Understand the costing concepts and their role in decision making.

CO2: Understand the project management concepts and their various aspects in selection

CO3: Interpret costing concepts with project execution.

CO4: Gain knowledge of costing techniques in service sector and various budgetary control techniques

CO5: Become familiar with quantitative techniques in cost management.

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2945	COMPOSITE MATERIALS	3	0	0	3

OUTCOMES:

On completion of the course, the student will be able to:

CO1: Know the characteristics of composite materials and effect of reinforcement in composite materials.

CO2 : Know the various reinforcements used in composite materials.

CO3 : Understand the manufacturing processes of metal matrix composites.

CO4 : Understand the manufacturing processes of polymer matrix composites.

CO5 : Analyze the strength of composite materials.

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2946	WASTE TO ENERGY	3	0	0	3

OUTCOMES:

On completion of the course, the student will be able to:

- CO1: Understand the various types of wastes from which energy can be generated
- CO2: Gain knowledge on biomass pyrolysis process and its applications
- CO3: Develop knowledge on various types of biomass gasifiers and their operations
- CO4: Gain knowledge on biomass combustors and its applications on generating energy
- CO5: Understand the principles of bio-energy systems and their features

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2947	INTRODUCTION TO DATA SCIENCE	3	0	0	3

OUTCOMES:

On completion of the course, the student will be able to:

- CO1: Explain the fundamental concepts of data science. (K2)
- CO2: Develop Python programs to perform data analysis. (K3)
- CO3: Apply the pre-processing steps to clean the data. (K3)
- CO4: Summarize the various statistical inferences. (K2)
- CO5: Solve the data science applications using machine learning. (K3)

Sri Sivasubramaniya Nadar College of Engineering
(An Autonomous Institution, Affiliated to Anna University, Chennai)
Rajiv Gandhi Salai (OMR), Kalavakkam – 603110

Bachelor of Technology
Chemical Engineering

Regulations 2018
Choice Based Credit System (CBCS)



Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Programme Educational Objectives (PEOs)

- a) **Career Achievement:** Our graduates will have a successful career in chemical and allied industries by demonstrating their skills in facing the challenges posed by the ever changing chemical industrial and research sector
- b) **Professionalism:** Our graduates will exhibit leadership qualities by taking suitable decisions and will work in multidisciplinary teams discharging their social responsibilities as engineers following ethical practices
- c) **Life-long Learning:** Our graduates will continue to expand their technical competence by developing their knowledge, skills and engaging themselves in learning activities throughout their career

Programme Outcomes (POs)

On Successful completion of the B.Tech Chemical Engineering Programme, Chemical Engineering Graduates will be able to

- 1) **Engineering knowledge:** Apply the knowledge of mathematics, science, and engineering fundamentals, to solve the complex chemical engineering problems
- 2) **Problem analysis:** Identify, formulate, review research literature, and analyze complex chemical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences
- 3) **Design/development of solutions:** Design solutions for complex chemical engineering problems and design system components or process that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations
- 4) **Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to proceed valid conclusions
- 5) **Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex chemical engineering activities with an understanding of the limitations
- 6) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional chemical engineering practice
- 7) **Environment and sustainability:** Understand the impact of the professional chemical engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development
- 8) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the chemical engineering practice
- 9) **Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings
- 10) **Communication:** Communicate effectively on complex chemical engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

- 11) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
- 12) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes in chemical engineering

Programme Specific Outcomes (PSOs):

PSO1: Design, develop, analyze, and control chemical processes by applying principles of thermodynamics, reaction engineering, momentum, mass and heat transfer.

PSO2: Develop safe and innovative solutions by applying chemical engineering technologies for existing problems.

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam-603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

B.Tech. CHEMICAL ENGINEERING

REGULATIONS 2018

CHOICE BASED CREDIT SYSTEM

I -VIII SEMESTERS COURSES

SEMESTER I

Sl. No..	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UEN1176	Communicative English	HS	3	3	0	0	3
2	UMA1176	Algebra and Calculus	BS	5	3	2	0	4
3	UPH1176	Engineering Physics	BS	3	3	0	0	3
4	UCY1176	Engineering Chemistry	BS	3	3	0	0	3
5	UGE1176	Problem Solving and Programming in Python	ES	3	3	0	0	3
6	UGE1177	Engineering Graphics	ES	5	1	0	4	3
PRACTICALS								
7	UGE1197	Programming in Python Lab	ES	3	0	0	3	1.5
8	UGS1197	Physics and Chemistry Lab	BS	3	0	0	3	1.5
Total				28	16	2	10	22

SEMESTER II

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UEN1276	Technical English	HS	3	3	0	0	3
2	UMA1276	Complex Functions and Laplace Transforms	BS	5	3	2	0	4
3	UPH1253	Physics of Materials	BS	3	3	0	0	3
4	UCY1251	Chemistry for Technologists	BS	3	3	0	0	3
5	UME1251	Basic Mechanical Engineering	ES	5	3	2	0	4
6	UCH1201	Principles of Chemical Engineering	PC	3	3	0	0	3
PRACTICALS								
7	UGE1297	Design Thinking & Engineering Practices Lab	ES	3	0	0	3	1.5
8	UCH1211	Chemical Analysis Lab	BS	3	0	0	3	1.5
Total				28	18	4	6	23

SEMESTER III

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UMA1376	Transform Techniques & Partial Differential Equations	BS	5	3	2	0	4
2	UCH1301	Chemical Process Calculations	PC	4	3	1	0	3.5
3	UCH1302	Fluid Mechanics for Chemical Engineers	PC	4	3	1	0	3.5
4	UCY1351	Physical & Organic Chemistry	BS	3	3	0	0	3
5	UEE1351	Principles of Electrical and Electronics Engineering	ES	3	3	0	0	3
6	UCE1351	Solid Mechanics for Technologists	ES	3	3	0	0	3
PRACTICALS								
7	UEE1371	Electrical Engineering Lab	ES	4	0	0	4	2
8	UME1371	Mechanical Engineering Lab	ES	4	0	0	4	2
Total				30	18	4	8	24

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UMA1476	Statistics and Numerical Methods	BS	5	3	2	0	4
2	UCH1401	Chemical Engineering Thermodynamics I	BS	3	3	0	0	3
3	UCY1276	Environmental Science	BS	3	3	0	0	3
4	UCH1402	Mechanical Operations	PC	3	3	0	0	3
5	UCH1403	Chemical Process Industries	PC	3	3	0	0	3
6	UCH1404	Heat Transfer	PC	3	3	0	0	3
PRACTICALS								
7	UCH1411	Fluid Mechanics Lab	PC	4	0	0	4	2
8	UCY1471	Organic Chemistry Lab	BS	4	0	0	4	2
Total				28	18	2	8	23
TOTAL CREDITS								177

SEMESTER V

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UCH1501	Industrial Process Plant Safety	PC	3	3	0	0	3
2	UCH1502	Chemical Engineering Thermodynamics II	PC	5	3	2	0	4
3	UCH1503	Mass Transfer I	PC	4	3	1	0	3.5
4	UCH1504	Chemical Reaction Engineering I	PC	4	3	1	0	3.5
5		Open Elective* I	OE	3	3	0	0	3
6		Professional Elective I	PE	3	3	0	0	3
PRACTICALS								
7	UCH1511	Mechanical Operations Lab	PC	4	0	0	4	2
8	UCH1512	Heat Transfer Lab	PC	4	0	0	4	2
Total				30	18	4	8	24

SEMESTER VI

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UCH1601	Chemical Reaction Engineering II	PC	4	3	1	0	3.5
2	UCH1602	Mass Transfer II	PC	4	3	1	0	3.5
3	UCH1603	Process Dynamics and Control	PC	3	3	0	0	3
4	UCH1604	Instrumental Methods of Analysis	PC	3	3	0	0	3
5		Professional Elective II	PE	3	3	0	0	3
6		Open Elective* II	OE	3	3	0	0	3
PRACTICALS								
7	UCH1611	Chemical Reaction Engineering Lab	PC	4	0	0	4	2
8	UCH1612	Mass Transfer Lab	PC	4	0	0	4	2
Total				30	16	6	8	23

SEMESTER VII

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UCH1701	Transport Phenomena	PC	3	3	0	0	3
2	UCH1702	Process Equipment Design	PC	3	3	0	0	3
3	UCH1703	Process Engineering Economics	PC	3	3	0	0	3
4	UCH1704	Chemical Process Modelling and Simulation	PC	3	3	0	0	3
5		Professional Elective III	PE	3	3	0	0	3
6		Professional Elective IV	PE	3	3	0	0	3
PRACTICALS								
7	UCH1711	Process Control Lab	PC	4	0	0	4	2
8	UCH1712	Computational Programming Laboratory for Chemical Engineers	PC	4	0	0	4	2
Total				26	18	0	8	22

SEMESTER VIII

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1		Professional Elective V	PE	3	3	0	0	3
2		Professional Elective VI	PE	3	3	0	0	3
PRACTICALS								
3	UCH1818	Project Work	EEC	20	0	0	20	10
Total				26	6	0	20	16

PROFESSIONAL ELECTIVE – I**SEMESTER V**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	UCH1521	Air Pollution and Control	PE	3	3	0	0	3
2	UCH1522	Wastewater Treatment	PE	3	3	0	0	3
3	UCH1523	Electrochemical Engineering	PE	3	3	0	0	3
4	UCH1524	Environmental Engineering	PE	3	3	0	0	3
5	UCH1525	Frontiers of Chemical Engineering	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – II**SEMESTER VI**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	UCH1621	Petroleum Refining and Petro Chemicals	PE	3	3	0	0	3
2	UCH1622	Food Technology	PE	3	3	0	0	3
3	UCH1623	Polymer Technology	PE	3	3	0	0	3
4	UCH1624	Drugs and Pharmaceutical Technology	PE	3	3	0	0	3
5	UCH1625	Pulp and Paper Technology	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – III**SEMESTER VII**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	UCH1721	Energy Technology	PE	3	3	0	0	3
2	UCH1722	Fundamentals of Nano Science	PE	3	3	0	0	3
3	UCH1723	Modern Separation Techniques	PE	3	3	0	0	3
4	UCH1724	Fluidization Engineering	PE	3	3	0	0	3
5	UCH1725	Biochemical Engineering	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – IV**SEMESTER VII**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	UCH1726	Process Plant Utilities	PE	3	3	0	0	3
2	UCH1727	Optimization of Chemical Processes	PE	3	3	0	0	3
3	UCH1728	Electrochemical Process Technology	PE	3	3	0	0	3
4	UCH1729	Green Chemistry and Engineering	PE	3	3	0	0	3
5	UCH1731	Pinch Technology	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – V**SEMESTER VIII**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	UCH1821	Fermentation Engineering	PE	3	3	0	0	3
2	UCH1822	Biological wastewater treatment	PE	3	3	0	0	3
3	UCH1823	Industrial Management	PE	3	3	0	0	3
4	UCH1824	Enzyme Engineering	PE	3	3	0	0	3
5	UCH1825	Industrial Nanotechnology	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – VI**SEMESTER VIII**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UGE1424	Disaster Management	PE	3	3	0	0	3
2.	UGE1476	Total Quality Management	PE	3	3	0	0	3
3.	UGE1576	Professional Ethics	PE	3	3	0	0	3
4.	UGE1578	Human Rights	PE	3	3	0	0	3

OPEN ELECTIVES**(Offered by the Department of Chemical to other branches)****ODD SEMESTER**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UCH1941	Pollution Abatement	OE	3	3	0	0	3
2.	UCH1942	Energy Conservation and Management	OE	3	3	0	0	3
3.	UCH1943	Environmental and Social Impact Assessment	OE	3	3	0	0	3
4	UCH1944	Industrial Safety	OE	3	3	0	0	3

EVEN SEMESTER

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UCH1041	Renewable Energy Sources	OE	3	3	0	0	3
2.	UCH1042	Fundamentals of Combustion	OE	3	3	0	0	3
3.	UCH1043	Introduction to Nanoscience	OE	3	3	0	0	3
4	UCH1044	Process Instrumentation	OE	3	3	0	0	3

COURSE OUTCOMES (COS) FOR EACH COURSES

COURSE CODE	COURSE TITLE	L	T	P	C
UEN1176	COMMUNICATIVE ENGLISH	3	0	0	3

COURSE OUTCOMES:

- Write cohesively and coherently.
- Listen and comprehend different spoken discourses.
- Speak fluently in real contexts
- Read different genres of texts adopting various reading strategies.

COURSE CODE	COURSE TITLE	L	T	P	C
UMA1176	ALGEBRA AND CALCULUS	3	2	0	4

COURSE OUTCOMES:

- Obtain the expansion of trigonometric functions using De-Moivre's theorem.
- Determine the Eigen values and Eigen vectors and diagonalize the given matrix.
- Evaluate the circle of curvature, evolute and envelope of a given curve.
- Find Taylor's expansion for functions of two variables, solve problems using Jacobians and find the extreme points of a function of two variables.
- Solve problems using beta and gamma functions and evaluate problems in double integral and triple integral.

COURSE CODE	COURSE TITLE	L	T	P	C
UPH1176	ENGINEERING PHYSICS	3	0	0	3

COURSE OUTCOMES:

- Comprehend and identify different crystal structures and their imperfections.
- Explain the elastic and thermal properties of materials and understand their significance.
- Develop an understanding of quantum mechanical phenomena and their applications.
- Provide an overview of the characteristics of sound, architectural acoustics and the production, detection and applications of ultrasound.
- Explain the origin of laser action, production of laser, fiber optics and their applications.

COURSE CODE	COURSE TITLE	L	T	P	C
UCY1176	ENGINEERING CHEMISTRY	3	0	0	3

COURSE OUTCOMES:

- Apply the principles of chemistry to determine the impurities present in water and their removal.
- Classify polymers based on synthesis, properties, application and explain the adverse effect of polymers and environment
- Construct phase diagram with the help of thermal analysis and apply electrochemical principles to control corrosion of metals and alloys
- Explain the characteristics of different types of fuels and apply the knowledge on combustion to improve the efficiency of fossil fuel.

COURSE CODE	COURSE TITLE	L	T	P	C
UGE1176	PROBLEM SOLVING AND PROGRAMMING IN PYTHON	3	0	0	3

COURSE OUTCOMES:

- Think logically to solve programming problems and write solutions in pseudo code.
- Understand and develop simple Python programs using conditionals and loops.
- Decompose a program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Perform input/output with files.

COURSE CODE	COURSE TITLE	L	T	P	C
UGE1177	ENGINEERING GRAPHICS	1	0	4	3

COURSE OUTCOMES:

- Familiarize with the fundamentals and standards of Engineering graphics
- Draw plane curves and perform free hand sketching of three dimensional objects.
- Draw the orthographic projections of points, lines and plane surfaces.
- Draw the projections of solids.
- Draw the projections of sectioned solids and development of surfaces.
- Draw Isometric projections of solids and practice building drawing.

COURSE CODE	COURSE TITLE	L	T	P	C
UGE1197	PROGRAMMING IN PYTHON LAB	0	0	3	1.5

COURSE OUTCOMES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- Read and write data from/to files in Python.

COURSE CODE	COURSE TITLE	L	T	P	C
UGS1197	PHYSICS AND CHEMISTRY LAB	0	0	3	1.5

PHYSICS LABORATORY

COURSE OUTCOMES:

At the end of this course, the students will be able to demonstrate the ability to formulate, conduct, analyse and interpret the results of experiments related to study/determination of

- Obtain basic Knowledge about physics concepts applied in optics, thermal physics and properties of matter.

CHEMISTRY LABORATORY

COURSE OUTCOMES

- Obtain basic knowledge in water quality parameters and to understand the principles and procedure for pH metry, Potentionmetry and conductometry.

COURSE CODE	COURSE TITLE	L	T	P	C
UEN1276	TECHNICAL ENGLISH	3	0	0	3

COURSE OUTCOMES:

- Write cohesively and coherently.
- Listen and comprehend different spoken discourses.
- Speak fluently in real contexts.
- Read different genres of texts adopting various reading strategies.

COURSE CODE	COURSE TITLE	L	T	P	C
UMA1276	COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS	3	2	0	4

COURSE OUTCOMES:

- Solve problems in Analytic functions and construction of analytic functions using C-R equations.
- Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function.
- Obtain the Laplace Transforms of standard functions.
- Solve Differential Equations of Second order and Simultaneous linear equations with constant coefficients of first order using Laplace Transform.
- Solve problems using divergence and curl and evaluate line, Surface and Volume integrals.

COURSE CODE	COURSE TITLE	L	T	P	C
UPH1253	PHYSICS OF MATERIALS	3	0	0	3

COURSE OUTCOMES:

- Comprehend and identify different crystal structures and their imperfections.,
- Explain the elastic and thermal properties of materials and understand their significance.
- Develop an understanding of quantum mechanical phenomena and their applications.
- Provide an overview of the characteristics of sound, architectural acoustics and the production, detection and applications of ultrasound.
- Explain the origin of laser action, production of laser, fiber optics and their applications.

COURSE CODE	COURSE TITLE	L	T	P	C
UCY1251	CHEMISTRY FOR TECHNOLOGISTS	3	0	0	3

COURSE OUTCOMES:

- Explain the types of reactions and reagents used in Chemical industries for the manufacture of some important organic compounds (Esters, Nitrocompounds, Sulphonic acids, Amines, Soaps etc.,)
- Explain the preparation, properties and uses of commercial oxidants (Hydrogen peroxide, Bleaching powder, Liquid bleach and chlorine di oxide)
- Describe the properties and uses of Engineering Materials (Abrasives, Refractories, Cements and Lubricants)
- Explain the know-how of what, when, why and how of a few commercially important substances (oil, fats, soaps and lubricants)
- Describe the interaction between light and matter and apply various theories to explain the reason for compounds to exhibit colour
- Explain the preparation, properties and uses of important azodyes (MO, MR and CR)

COURSE CODE	COURSE TITLE	L	T	P	C
UME1251	BASIC MECHANICAL ENGINEERING	3	2	0	4

COURSE OUTCOMES:

- Understand the principles behind the operation of thermal equipment like IC engines and turbines etc.,
- Appreciate the theory behind operation of machinery and be able to design simple mechanisms

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1201	PRINCIPLES OF CHEMICAL ENGINEERING	3	0	0	3

COURSE OUTCOMES:

- Understand the role of chemical engineers and industrial operations for producing chemicals in a large scale.
- Understand the terminologies of chemical process calculations and get an overview of fluid mechanics and pumps
- Describe heat transfer principles and equipment
- Explain mass transfer operation principles and equipment
- Recognize the concepts of chemical reaction engineering and reactors

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1211	CHEMICAL ANALYSIS LAB	0	0	3	1.5

COURSE OUTCOMES:

- Calculate the Chemical Properties of solid fuels.
- Predict the properties of various oils relevant to chemical engineers.
- Use analytical techniques in estimating the basic water pollutant parameters.
- Compute the physiochemical parameters to assess the quality of soap.
- Examine the composition of various oxides present in the cement.

COURSE CODE	COURSE TITLE	L	T	P	C
UMA1376	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS	3	2	0	4

COURSE OUTCOMES:

After completing this course, the students will be able to

- Solve engineering problems using Fourier series
- Analyze and solve partial differential equations of first and higher order
- Use Fourier series techniques to solve partial differential equations
- Apply Fourier transform techniques to solve some of the physical problems of engineering.
- Apply Z - transform techniques to solve some of the physical problems of engineering.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1301	CHEMICAL PROCESS CALCULATIONS	3	1	0	3.5

COURSE OUTCOMES:

- Determine composition of mixture, solution and gas.
- Perform material balance for various chemical processes.
- Apply psychrometry in solving Chemical Engineering problems.
- Make energy balances for various chemical processes.
- Solve problems on combustion and apply process simulations in energy and material balance problems

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1302	FLUID MECHANICS FOR CHEMICAL ENGINEERS	3	1	0	3.5

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Understand the fundamental properties of fluids and analyze pressure measurement methods.
- Analyze characteristics of the fluid in motion.
- Develop empirical correlation using dimensionless analysis.
- Analyze the fluid flow through a pipe and also over the bed of solids.
- Understand the principles of pump operation and analyze the characteristics of various pumps used in chemical process industries.

COURSE CODE	COURSE TITLE	L	T	P	C
UCY1351	PHYSICAL AND ORGANIC CHEMISTRY	3	0	0	3

COURSE OUTCOMES:

- Student will be able to understand and apply the principles of distribution law in different fields.
- Student will be able to understand and appreciate the properties and applications of colloids
- Student will be able to depict and explain the mechanism of simple organic reactions.
- Student will be able to elucidate the structure of simple organic molecules by deciphering its chemical properties.
- Student will be able to explain the preparation, properties and uses of a variety of commercially important organic compounds.

COURSE CODE	COURSE TITLE	L	T	P	C
UEE1351	PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Analyze various characteristics of different types of DC machines.
- Explain the performance of the transformer.
- Analyze the operation of single induction machines
- Determine the performance of three-phase induction machines
- Understand the operation of the synchronous motor

COURSE CODE	COURSE TITLE	L	T	P	C
UCE1351	SOLID MECHANICS FOR TECHNOLOGISTS	3	0	0	3

COURSE OUTCOMES:

- Gain knowledge on stress strain and deformation of solids
- Understand and draw the shear force and bending moment distribution of beams
- To calculate the slope and deflection in beams
- To gain knowledge of bending stress and shear stress in beams
- To understand the concept of torsion in springs and columns

COURSE CODE	COURSE TITLE	L	T	P	C
UEE1371	ELECTRICAL ENGINEERING LAB	0	0	4	2

COURSE OUTCOMES:

- Analyze various characteristics of different types of DC machines.
- Explain the performance of the transformer.
- Analyze the operation of single induction machines
- Determine the performance of three-phase induction machines
- Understand the operation of the synchronous motor

COURSE CODE	COURSE TITLE	L	T	P	C
UME1371	MECHANICAL ENGINEERING LAB	0	0	4	2

COURSE OUTCOMES:

- Operate IC engines and conduct experiments
- To understand test procedures in testing material for engineering applications

COURSE CODE	COURSE TITLE	L	T	P	C
UMA1476	STATISTICS AND NUMERICAL METHODS	3	2	0	4

COURSE OUTCOMES:

- Identify and apply the suitable testing of hypothesis under normal and t and F distribution.
- Solve problems in analysis of variance.
- Compute roots of nonlinear equations, solving the system of equations and finding the eigen values of matrix numerically
- Find interpolating polynomial and to perform numerical differentiation and numerical integration.
- Solve numerical solution to ordinary differential equation using different techniques.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1401	CHEMICAL ENGINEERING THERMODYNAMICS I	3	0	0	3

COURSE OUTCOMES:

- Summarize the basic concepts of thermodynamics such as temperature, pressure, system, properties, process, state, cycles and equilibrium.
- Calculate the properties of ideal and real mixtures based on thermodynamic principles.
- Apply the law of thermodynamics to open and closed systems
- Develop the fundamental thermodynamic property relationships for homogeneous phases.
- Apply mass, energy and entropy balances to flow processes.

COURSE CODE	COURSE TITLE	L	T	P	C
UCY1276	ENVIRONMENTAL SCIENCE	3	0	0	3

COURSE OUTCOMES:

- Describe the structure and functions of the ecosystems and diversity among life forms within an ecosystem
- Summarize the importance of various natural resources and its sustainable use
- Articulate on various environmental issues such as pollution, population explosion etc and suggest remedial measures.
- Analyze the role of various environmental machineries and to ensure proper environmental regulation.
- Relate the role of environment in human population growth and development

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1402	MECHANICAL OPERATIONS	3	0	0	3

COURSE OUTCOMES:

- Categorize the characteristics of solid particle and select appropriate particle size measurement techniques.
- Examine the performance of various size reduction and size enlargement techniques
- Identify a suitable separation technique for gas-solid and liquid-solid systems.
- Examine the pressure drop, specific cake resistance and filter medium resistance for designing the appropriate filtration process.
- Select appropriate mixer, agitator, storage vessel and conveyors for mixing and transportation of solids (dry and wet).

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1403	CHEMICAL PROCESS INDUSTRIES	3	0	0	3

COURSE OUTCOMES:

- Analyse the process flow diagrams of natural products viz., pulp and paper, rayon, sugar, and starch production.
- Compare the various industrial manufacturing process in the mining of raw material to production of finished goods, such as chloro-alkali compounds, Sulfur, sulfuric and hydrochloric acids.
- Illustrate the operation of fertilizer industry and its classification
- Compare a suitable process for the manufacturing of cement and examining the operation of various gases, paints, and pigments.
- Outline the processes involved in petroleum refinery and the petrochemical industry.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1404	HEAT TRANSFER	3	0	0	3

COURSE OUTCOMES:

- Apply the principles of conduction to predict heat transfer for simple geometries.
- Estimate the convective heat transfer coefficient
- Examine the boiling and condensation process and predict the heat transfer co-efficient for the phase changing mechanisms.
- Analyse and evaluate the performance of different types of heat exchanger.
- Apply the heat transfer mechanisms to design the evaporators and gain fundamental knowledge on radiation mode of heat transfer.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1411	FLUID MECHANICS LAB	0	0	4	2

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

- Demonstrate fluid flow using variable area flow meters and variable head flow meters
- Interpret head losses through open channels.
- Develop pump characteristics curves for the transportation of fluids based on process conditions/requirements.
- Interpret viscosity of fluids.
- Examine pressure drop for fluid flow around solid objects.

COURSE CODE	COURSE TITLE	L	T	P	C
UCY1471	ORGANIC CHEMISTRY LAB	0	0	4	2

COURSE OUTCOMES:

- Carry out simple organic synthesis.
- Analyze simple organic substances

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1501	INDUSTRIAL PROCESS PLANT SAFETY	3	0	0	3

OBJECTIVE:

COURSE OUTCOMES:

Upon completion of the course, the students would be able to

- Describe potential industrial hazards and need for safety measures
- Apply appropriate safety guidelines to overcome the various hazards in the workplace.
- Analyze the risk associated with radiation, explosion and fire using ISO guidelines
- Devise suitable hazard identification method for accident analysis
- Apply HAZOP analysis to various case studies

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1502	CHEMICAL ENGINEERING THERMODYNAMICS II	3	2	0	4

COURSE OUTCOMES:

- Calculate the thermodynamic properties (such as partial molar properties, fugacity coefficient, activity coefficient etc.) of fluid mixtures.
- Predict equilibrium composition of components in the mixtures under phase equilibria.
- Predict bubble-point and dew-point temperature, equilibrium constant and composition using thermodynamic models.
- Calculate the equilibrium constant and composition of mixtures under chemical reaction equilibria using thermodynamic principles.
- Illustrate various refrigeration cycles (such as Carnot, Bell-Coleman, etc.) and Their performances using thermodynamic concepts

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1503	MASS TRANSFER I	3	1	0	3.5

COURSE OUTCOMES:

- Determine the diffusion coefficients and rate of mass transfer in all three phases viz. solid, liquid, and gaseous phases.
- Solve for the mass transfer coefficients and flux in different flow conditions.
- Design humidification equipment based on material and energy balances.
- Calculate the process parameters used for designing dryers
- Calculate the process parameters used for designing crystallizers.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1504	CHEMICAL REACTION ENGINEERING I	3	1	0	3.5

COURSE OUTCOMES:

- Apply reaction kinetics principles in designing batch reactors and derive rate equations.
- Design different types of ideal reactors for homogeneous chemical reactions and demonstrate various combinations of reactors to achieve maximum performance.
- Analyze proper reactors among the single and multiple reactor combinations, and outline the importance of recycle reactor.
- Interpret the isothermal/non-isothermal homogeneous reactor data and identify the heat exchange equipment required for the reaction.
- Analyze the non-ideal flow behaviour in the reactors and analyze the basic models that explain the non-ideal flow conditions.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1511	MECHANICAL OPERATIONS LAB	0	0	4	2

COURSE OUTCOMES:

- Examine the performance of various size reduction equipment.
- Analyze the particle size distribution in the mixture by sieve analysis.
- Perform filtration experiment to calculate filter medium and cake resistance.
- Evaluate the minimum area required to separate solid from liquid using sedimentation process.
- Estimate the efficiency of solid-gas separation equipment

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1512	HEAT TRANSFER LAB	0	0	4	2

COURSE OUTCOMES:

- Evaluate the performance of bare and finned tube exchangers.
- Estimate the performance of different heat exchangers used in chemical industries such as tubular, shell-and-tube, and packed bed heat exchangers.
- Compare the performance of coil and jacketed arrangements of heating.
- Calculate and compare the performance of horizontal and vertical condensers.
- Estimate the heat load required for the evaporation process.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1601	CHEMICAL REACTION ENGINEERING II	3	1	0	3.5

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Develop the reaction mechanism and develop the rate equations for heterogeneous reactions.
- Analyse the performance of different kinds of non-catalytic reactors by applying the knowledge on gas-solid non-catalytic reactions.
- Discuss appropriate preparation, testing, and characterization of catalysts.
- Analyse the performance of different kinds of catalytic reactors by applying the knowledge on gas-solid catalytic reactions.
- Design of gas-liquid reactors by applying the knowledge on gas-liquid reactions.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1602	MASS TRANSFER II	3	1	0	3.5

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Design of gas absorption columns by applying the concept of height determinations using HTU and NTU.
- Design of distillation columns by applying the knowledge on vapour – liquid equilibrium.
- Calculate the number of stages required for separating liquid mixture using extraction principles.
- Calculate the number of stages required for separation using leaching process.
- Analyze the adsorption mechanism, operation and outline the basic concepts of membrane separation.

COURSE CODE	COURSE TITLE	L	T	P	C

UCH1603	PROCESS DYNAMICS AND CONTROL	3	0	0	3

COURSE OUTCOMES:

After completion of the course, students will be able to

- Determine the importance of control in process industries and the apply the concept of Laplace transform in process control.
- Analyze the first and second order transient response for open loop systems
- Devise the block diagram for the components in closed loop systems using their transfer function.
- Evaluate the Stability and tuning for open and closed loop system.
- Explain the advanced control systems and computer control for chemical processes.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1604	INSTRUMENTAL METHODS OF ANALYSIS	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Explain the fundamental concepts of electromagnetic radiation and their application in optical instruments.
- Discuss the theory, instrumentation and applications of UV-Vis Spectrophotometers.
- Discuss the theory, instrumentation and applications of IR Spectrophotometers.
- Define the interaction between matter and radiation and describe the theory and application of solid characterization techniques such X-ray diffraction, SEM, and thermal gravimetric analysis.
- Classify chromatographic techniques and explain their working principles and mode of separation involved

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1611	CHEMICAL REACTION ENGINEERING LAB	0	0	4	2

COURSE OUTCOMES:

On successful completion of this course, the student will be able to gain

- Apply knowledge on batch and semi batch reactor for performing kinetic studies.
- Apply knowledge on types of flow reactor for performing kinetic studies.
- Analyze performance of real reactors and degree of non-ideality.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1612	MASS TRANSFER LAB	0	0	4	2

COURSE OUTCOMES:

- Apply Fick's law of diffusion to determine the diffusivity.
- Conduct a drying test to evaluate the drying characteristic curve of solid material.
- Determine the mass transfer coefficient using various mass transfer equipment.
- Verify the Rayleigh's equation and evaluate the performance of packed and steam distillation.
- Evaluate the extraction efficiency for liquid extractor and leaching equipment

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1701	TRANSPORT PHENOMENA	3	0	0	3

COURSE COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Use the concepts of transport processes and their mechanisms.
- Deduct equations for steady-state momentum transport processes at a microscopic and macroscopic level.
- Deduct equations for steady-state heat transport processes at a microscopic and macroscopic level.
- Deduct equations for steady-state mass transport processes at a microscopic and macroscopic level.
- Analyse transport equations in turbulence and discuss the boundary layer concepts.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1702	PROCESS EQUIPMENT DESIGN	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to

- Perform thermal design of heat transfer equipment like shell and tube and double pipe heat exchangers, and evaporators, and assess their thermal efficiency.
- Demonstrate skills in basic design and drawing of cooling towers and different dryers.
- Apply the concepts involved in phase separation and design separation columns such as distillation, extraction, absorption, and adsorption columns
- Demonstrate the skills in mechanical design of packed bed reactors, pressure vessels, storage tanks and their auxiliary devices.
- Design plant layouts with proper schematic representation of pipelines, fittings and relevant structures.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1703	PROCESS ENGINEERING ECONOMICS	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to

- Illustrate the basic principles and functions of management, and Management information system.
- Summarize production planning and Quality control
- Compute the plant cost analysis including depreciation and capital recovery.
- Prepare the financial statements and balance sheet by applying the accounting principles.
- Summarize the essentials of economic balance for process industries.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1704	CHEMICAL PROCESS MODELLING AND SIMULATION	3	0	0	3

COURSE OUT COMES:

On successful completion of the course the students will be able to

- Discuss the several stages involved in the mathematical models used in Software/Tools.
- Demonstrate the degrees-of-freedom analysis, flow-sheeting and modeling of steadystate lumped systems.
- Develop Models for unsteady-state lumped systems with initial value conditions in Software/Tools.
- Develop the mathematical models distributed parameter systems of boundary values problems.
- Demonstrate the model solving ability of unsteady-state distributed systems with chemical engineering examples in aspen plus software.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1711	PROCESS CONTROL LAB	0	0	4	2

COURSE OUTCOMES:

- Apply the control system to industrial parameters like that- fluid flow, level, pressure, temperature problems.
- Analyze the performance and characteristics of second order system.
- Develop characteristics of control valve.
- Evaluate performance of Advanced Control systems
- Implement optimal values for PID controllers for any application

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1712	COMPUTATIONAL PROGRAMMING LAB FOR CHEMICAL ENGINEERS	0	0	4	2

COURSE OUTCOMES:

- To understand the aspects of MS-Excel for Engineering usage, and solving typical problems of Chemical Engineering using it.
- To understand the aspects of MATLAB for Engineering usage, and solving typical problems of Chemical Engineering using it.
- To understand the aspects of AspenPlus, and solving typical problems of Chemical Engineering using it.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1818	PROJECT WORK	0	0	20	10

COURSE OUTCOMES:

On successful completion of the course the students will be able to

- Extract appropriate problem statement using extensive literature review in the chosen area.
- Determine and apply suitable methodology for chosen research problem
- Coordinate with other team members in carrying out the project and produce solutions
- Design of Chemical Engineering Equipment and Cost Economics Analysis
- Prepare project reports and summarize the results by making organized presentations

PROFESSIONAL ELECTIVES (PE)

PROFESSIONAL ELECTIVE – I, SEMESTER 5

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1521	AIR POLLUTION AND CONTROL	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to

- ~~Summarize~~ Identify pollution sources, its effects, mechanisms for air pollution prevention and its regulatory norms.
- Design, operate and analyze performance of gaseous air pollutant removal.
- Characterize and removal of particulate air pollutants.
- Review on hybrid systems for removing air pollutants.
- Estimate the cost for air pollution control equipment.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1522	WASTEWATER TREATMENT	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to

- List the types of constituents present in the wastewater and their health effects.
- Discuss the types of reactors for treating different kinds of wastewater and selection of appropriate types of reactors for the wastewater treatment.
- Illustrate the different kinds of chemical unit processes in wastewater treatment.
- Categorize the different kinds of biological processes in the wastewater treatment.
- Analyze the different types of advanced wastewater treatment technologies.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1523	ELECTROCHEMICAL ENGINEERING	3	0	0	3

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of the course the students will be able to

- Summarize the principles of electrochemistry and mechanism involved in electrochemical systems
- Apply the concepts of mass transfer in electrochemical systems
- Interpret the mechanism of corrosion control measures.
- Illustrate the different electrochemical processes.
- Interpret different types of electrodes in electrochemical reactor/ reactions.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1524	ENVIRONMENTAL ENGINEERING	3	0	0	3

OUTCOMES

On successful completion of the course the students will be able to

- List the consequences of population growth with respect to the environment and energy.
- Explain the application of chemical engineering processes in abatement of Environmental pollution.
- Determine the recycling methodologies and their economic recovery for a cleaner environment.
- Outline on clean technologies for effluent treatment.
- Analyze on the role of government, Industries and mass exchange network synthesis in pollution prevention.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1525	FRONTIERS OF CHEMICAL ENGINEERING	3	0	0	3

OUTCOMES

On Successful completion of this course, the students will be able to

- Describe the role of process intensification for sustainable development.
- Summarize the concepts of chemical product design.
- Explain the benefits of various types of renewable energy resources.
- Discuss on the improved properties of various engineered materials.
- Summarize the bioengineering principles and their advanced applications.

PROFESSIONAL ELECTIVE – II SEMESTER 6

COURSE CODE	COURSE TITLE	L	T	P	C

UCH1621	PETROLEUM REFINING AND PETROCHEMICALS	3	0	0	3

COURSE OUTCOMES:

At the end of the course, the students would be able to

- Summarize on the classification, composition and testing methods of crude oil/products for developing the refining process.
- Describe cracking and reforming processes for enhancing the quality of petroleum products.
- Articulate on various processes for Isomerization, Alkylation and Polymerization of petroleum products.
- Apply the various treatment processes for improving the quality of petroleum products.
- Explain the different processes involved in the production of petrochemical products

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1622	FOOD TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Acquire the general aspects of the food industry and its need in India and the world.
- Outline the constituents of food material and discuss the quality and control measures on their deteriorative factors.
- Describe the necessity of preliminary food processing methods and preservative operations to minimize food deterioration.
- Differentiate various food preservative techniques and their usage in the food industry.
- Summarize the production methodologies adapted for different types of common food products and discuss their utilization in the world.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1623	POLYMER TECHNOLOGY	3	0	0	3

COURSE OUTCOME

On successful completion of this course, the student will be able to

- Summarize the properties and application of natural polymers.
- Describe the different types of polymerization.
- Illustrate the suitable raw materials for the manufacture of synthetic polymers.
- Classify polymers based on configuration, end use etc.
- Discuss the polymer recycling process.

COURSE CODE	COURSE TITLE	L	T	P	C

UCH1624	DRUGS AND PHARMACEUTICAL TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On Successful completion of this course, the students will be able to

- Articulate on development of drugs, organic therapeutic agents and their economics.
- Apply the chemical principles of drug metabolism, pharmaco-kinetics and pharmaco-dynamics.
- Categorize the chemical conversion process of manufacturing drugs and their applications.
- Summarize the unit processes involved in manufacturing of drugs.
- Apply suitable analytical methods for testing and quality control of various drugs.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1625	PULP AND PAPER TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

- Describe the essential aspects of the pulp and paper industry
- Discuss the different types of wood yard operations
- Explain the different types of paper-making process
- Discuss the surface treatment and finishing of paper and paper board
- Describe the role of process control in quality assurance

PROFESSIONAL ELECTIVE – III, SEMESTER 7

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1721	ENERGY TECHNOLOGY	3	0	0	3

OUTCOMES

On successful completion of the course the students will be able to

- Categorize energy sources and assess the energy demand and impact of energy production on the environment.
- Articulate energy management through technology developments in conventional power plants.
- Summarize the developments in renewable energy technologies.
- Summarize the developments in biomass energy conversion and its utilization.
- Articulate on energy conservation, implementation strategies and auditing.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1722	FUNDAMENTALS OF NANOSCIENCE	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to

- Summarize the fundamentals of nanoscience and its interdisciplinary nature.
- Articulate on the general preparation of nanomaterials
- Explore the types of nanomaterials and its synthesis.
- Characterize nanomaterials using appropriate techniques.

Elaborate the applications of nanomaterials in various industries. COURSE CODE	COURSE TITLE	L	T	P	C
UCH1723	MODERN SEPARATION TECHNIQUES	3	0	0	3

COURSE OUTCOMES:

On Successful completion of this course, the students will be able to

- Summarize the conventional separation process and explain separation techniques based on size, surface and ionic properties.
- Articulate on the concepts and fundamentals of adsorption and chromatography techniques.
- Explain the basic concepts, principle and applications of various membrane separation processes.
- Apply the concept of electric field influenced separation processes.
- Appraise the significance of various advanced separation techniques used in industries.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1724	FLUIDIZATION ENGINEERING	3	0	0	3

OUTCOME

On Successful completion of this course, the students will be able to

- Summarize the fundamentals of fluidization engineering.
- Articulate on the different types of fluidized beds.
- Design catalytic and non-catalytic fluidized bed system.
- Analyze the heat and mass transfer in fluidized beds
- Explain the concepts of multistage fluidization.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1725	BIOCHEMICAL ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to

- Learn the basic concepts of biology
- Know about importance of enzyme kinetics and immobilization
- Develop knowledge on design of bioreactors
- Apply Chemical Engineering principles to design novel bioprocesses
- Learn the various Unit operations used in biological research areas.

PROFESSIONAL ELECTIVE – IV SEMESTER 7

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1726	PROCESS PLANT UTILITIES	3	0	0	3

COURSE OUTCOMES:

At the end of this course, the students will understand

- Justify the importance of requisites of industrial water.
- Articulate on the properties of steam and different methods of steam generation.
- Summarize the methods of refrigeration and types of refrigerants used in industry.
- Categorize different types of compressor and humidification equipment's used in process industries.
- Summarize the types of fuel used in chemical process industries for power generation and various waste disposal methods.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1727	OPTIMIZATION OF CHEMICAL PROCESSES	3	0	0	3

COURSE OUTCOMES:

Upon completion of this course, the students would have the knowledge about

- Apply fundamental concepts of mathematics to formulate optimization models for chemical engineering problems.
- Evaluate the performance of numerical methods to optimize the unimodal functions.
- Analyze the significance and application of multivariable optimization techniques.
- Analyze the linear and non-linear programming in chemical engineering problems.
- Evaluate the performance of numerical methods and optimization techniques in chemical engineering processes.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1728	ELECTROCHEMICAL PROCESS TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On Successful completion of this course, the students will be able to

- Summarize the preparation, characteristics and applications of different types of electrodes and separators
- Analyse the electrolytic production of different inorganic chemicals.
- Explore the electrodialysis process and to understand the electro-organic chemistry principles.
- Analyse the electrochemical reduction and oxidation of functional groups.
- Apply the concepts involved in electro organic processes, and electropolymerization systems.

COURSE CODE	COURSE TITLE	L	T	P	C

UCH1729	GREEN CHEMISTRY AND ENGINEERING	3	0	0	3

COURSE OUTCOMES:

Upon completion of this course, the students would be able to

- Describe global environmental issues and apply the risk assessment techniques in the engineering profession.
- Explain pollution prevention methods and assess the impact of chemical structure of pollutant on the ambient atmosphere.
- Apply green chemistry pathways and the pollution prevention steps while handling chemical reactors, separator devices and storage tanks manufacturing.
- Analyze process energy integration and mass integration using a case study relevant to chemical engineering.
- Select a life cycle assessment framework for various energy and product technologies in the chemical industry

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1731	PINCH TECHNOLOGY	3	0	0	3

COURSE COURSE OUTCOMES:

On Successful completion of this course, the students will be able to

- Interpret the pinch and quantify the energy requirement for a piece of equipment in a chemical plant.
- Examine the composite curves and locate the pinch point for a heat exchanger network.
- Examine and Minimize energy requirements for a heat exchanger network.
- Implement pinch technique for batch and continuous processes and do sensitivity analysis.
- Examine and Optimize energy requirements for a large chemical plant by compartmentalizing appropriately.

PROFESSIONAL ELECTIVE – V SEMESTER VIII

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1821	FERMENTATION ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Categorize the microbes and their mechanism.
- Develop knowledge on control of fermentation process.
- Knowledge on downstream processing in fermentation products.
- Apply the concepts of fermentation industries effluent treatment.
- Knowledge on microbial isolation and economics.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1822	BIOLOGICAL WASTEWATER TREATMENT	3	0	0	3

OUTCOMES

On successful completion of this course, the student will be able to

- Summarize the concepts and fundamentals of biological processes used in wastewater treatment
- Apply the design procedures for aerobic wastewater treatment units.
- Outline the design of anaerobic wastewater treatment units.
- Examine the design of sludge management facilities.
- Analyze the construction, operations and maintenance aspects of wastewater treatment facility.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1823	INDUSTRIAL MANAGEMENT	3	0	0	3

COURSE OUTCOMES:

At the end of this course, the students would have

- Summarize on the basic management principles to become management(s) professional.
- Review the various functions of management.
- Interpret the organizational behavior and its effect on performance
- Analyze the organization group dynamics.
- Elaborate on modern concepts of industrial management.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1824	ENZYME ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Categorize the microbes and knowledge on isolation and purification of enzymes.
- Summarize the mechanisms and kinetics of fermentation process.
- Review the parameters used for bioreactor design.
- Articulate the basic concepts of biochemistry.
- Design industrial bioreactor for specified applications.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1825	INDUSTRIAL NANOTECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Summarize the importance of nanotechnology in the electronics industry and energy sector.

- Explain the significance of nano-biotechnology in the biomedical industry with examples.
- Examine how nanotechnology is used in the production of smart chemicals like catalysts, nanocomposites, and nanoporous zeolites.
- Identify the importance of nanotechnology in the agriculture and food sectors.
- Discuss different types of nanomaterials used in the textile and cosmetic industries

**PROFESSIONAL ELECTIVE – VI
SEMESTER 8**

COURSE CODE	COURSE TITLE	L	T	P	C
UCE1424	DISASTER MANAGEMENT	3	0	0	3

COURSE OUTCOMES:

On Successful completion of this course, the students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.
- Discuss disaster risk management in our country.
- Analyze various case studies of disaster management

COURSE CODE	COURSE TITLE	L	T	P	C
UGE1476	TOTAL QUALITY MANAGEMENT	3	0	0	3

COURSE OUTCOMES:

On Successful completion of this course, the students will be able to

- Summarize the basic concepts of TQM.
- Apply TQM principles in an organization.
- Analyze Traditional tools of quality and FMEA.
- Evaluate various TQM tools and techniques.
- Discuss the benefits of QMS and EMS in any organization.

COURSE CODE	COURSE TITLE	L	T	P	C
UGE1576	PROFESSIONAL ETHICS	3	0	0	3

COURSE OUTCOME

On successful completion of this course, the student will be able to

- Apply ethics in society and understand human values.
- Deliberate the ethical issues related to engineering.
- Realize the responsibilities and rights in the society and organization.
- Perceive safety, risk and responsibilities.
- Instill moral, social values, loyalty and code of conduct.

COURSE CODE	COURSE TITLE	L	T	P	C
UGE1578	HUMAN RIGHTS	3	0	0	3

COURSE OUTCOME

On successful completion of the course the students will be able to

- Summarize the concept of human rights and its classification.
- Articulate on the theories of human rights and its evolution.
- Elaborate on theories and perspectives of UN Laws.
- Review Human Rights in India and various laws.
- Summarize Human Rights of Disadvantaged People.

OPEN ELECTIVES

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1941	POLLUTION ABATEMENT	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Summarize the knowledge on pollution and Indian regulations.
- Evaluate qualitatively and quantitatively pollution of water.
- Evaluate soil pollution, disposal techniques and characterization.
- Evaluate air pollution, sources, characterization and reducing methods.
- Evaluate noise pollution, measurement and control.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1942	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

- Categorize energy sources and assess the energy demand and supply.
- Articulate energy management through technology developments in power plants.
- Summarize the developments in energy conservation measures.
- Illustrate the developments in energy auditing.
- Discuss issues in energy management and policies.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1943	ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	3	0	0	3

COURSE OUTCOMES:

The students completing the course will have ability to

- Carry out scoping and screening of developmental projects for environmental and social assessments.
- Explain different methodologies for environmental impact prediction and assessment.

- Plan environmental impact assessments and environmental management plans.
- Evaluate environmental impact assessment reports.
- Knowledge on the EIA pertaining to various real time projects.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1944	INDUSTRIAL SAFETY	3	0	0	3

COURSE OUTCOMES:

- Demonstrate the awareness of industrial safety in selection and layout of plants and the usage of safety codes.
- Discuss the awareness of Safety in process design and pressure system design
- Discuss the concept of accident investigation and prevention.
- Explain the various hazard identification analysis and its control methodologies
- Apply the knowledge in devising safety policy and procedures to be adopted to implement total plant safety in an industry.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1041	RENEWABLE ENERGY SOURCES	3	0	0	3

COURSE OUTCOMES:

- Summarize on economics and environmental aspects of various energy sources.
- Determine solar radiation and explain solar energy conversion & its applications
- Calculate wind energy and summarize on its conversion & applications
- Explain bio energy conversion and its applications
- Articulate on fuel cells and other renewable energy sources

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1042	FUNDAMENTALS OF COMBUSTION	3	0	0	3

COURSE OUTCOMES:

- Calculate thermochemical aspects of combustion.
- Describe the kinetic aspects of combustion.
- Summarize the fundamentals of gas turbine engines.
- Analyze various solid and liquid propellants for combustion in rocket engines.
- Analyze the mixing and reaction processes in supersonic combustion.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1043	INTRODUCTION TO NANOSCIENCE	3	0	0	3

Outcomes

- Interpret the science of nanomaterials
- Classify different types of nanomaterials
- Review the various methods of nanomaterial preparation
- Analyze nanomaterials using various characterization techniques.
- Summarize the applications of nanomaterials in various industries.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH1044	PROCESS INSTRUMENTATION	3	0	0	3

Outcomes

- Summarize the basics of measurement characteristics
- Articulate the principle and various techniques of pressure measurement
- Articulate the principle and various techniques of temperature measurement
- Articulate the principle and various techniques of flow and level measurement
- Review the principle of various spectroscopic techniques for composition analysis

Sri Sivasubramaniya Nadar College of Engineering

(An Autonomous Institution, Affiliated to Anna University, Chennai)



Regulation 2021

Curriculum and Syllabi for
B.Tech. in Chemical Engineering

Sri Sivasubramaniya Nadar College of Engineering
(An Autonomous institution, Affiliated to Anna University Chennai)

Department of Chemical Engineering

B. Tech., - Chemical Engineering

VISION

- To be a globally recognized Chemical Engineering department with excellence in teaching, research and consultancy services.

MISSION

- To prepare our students to become successful professional Chemical Engineers capable of undertaking advanced studies and life-long learning.
- To produce Chemical Engineers who will contribute to the process industries worldwide.
- To provide the students a strong fundamental technical education that makes them capable of catering to the needs of a changing technological environment and the society.
- To nurture the innovative capabilities of students by providing them with a research platform and exposure to current technologies.

PROGRAMME EDUCATIONAL COURSE OBJECTIVES (PEOS)

1. CAREER ACHIEVEMENT:

Our graduates will have a successful career in chemical and allied industries by demonstrating their skills in facing the challenges posed by the ever-changing chemical industrial and research sector.

2. PROFESSIONALISM:

Our graduates will exhibit their leadership qualities by taking suitable decisions and also work with multidisciplinary teams they will discharge their social responsibilities as engineers by following ethical practices.

3. LIFE-LONG LEARNING:

Our graduates will continue to expand their technical competence by developing their knowledge, skills and engaging themselves in learning activities throughout their life.

PROGRAM OUTCOMES (POS)

Engineering Graduates will be able to

1. Engineering Knowledge:

Apply the knowledge of mathematics, science, and engineering fundamentals, to solve the complex chemical engineering problems

2. Problem analysis:

Identify, formulate, review research literature, and analyze complex chemical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

3. Design/development of solutions:

Design solutions for complex chemical engineering problems and design system components or process that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

4. Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to proceed valid conclusions.

5. Modern tool usage:

Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex chemical engineering activities with an understanding of the limitations.

6. The engineer and society:

Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional chemical engineering practice.

7. Environment and sustainability:

Understand the impact of professional chemical engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

8. Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the chemical engineering practice.

9. Individual and teamwork:

Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication:

Communicate effectively on complex chemical engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance:

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning:

Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes in chemical engineering.

Program Specific Outcomes (PSOs)

PSO1: Design, develop, analyze and control chemical processes by applying principles of thermodynamics, reaction engineering, momentum, mass and heat transfer.

PSO2: Develop safe and innovative solutions by applying emerging chemical engineering technologies for existing and future problems.

PEOs mapping with POs and PSOs

PEOs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
PEO – I	3	3	3	3	3	2	2	3	2	3	3	2	3	3
PEO – II	2	2	2	2	2	3	3	3	3	3	3	2	2	2
PEO – III	2	2	2	2	2	2	2	3	2	3	2	3	2	3

CO-PO-PSO Mapping

Semester	Course Name	Program Outcomes													
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
I	Technical English									2	3		2		
	Matrices and Calculus	3	2										1	1	
	Engineering Physics	3	2	1											
	Engineering Chemistry	3	2	1											
	Problem solving and Programming in Python	1	2		1									2	1
	Engineering Graphics	3	2	2			2				3			1	
	Programming in Python Lab	3	3		1				1	1	1			3	1
	Physics and Chemistry Lab	3													
II	Complex Functions and Laplace Transforms	3	2										1	1	
	Solid Mechanics for Technologists	2	3	2	3		1						1	1	1
	Chemical Engineering Fundamentals and Practice	2								2	2			2	
	Environmental Science (Non-credit)	3	2	1											
	Chemistry for Chemical Engineering	3	2	2											
	Chemical Analysis Laboratory	3			2					3			3		1
	Design thinking and Engineering practices Lab	2	1	1		1			3						
III	Transform Techniques and Partial Differential Equations	3	2										1	1	
	Principles of Electrical and Electronics Engineering	3	2	1			2	1							
	Universal Human Values: Understanding Harmony						2		3	3	2		3		
	Chemical Process Calculations	3	3								3			2	
	Chemical Process Industries	3	3	2		3	3			3	2		3	3	3
	Fluid Mechanics for Chemical Engineers	3	3								3			1	
	Electrical Engineering Laboratory	3	2	1			2	1							
	Fluid Mechanics Laboratory	3	3		1					3	3			1	

IV	Numerical Methods for Chemical Engineering	3	3			1						1	1	
	Indian Constitution (Non-credit)						2		2	2	2	2	1	
	Chemical Engineering Thermodynamics I	3	2	2	3	3				3	3			1
	Heat Transfer	3	2			3					3			2
	Mechanical Operations	3	3	2						3	3			1
	Professional Elective I													
	Mechanical Operations Laboratory	3	3		1					3	3			2
V	Management Elective													
	Chemical Engineering Thermodynamics II	3	2		1	2				3	3		3	1
	Chemical Reaction Engineering I	3	3	3							3			1
	Mass Transfer I	3	2	2							3		3	1
	Process Instrumentation, Dynamics and Control	3	3	3		2								2
	Heat Transfer Laboratory	3	3		3					2	2			2
	Process Dynamics and Control Laboratory	3	3	2	2	3				2	2	2		2
VI	Chemical Reaction Engineering II	3	3	3							3			1
	Mass Transfer II	3	3	2							3		3	2
	Process Engineering Economics	2	2					3		3	3	3		2
	Industrial Process Plant Safety		3				2	3		3	3	2		2
	Chemical Reaction Engineering and Thermodynamics Laboratory	3	2		1	2				3	3			1
	Mass Transfer Laboratory	3	2		2									2
VII	Process Equipment Design	3	3	3			2				3		3	2
	Chemical Process Modeling and Simulation	3	2		1	2				3	3			1
	Transport Phenomena	3	3								3			2
	Project Phase I	3	3	3	1	2	2	1	3	3	2	2	3	3
	Industrial Training /Internship*	3	3	3	3	2	2	1	3	3	3	3	3	3
VIII	Project Phase II	3	3	3	3	2	1	1	3	3	3	1	3	3
Professional Electives	Air Pollution and Control	2					3	3	1				1	
	Basic Industrial Biotechnology	2									2		2	
	Fuels and Combustion	2	1					2	1	1	1			
	Elements of Nano science	3					2	3			2			

and nanotechnology														
Instrumental Methods of Analysis	2	1	2	2	2	1	1				1	2	2	2
Food Technology	2			2	1	2	3				3	3		1
Environmental Engineering	2					3	3	1				1		1
Wastewater Treatment	2					3	3	1				1		1
Bioprocess principles	2									2		2		1
Energy, Environment and Impact Assessment	2					3	3	1				1		1
Synthesis and Applications of Nanomaterials	3					2	3			3				2
Pulp and Paper Technology	2	1	2				2						1	1
Carbon Capture Utilization and Storage	3				2	2	3			2		2	2	2
Drugs and Pharmaceutical Technology	2			1	1		1					1		1
Solid waste Management	2		1			3	3	1				1		1
Bioprocess Engineering	2	2	2					3						1
Bio-Energy Technology	2									2		2		1
Polymer and Nano composites	3					2	3			2				3
Multiphase Flow	3	2								3		3	2	
Optimization of Chemical Processes	2	3	3	3	3	3			2	2			2	
Carbon Trading and Carbon Footprint						2	3		3	3	3			2
Green Chemistry and Engineering	2					3	3	1				1		2
Downstream Processing	2	1								3		2	1	
Fuel Cells	2	3	3	3	3						3	3	1	
Industrial Nanotechnology	2					1	3			2				3
Chemical Product Design	3	3			3		3	3			3	3	3	3
Polymer Technology	2	2	2	2		1	1					1	2	2
Adsorption	2	2		1		3	3	1				1		1
Pinch Technology	3	3	2										1	
Recombinant DNA Technology	2	1					3			2		2		1
Alternative Fuels	2					3	3	1				1		2
Nano biotechnology	2									2		2		1
Fluidization Engineering	2	2	3							2		2	2	
Industrial Instrumentation	2		2	2							2	1	2	
Modern Separation Techniques	3	2								3		3	2	
Process Intensification	3	3	3	3	3								1	
Electrochemical Engineering	2	3	3	3					3				1	
Frontiers of Chemical Engineering	2	2	2			2						1		2
Petroleum Refining and Petrochemicals	3								3	3			2	
Membrane Separations	3	2	2			3	3			3		3	2	1

	Technology														
	Energy Technology	2	3	3	3	1				2				1	
	Process Plant Utilities	3	3	2	1		3	3	3	3	3		3	3	3
Management Electives	Principles of Management					3				2	2	2	1		
	Total quality Management					2	3	2	2	1		1	1		
	Operation Research	1	1	1	1	1			1	1	1	3	3	1	
	Work ethics, Corporate social responsibility and Governance						3	2	3	1	1	3	2		
Humanities I Electives	Language and Communication									2	3		2		
	Fundamentals of Linguistics									2	3		2		
	Film Appreciation									2	3		2		
	Human relations at work						2		2	3	2		2		
	Application of Psychology in everyday life						2		2	3	2		2		
	Understanding Society and Culture through Literature									2	3		2		

I to VIII semesters Curriculum - R 2021 (Choice Based Credit System)

S. No.	COURSE CODE	COURSE TITLE
1	UEN2176	Technical English
2	UMA2176	Matrices and Calculus
3	UPH2176	Engineering Physics
4	UCY2176	Engineering Chemistry
5	UGE2176	Problem solving and Programming in Python
6	UGE2177	Engineering Graphics
7	UGE2197	Programming in Python Lab
8	UGS2197	Physics and Chemistry Lab
1	UMA2276	Complex Functions and Laplace Transforms
2	UCE2251	Solid Mechanics for Technologists
3	UCH2201	Chemical Engineering Fundamentals and Practice
4	ACY2276	Environmental Science (Non-credit)
5		Humanities I-Elective
6	UCY2251	Chemistry for Chemical Engineering
7	UCH2211	Chemical Analysis Laboratory
8	UGE2297	Design thinking and Engineering Practices Laboratory

1	UMA2376	Transform Techniques and Partial Differential Equations
2	UEE2351	Principles of Electrical and Electronics Engineering
3	UHS2376	Humanities II -Universal Human Values: Understanding Harmony
4	UCH2301	Chemical Process Calculations
5	UCH2302	Chemical Process Industries
6	UCH2304	Fluid Mechanics for Chemical Engineers
7	UEE2371	Electrical Engineering Laboratory
8	UCH2311	Fluid Mechanics Laboratory
1	UMA2451	Numerical Methods for Chemical Engineering
2	AHS2476	Indian Constitution (Non-credit)
3	UCH2401	Chemical Engineering Thermodynamics I
4	UCH2402	Heat Transfer
5	UCH2403	Mechanical Operations
6		Professional Elective I
7	UCH2411	Mechanical Operations Laboratory
1		Management Elective
2	UCH2501	Chemical Engineering Thermodynamics II
3	UCH2502	Chemical Reaction Engineering I
4	UCH2503	Mass Transfer I
5	UCH2504	Process Instrumentation, Dynamics and Control
6		Professional Elective II
7	UCH2511	Heat Transfer Laboratory
8	UCH2512	Process Dynamics and Control Laboratory

S. No.	COURSE CODE	COURSE TITLE
1	UCH2601	Chemical Reaction Engineering II

2	UCH2602	Industrial Process Plant Safety
3	UCH2603	Mass Transfer II
4	UCH2604	Process Engineering Economics
5		Professional Elective II
6		Open Elective I
7	UCH2611	Mass Transfer Laboratory
8	UCH2612	Chemical Reaction Engineering and Thermodynamics Laboratory
1	UCH2701	Chemical Process Modeling and Simulation
2	UCH2702	Process Equipment Design
3	UCH2703	Transport Phenomena
4		Professional Elective IV
5		Professional Elective V
6	UCH2717	Project Phase I
7	UCH2716	Industrial Training /Internship*

*Students will undergo 4 weeks Industrial training / Internship/ In-house Research Projects during previous vacation

S. No.	COURSE CODE	COURSE TITLE
1		Professional Elective VI
2		Open Elective II
1	UCH2818	Project Phase II

Humanities and Social Science Courses (HS)

S. No.	COURS E CODE	COURSE TITLE
1.	UEN2176	Technical English
2.		Humanities I-Elective
3.	UHS2376	Universal Human Values: Understanding Harmony
4.		Management I –Elective

Basic Science Courses (BS)

S. No.	COURSE CODE	COURSE TITLE
1.	UMA2176	Matrices and Calculus
2.	UPH2176	Engineering Physics
3.	UCY2176	Engineering Chemistry
4.	UGS2197	Physics and Chemistry Lab
5.	UMA2276	Complex Functions and Laplace Transforms
6.	UCY2251	Chemistry for Chemical Engineering
7.	UCH2211	Chemical Analysis Laboratory
8.	UMA2376	Transform Techniques and Partial Differential Equations

Engineering Science Courses (ES)

S. No.	COURSE CODE	COURSE TITLE
1.	UGE2176	Problem solving and Programming in Python
2.	UGE2177	Engineering Graphics
3.	UGE2197	Programming in Python Lab
4.	UCE2251	Solid Mechanics for Technologists
5.	UCH2201	Chemical Engineering Fundamentals and Practice (TCP)
6.	UGE2297	Design thinking and Engineering Practices Lab
7.	UEE2351	Principles of Electrical and Electronics Engineering
8.	UEE2371	Electrical Engineering Laboratory
9.	UMA2451	Numerical Methods for Chemical Engineering

Professional Core Courses (PC)

S. No.	COURSE CODE	COURSE TITLE
1.	UCH2301	Chemical Process Calculations
2.	UCH2302	Chemical Process Industries
3.	UCH2304	Fluid Mechanics for Chemical Engineers
4.	UCH2311	Fluid Mechanics Laboratory
5.	UCH2401	Chemical Engineering Thermodynamics I
6.	UCH2402	Heat Transfer
7.	UCH2403	Mechanical Operations
8.	UCH2411	Mechanical Operations Laboratory

9.	UCH2501	Chemical Engineering Thermodynamics II
10.	UCH2502	Chemical Reaction Engineering I
11.	UCH2503	Mass Transfer I
12.	UCH2504	Process Instrumentation, Dynamics and Control
13.	UCH2511	Heat Transfer Laboratory
14.	UCH2512	Process Dynamics and Control Laboratory
15.	UCH2601	Chemical Reaction Engineering II
16.	UCH2602	Industrial Process Plant Safety
17.	UCH2603	Mass Transfer II
18.	UCH2604	Process Engineering Economics
19.	UCH2611	Mass Transfer Laboratory

20.	UCH2612	Chemical Reaction Engineering and Thermodynamics Laboratory
21.	UCH2701	Chemical Process Modeling and Simulation
22.	UCH2702	Process Equipment Design
23.	UCH2703	Transport Phenomena

Employability Enhancement Courses (EEC)

S. No.	COURSE CODE	COURSE TITLE
1.	UCH2717	Project Phase I
2.	UCH2716	Industrial Training /Internship*
3.	UCH2818	Project Phase II

Mandatory Courses (MC)

S. No.	COURSE CODE	COURSE TITLE
1.	ACY2276	Environmental Science (Non-credit)
2.	AHS2476	Indian Constitution (Non-credit)

HSMC – Electives –Humanities I (II semester)

S. No.	COURSE CODE	COURSE TITLE
1	UEN2241	Language and Communication
2	UEN2242	Fundamentals of Linguistics
3	UHS2243	Film Appreciation
4	UHS2241	Human relations at work
5	UHS2242	Application of Psychology in everyday life
6	UEN2243	Understanding Society and Culture through Literature

Management Electives (V semester)

S. No.	COURSE CODE	COURSE TITLE
1	UBA2541	Principles of Management
2	UBA2542	Total quality Management
3	UBA2545	Operation Research
4	UBA2543	Work ethics, Corporate social responsibility and Governance

PROFESSIONAL ELECTIVES (PE)**Professional Elective I (Semester IV)**

S. No.	COURSE CODE	COURSE TITLE
1	UCH2421	Air Pollution and Control
2	UCH2422	Basic Industrial Biotechnology
3	UCH2423	Fuels and Combustion
4	UCH2424	Elements of nanoscience and nanotechnology
5	UCH2425	Instrumental Methods of Analysis
6	UCH2426	Food Technology
7	UCH2427	Environmental Engineering

Professional Elective II (Semester V)

S. No.	COURSE CODE	COURSE TITLE
1	UCH2521	Wastewater Treatment
2	UCH2522	Bioprocess principles
3	UCH2523	Energy, Environment and Impact Assessment
4	UCH2524	Synthesis and Applications of Nanomaterials

5	UCH2525	Pulp and Paper Technology
6	UCH2526	Carbon Capture Utilization and Storage
7	UCH2527	Drugs and Pharmaceutical

		Technology					

Professional Elective III (Semester VI)

S. No.	COURSE CODE	COURSE TITLE
1	UCH2621	Solid waste Management
2	UCH2622	Bioprocess Engineering
3	UCH2623	Bio-Energy Technology
4	UCH2624	Polymer and nanocomposites
5	UCH2625	Multiphase Flow
6	UCH2626	Optimization of Chemical Processes
7	UCH2627	Carbon Trading and Carbon Footprint

Professional Elective IV (Semester VII)

S. No.	COURSE CODE	COURSE TITLE
1	UCH2721	Green Chemistry and Engineering
2	UCH2722	Downstream Processing
3	UCH2723	Fuel Cells
4	UCH2724	Industrial Nanotechnology
5	UCH2725	Chemical Product Design
6	UCH2726	Polymer Technology
7	UCH2727	Adsorption

Professional Elective V (Semester VII)

S. No.	COURSE CODE	COURSE TITLE
1	UCH2728	Pinch Technology
2	UCH2735	Recombinant DNA Technology
3	UCH2729	Alternative Fuels

4	UCH2731	Nanobiotechnology
5	UCH2732	Fluidization Engineering
6	UCH2733	Industrial Instrumentation
7	UCH2734	Modern Separation Techniques

Professional Elective VI (Semester VIII)

S. No.	COURSE CODE	COURSE TITLE
1	UCH2821	Process Intensification
2	UCH2822	Electrochemical Engineering
3	UCH2823	Frontiers of Chemical Engineering
4	UCH2824	Petroleum Refining and Petrochemicals
5	UCH2825	Membrane Separations Technology
6	UCH2826	Energy Technology
7	UCH2827	Process Plant Utilities

List of professional elective course for Specialization

Semester	Subject Code	Subject Name
IV	UCH2422	Basic Industrial Biotechnology
V	UCH2522	Bioprocess principles
VI	UCH2622	Bioprocess Engineering
VII	UCH2722	Downstream Processing

Semester	Subject Code	Subject Name
IV	UCH2423	Fuels and Combustion
V	UCH2523	Energy, Environment and Impact Assessment
VI	UCH2623	Bio-Energy Technology
VII	UCH2723	Fuel Cells

Semester	Subject Code	Subject Name
IV	UCH2421	Air Pollution and Control
V	UCH2521	Wastewater Treatment
VI	UCH2621	Solid waste Management
VII	UCH2721	Green Chemistry and Engineering

Semester	Subject Code	Subject Name
IV	UCH2424	Elements of nanoscience and nanotechnology
V	UCH2524	Synthesis and Applications of Nanomaterials
VI	UCH2624	Polymer and nanocomposites
VII	UCH2724	Industrial Nanotechnology

Professional Elective Course for Honors in

Green Technology and Sustainability Engineering

Subject Code	Subject Name
UCH2424	Elements of nanoscience and nanotechnology
UCH2427	Environmental Engineering
UCH2523	Energy, Environment and Impact Assessment
UCH2526	Carbon Capture Utilization and Storage
UCH2623	Bio-Energy Technology
UCH2624	Polymer and nanocomposites
UCH2626	Optimization of Chemical Processes
UCH2721	Green Chemistry and Engineering
UCH2729	Alternative Fuels
UCH2821	Process Intensification
UCH2823	Frontiers of Chemical Engineering

COURSE CODE	COURSE TITLE	L	T	P	C
UEN2176	TECHNICAL ENGLISH	2	0	2	3

COURSE OUTCOMES:

At the end of this course, students will be able,

CO1: Read and comprehend texts (technical) effectively.

CO2: Write proposals, reports, emails, letters, SOPs meeting professional expectations.

CO3: Improve Vocabulary (use of right collocations, idioms and phrases etc).

CO4: Enhance their grammatical competency for writing, and speaking.

CO5: Improve their ability to listen and comprehend at deeper

levels.**CO-PO Mapping:**

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1									2	3		2
2									2	3		2
3									2	3		2
4									2	3		2
5									2	3		2

COURSE CODE	COURSE TITLE	L	T	P	C
UMA2176	MATRICES AND CALCULUS (Common to all B.E./B. Tech. degree programs)	3	1	0	4

COURSE OUTCOMES:

At the end of this course, students will be able,

CO1: Reduce quadratic form to canonical form by orthogonal transformation and identify the nature of the quadratic form

CO2: Analyse the convergence of a given infinite series

CO3: Find evolute of a given curve and envelope of family of curves

CO4: Find the extrema of function of two variables

CO5: Evaluate the double and triple integrals

CO6: Application of extreme points of functions and multiple integrals in engineering Problems

Course Code & Name: UMA 2176 MATRICES AND CALCULUS		PO's											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Identify the nature of quadratic form by reducing it to canonical form	3	2	-	-	-	-	-	-	-	-	-	-
CO2	Analyse the convergence of a given infinite series	3	2	-	-	-	-	-	-	-	-	-	-

CO3	Find evolute of a given curve and envelope of family of curves	3	2	-	-	-	-			-		-	-
CO4	Find the extrema of function of two variables	3	2	-	-	-	-		-	-		-	-
CO5	Evaluate the double and triple integrals	3	2	-	-	-	-	-	-	-		-	-
CO6	application of extreme points of functions and multiple integrals in engineering problems	3	2	-	-	-	-	-	-	-	-	-	1

COURSECODE	COURSE TITLE	L	T	P	C
UPH2176	ENGINEERING PHYSICS (Common to all B.E./B.Tech programs)	3	0	0	3

COURSE OUTCOMES:

At the end of this course, students will be able to,

CO1: Analyze crystal structures and the influence of imperfections on their properties.

CO2: Demonstrate and explain the general concepts of elastic and thermal properties of materials.

CO3: Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.

CO4: Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.

CO5: Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.

CO-PO Mapping:

Course Code & Name: UPH2176 ENGINEERING PHYSICS		PO's											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Analyze crystal structures and the influence of imperfections on their properties.	3	2	-	1	1	-	2	-	-	2	-	-
CO2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.	3	2	-	1	1	-	2	-	-	2	-	-
CO3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.	3	2	-	1	1	-	2	-	-	2	-	-
CO4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines	3	2	-	1	1	-	2	-	-	2	-	-
CO5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication	3	2	-	1	1	-	2	-	-	2	-	-

COURSECODE	COURSE TITLE	L	T	P	C

UCY2176	ENGINEERING CHEMISTRY (Common to all B.E./B. Tech degree Programs)	3	0	0	3

COURSE OUTCOMES:

At the end of this course, students will be able to

CO1: The unique properties of nanoparticles and their applications

CO2: The principles of electrochemistry and its application for quantitative analysis

CO3: The various types of corrosion under normal to severe corrosive environments and their control measures

CO4: Construction of phase diagram and its application to analyse simple eutectic Systems

CO5: The synthesis, properties and applications of important industrial polymers

CO-PO Mapping:

Course Code & Name: UCY2176 ENGINEERING CHEMISTRY		PO's											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	The unique properties of nanoparticles and their applications	3	2	1	-	-	-	-	-	-	-	-	-
CO2	The principles of electrochemistry and its application for quantitative analysis	3	2	1	-	-	-	-	-	-	-	-	-
CO3	The various types of corrosion under normal to severe corrosive environments and their control measures	3	2	1	-	-	-			-		-	-
CO4	Construction of phase diagram and its application to analyse simple eutectic systems	3	2	1	-	-	-		-	-		-	-
CO5	The synthesis, properties and applications of important industrial polymers	3	2	1	-	-	-	-	-	-		-	-

COURSECODE	COURSE TITLE	L	T	P	C
UGE2176	PROBLEM SOLVING AND PROGRAMMING IN PYTHON (Common to all B.E./B. Tech degree Programs)	3	0	0	3

COURSE OUTCOMES:

After the completion of this course, students will be able to:

CO1: Solve programming problems and express solutions in pseudo code.

CO2: Develop simple programs using basic constructs.

CO3: Construct programs using conditions and iterations decompose a problem into

functions.

CO4: Make use of strings, lists, tuples and dictionaries data structures.

CO5: Perform Input/Output Operations using files.

CO-PO Mapping:

Course Code & Name: UGE2176 PROBLEM SOLVING AND PROGRAMMING IN PYTHON		PO's											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Solve programming problems and express solutions in pseudo code.	2	1	0	0	-	-	-	-	-	-	-	-
CO2	Develop simple programs using basic constructs	2	2	0	0	-	-	-	-	-	-	-	-
CO3	Construct programs using conditions and iterations decompose a problem into functions.	2	3	2	1	-	-	-	-	-	-	-	-
CO4	Make use of strings, lists, tuples, and dictionaries data structures.	2	3	2	1	-	-	-	-	-	-	-	-
CO5	Perform Input/Output Operations using files.	2	2	2	1	-	-	-	-	-	-	-	-

COURSECODE	COURSE TITLE	L	T	P	C
UGE2177	ENGINEERING GRAPHICS (Common to all B.E./B.Tech programs)	1	0	4	3

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

CO1: Draw Plane curves and perform Free hand sketching of three - dimensional objects.
(BL: L3)

CO2: Draw the Orthographic projections of points, lines and plane surfaces. (BL: L3)

CO3: Draw the Projections of solids. (BL: L3)

CO4: Draw the Projections of sectioned solids and Development of surfaces. (BL: L3)

CO5: Draw the Isometric and Perspective projections of solids. (BL: L3)

CO-PO Mapping:

Course Code & Name: UGE2177 ENGINEERING GRAPHICS		PO's											
		1	2	3	4	5	6	7	8	9	10	11	12

CO1	Draw Plane curves and perform Free hand sketching of three - dimensional objects.	3	2	2	-	-	2	-	-	-	3	-	-
CO2	Draw the Orthographic projections of points, lines and plane surfaces.	3	2	2	-	-	2	-	-	-	3	-	-
CO3	Draw the Projections of solids.	3	2	2	-	-	2	-	-	-	3	-	-
CO4	Draw the Projections of sectioned solids and Development of surfaces.	3	2	2	-	-	2	-	-	-	3	-	-
CO5	Draw the Isometric and Perspective projections of solids.	3	2	2	-	-	2	-	-	-	3	-	-

COURSECODE	COURSE TITLE	L	T	P	C
UGE2197	PROGRAMMING IN PYTHON LAB (Common to all B.E./B. Tech degree Programs)	0	0	3	1.5

COURSE OUTCOMES:

After the completion of this course, students will be able to:

CO 1: Write, test, and debug simple Python programs.

CO 2: Build Python programs with conditionals and loops.

CO 3: Solve a problem using functions in python programming.

CO 4: Construct python programs using compound data like lists, tuples, and dictionaries.

CO 5: Build a simple application in teams using files and appropriate datatypes by applying the best programming practices.

Course Code & Name: UGE2197 PROGRAMMING IN PYTHON LAB		PO's											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Write, test, and debug simple Python programs	2	2	0	0	-	-	-	1	-	-	-	-
CO2	Build Python programs with conditionals and loops.	3	3	0	1	-	-	-	1	-	-	-	-
CO3	Solve a problem using functions in python programming.	3	3	0	1	-	-	-	1	-	-	-	-
CO4	Construct python programs using compound data like lists, tuples, and dictionaries.	3	3	0	1	-	-	-	1	-	-	-	-

CO5	Build a simple application in teams using files and appropriate datatypes by applying the best programming practices.	3	3	0	2	-	-	-	1	3	2	-	-

COURSECODE	COURSE TITLE	L	T	P	C
UGS2197	PHYSICS AND CHEMISTRY LABORATORY	0	0	3	1.5

COURSE OUTCOMES

Upon successful completion of the course, students will be able to

CO1: Apply principles of elasticity, optics, viscosity, thermal and band gap determination for engineering applications

CO-PO Mapping:

Course Code & Name: UGS2197 A. PHYSICS LABORATORY		PO's											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Apply principles of elasticity, optics, viscosity, thermal and band gap determination for engineering applications	3			2	1	-	-	-	-	-	-	-

A. CHEMISTRY LABORATORY

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to

CO1: Analyse ions like Fe²⁺, Fe³⁺, H⁺ using different instruments

CO2: Determine the Molecular weight and Degree of Polymerisation using viscometer

CO-PO mapping

Course Code & Name: UGS2197 B. CHEMISTRY LABORATORY		PO's											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Analyse ions like Fe ²⁺ , Fe ³⁺ , H ⁺ using different instruments	3			-	-	-	-	-	-	-	-	-

CO2	Determine the Molecular weight and Degree of Polymerisation using viscometer	3			-	-	-	-	-	-	-	-	-

COURSE CODE	COURSE TITLE	L	T	P	C
UMA2276	COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS (Common to all Second semester B.E./B.Tech)	3	1	0	4

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

CO1: Solve problems in Analytic functions and construction of analytic functions using C-R equations

CO2: Solve problems using integration techniques, find Taylor's and Laurent's Series expansions

CO3: Obtain the Laplace Transforms and inverse transforms of standard functions.

CO4: Solve Differential Equations using different techniques

CO5: Evaluate Line, Surface and Volume integrals

CO6: Application of Complex integration, Laplace transforms, Ordinary differential equations, and vector calculus in engineering problems

CO-PO-PSO MAPPING

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2											1	
2	3	2											1	
3	3	2											1	
4	3	2											1	
5	3	2											1	
6	3	2										1	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCE2251	SOLID MECHANICS FOR TECHNOLOGISTS	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to

CO1: To gain knowledge of stress, strain and deformation of solids.

CO2: To gain knowledge of shear force and bending moments diagram for beam subjected to transverse loading

CO3: To gain knowledge of various methods used to find the deflection of beams

CO4: To acquire the knowledge of bending stress and shear stress in beams

CO5: To gain knowledge of torsion and spring and columns.

CO-PO-PSO MAPPING

COs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	3	2	2		1						1	1	1		
2	2	3	2	3		1						1	1	1		
3	2	3	2	3		1						1	1	1		
4	2	3	2	3		1						1	1	1		
5	2	3	2	3		1						1	1	1		
COURSE CODE		COURSE TITLE										L	T	P	EL	C
UCH2201		CHEMICAL ENGINEERING FUNDAMENTALS AND PRACTICE										3	0	2	3	5

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Understand the role of chemical engineers and industrial operations for producing chemicals in a large scale.

CO2: Understand the terminologies of chemical process calculations and get an overview of fluid mechanics and pumps

CO3: Describe heat transfer principles and equipment

CO4: Explain mass transfer operation principles and equipment

CO5: Recognize the concepts of chemical reaction engineering and reactors

CO-PO-PSO MAPPING

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2								2	2			2	
2	2								2	2			2	
3	2								2	2			2	
4	2								2	2			2	
5	2								2	2			2	

COURSE CODE	COURSE TITLE	L	T	P	C
ACY2276	ENVIRONMENTAL SCIENCE	3	0	0	0

COURSE OUTCOMES:

On successful completion of this course, the students will be able to demonstrate understanding of

The structure and functions of the ecosystems and diversity among life forms within an ecosystem

The importance of various natural resources and its sustainable use

The various environmental issues such as pollution, population explosion etc and suggest remedial measures.

The role of engineering techniques to minimize environmental stress

The role of various environmental machineries and to ensure proper environmental regulation.

REFERENCES:

1. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014

CO-PO-PSO MAPPING

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		1											
2	3	2	1											
3	3	2	1											
4	3	2	1											
5	3		1											

COURSE CODE	COURSE TITLE	L	T	P	C
UCY2251	CHEMISTRY FOR CHEMICAL ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to demonstrate understanding on

CO1: The Industrial synthesis of simple organic compounds

CO2: The process and mechanism of adsorption and role of chromatography in industries

CO3: The elucidation of the structure of sugars and glycans by deciphering their chemical behaviour.

CO4: The preparation, properties and uses of a variety of heterocyclic compounds and dyes.

CO5: The preparation, properties and uses of a variety of commercially important chemicals and auxiliaries.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1											
2	3	2	3											
3	3	2	3											
4	3													
5	3													

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2211	CHEMICAL ANALYSIS LABORATORY	0	0	3	1.5

COURSE OBJECTIVES:

- To make students acquire practical skills in wet chemical practices and analytical methods.
- To create awareness about various experimental practices that help to analyse the composition of certain chemical and related products.
- To educate students about different quantitative techniques used in product analysis.

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Calculate the Chemical Properties of solid and liquid fuels.

CO2: Analyze the properties of various oils of importance to chemical engineers.

CO3: Use analytical techniques in estimating the basic water pollutant parameters.

CO4: Assess the quality of soaps and Cement.

CO5: Investigate biological materials for cellulose and glucose content.

CO-PO-PSO MAPPING

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			1			2		3			3		1
2	3			2					3			3		1
3	3			1					3			3		1
4	3			3					3			3		1
5	3			2					3			3		1

Course Code	Course Title	L	T	P	C
UGE2297	DESIGN THINKING AND ENGINEERING PRACTICES LAB	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Draw pipeline plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household woodwork (K2)					
CO2: Practice machining to make holes on different materials; fabricate sheet metal components (K2)					
CO3: Dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model of various components (K2)					
CO4: Construct domestic electrical circuits and verify their output parameters (K3)					
CO5: Construct electronics circuits and verify their output (K3)					

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2		1					2	1		1
2	3	2		1					2	1		1
3	3	2		1					2	1		1
4	3	3	3	3					3	1		1
5	3	3	3	3					3	1		1

COURSE CODE	COURSE TITLE	L	T	P	C
UMA2376	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS (Common to Third Semester BME, CHEM and EEE)	3	1	0	4

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Obtain Fourier series expansion of periodic functions.

CO2: Solve the problems in partial differential equations.

CO3: Able to solve initial and boundary value problems using Fourier series techniques.

CO4: Obtain Fourier transform of various functions.

CO5: Evaluate difference equations using Z- transform technique.

CO6: Application of Fourier Series, Partial differential equations, Fourier transform, and Z-transforms in engineering problems

CO-PO-PSO MAPPING

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2											1	
2	3	2											1	
3	3	2											1	
4	3	2											1	
5	3	2											1	
6	3	2											1	

COURSE CODE	COURSE TITLE	L	T	P	C
UHS2376	HUMANITIES II-UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY	2	0	2	3

COURSE OUTCOMES:

On completion of this course, the students will be able to

- Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore

the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.

- Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
- Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.
- Understand the harmony in nature and existence, and work out their mutually fulfilling participation in nature.
- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1						2		3	3	2		3
2						2		3	3	2		3
3						2		3	3	2		3
4						2		3	3	2		3
5						2		3	3	2		3

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2301	CHEMICAL PROCESS CALCULATIONS	3	1	0	4

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Compute composition of mixtures, solution, and gases in chemical engineering.

CO2: Perform material balance for various unit operations commonly found in the chemical industry.

CO3: Apply psychrometry in solving Chemical Engineering problems.

CO4: Calculate heat load and reaction temperature required for various chemical processes.

CO5: Solve problems on fuels and combustion.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3								3			2	
2	3	3								3			2	
3	3	3								3			2	
4	3	3								3			2	

5	3	3							3			2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2302	CHEMICAL PROCESS INDUSTRIES	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Analyse the process flow diagrams of natural products viz., pulp and paper, rayon, sugar, and starch production.

CO2: Compare the various industrial manufacturing process in the mining of raw material to production of finished goods, such as chloro-alkali compounds, Sulfur, sulfuric and hydrochloric acids.

CO3: Illustrate the operation of fertilizer industry and its classification

CO4: Compare a suitable process for the manufacturing of cement and examining the operation of various gases, paints, and pigments.

CO5: Outline the processes involved in petroleum refinery and the petrochemical industry.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	1		1	1			2	2		2		3
2	3	3	2		3	3			3			3	3	3
3	3	3	2		3	3			3			3		3
4	3	3	2		3	3			3			3		3
5	3	3	2		3	3			3			3		3

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2304	FLUID MECHANICS FOR CHEMICAL ENGINEERS	2	1	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Understand the fundamental properties of fluids and analyze pressure measurement methods.

CO2: Analyze characteristics of the fluid in motion.

CO3: Develop empirical correlation using dimensionless analysis.

CO4: Analyze the fluid flow through a pipe and also over the bed of solids.

CO5: Understand the principles of pump operation and analyze the characteristics of various pumps used in chemical process industries.

CO-PO-PSOs Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3								3			1	
2	3	3								3			1	
3	3	3								3			1	
4	3	3								3			1	
5	3	3								3			1	

COURSE CODE	COURSE TITLE	L	T	P	C
UEE2351	PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On the successful completion of the course, students will be able to,

CO1: Comprehend the fundamental concepts of DC Circuits

CO2: Describe the basic concept of AC Circuits

CO3: Explain the characteristics of various static and rotating machines such as DC motor, DC generator and single-phase transformer.

CO4: Conduct experiment on various single and three phase AC motors and generators.

CO5: Illustrate the application of the various electronic devices

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	3	3				2	1					
CO2:	3	2	1			2	1					
CO3:	3	2	1			2	1					
CO4:	3	2	1			2	1					
CO5:	3	2	2			2	1					

COURSE CODE	COURSE TITLE	L	T	P	C
UEE2371	ELECTRICAL ENGINEERING LABORATORY	0	0	3	1.5

COURSE OUTCOMES:

Student will be able to

CO1: Analyse various characteristics of different types of DC machines.

CO2: Explain the performance of transformer.

CO3: Analyse the operation of single & three phase synchronous and asynchronous types of

AC machines.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3				2	1							
2	3	2	1			2	1							
3	3	2	1			2	1							
4	3	2	1			2	1							
5	3	2	2			2	1							

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2311	FLUID MECHANICS LABORATORY	0	0	3	1.5

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Demonstrate fluid flow using variable area flow meters and variable head flow meters

CO2: Interpret head losses through open channels.

CO3: Develop pump characteristics curves for the transportation of fluids based on process conditions/requirements.

CO4: Interpret viscosity of fluids.

CO5: Examine pressure drop for fluid flow around solid objects.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3		1					3	3			1	
2	3	3		1					2	2			1	
3	3	3		1					3	3			1	
4	3	3		1					2	2			1	
5	3	3		1					3	3			1	

COURSE CODE	COURSE TITLE	L	T	P	C
UMA2451	NUMERICAL METHODS FOR CHEMICAL ENGINEERING	2	1	3	4.5

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Obtain the numerical solution of algebraic and transcendental equations with its applications to chemical engineering problems through software coding.

CO2: Find the interpolating polynomials and apply the techniques of regression in chemical engineering problems through software coding.

CO3: Solve and apply the numerical techniques of integration in chemical engineering problems.

CO4: solve first and second order ordinary differential equations numerically and through software coding.

CO5: find numerical solutions to boundary value problems in partial differential equations and obtain solution through software coding.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3			1							1	1	
2	3	3			1							1	1	
3	3	3			1							1	1	
4	3	3			1							1	1	
5	3	3			1							1	1	

COURSE CODE	COURSE TITLE	L	T	P	C

AHS2476	INDIAN CONSTITUTION	3	0	0	0

COURSE OUTCOMES:

At the end of the course, students will be able to,

- Understand the history and philosophy of the Indian constitution.
- Realize the powers and functions of the Indian government.
- Acquire awareness of the structure and functions of local administration.
- Enhance knowledge about the organization and composition of the judiciary.
- Explore the distribution of financial powers and emergency provisions.

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1						2		2	2	2		2
2						2		2	2	2		2
3						2		2	2	2		2
4						2		2	2	2		2
5						2		2	2	2		2

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2401	CHEMICAL ENGINEERING THERMODYNAMICS I	2	1	0	3

COURSE OUTCOMES:

CO1: Summarize the basic concepts of thermodynamics such as temperature, pressure, system, properties, process, state, cycles and equilibrium.

CO2: Calculate the properties of ideal and real mixtures based on thermodynamic principles.

CO3: Apply the law of thermodynamics to open and closed systems

CO4: Develop the fundamental thermodynamic property relationships for homogeneous phases.

CO5: Apply mass, energy and entropy balances to flow processes.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3											1	
2	3	3			3				3	3			1	
3	3	2	2										1	
4	3	2	2	3					3	3			2	
5	3	2	2	3					3	3			2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2402	HEAT TRANSFER	2	1	0	3

COURSE OUTCOMES:

CO1: Apply the principles of conduction to predict heat transfer for simple geometries.

CO2: Estimate the convective heat transfer coefficient

CO3: Examine the boiling and condensation process and predict the heat transfer co-efficient for the phase changing mechanisms.

CO4: Analyze and evaluate the performance of different types of heat exchanger.

CO5: Apply the heat transfer mechanisms to design the evaporators and gain fundamental knowledge on radiation mode of heat transfer

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2											1	
2	3	3								3			2	
3	3	2								3			2	
4	3	3			3					3			3	
5	3	2			2					3			3	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2403	MECHANICAL OPERATIONS	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Categorize the characteristics of solid particle and select appropriate particle size measurement techniques.

CO2: Examine the performance of various size reduction and size enlargement techniques

CO3: Identify a suitable separation technique for gas-solid and liquid-solid systems.

CO4: Examine the pressure drop, specific cake resistance and filter medium resistance for designing the appropriate filtration process.

CO5: Select appropriate mixer, agitator, storage vessel and conveyors for mixing and transportation of solids (dry and wet).

CO-PO-PSO Mapping

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3									3			1	

2	3								3	3			1	
3	3								3	3			1	
4	3	3	2						3	3			2	
5	3								3	3			1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2411	MECHANICAL OPERATIONS LABORATORY	0	0	3	1.5

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Examine the performance of various size reduction equipment.

CO2: Analyze the particle size distribution in the mixture by sieve analysis.

CO3: Perform filtration experiment to calculate filter medium and cake resistance.

CO4: Evaluate the minimum area required to separate solid from liquid using sedimentation process.

CO5: Estimate the efficiency of solid-gas separation equipment.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2		1					3	3			2	
2	3	3		1					3	3			2	
3	3	3		1					3	3			2	
4	3	3		2					3	3			2	
5	3	3		2					3	3			2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2501	CHEMICAL ENGINEERING THERMODYNAMICS II	2	1	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Calculate the thermodynamic properties (such as partial molar properties, fugacity coefficient, activity coefficient etc.) of fluid mixtures.

CO2: Predict equilibrium composition of components in the mixtures under phase equilibria.

CO3: Predict bubble-point and dew-point temperature, equilibrium constant and composition using thermodynamic models.

CO4: Calculate the equilibrium constant and composition of mixtures under chemical-

reaction equilibria using thermodynamic principles.

CO5: Illustrate various refrigeration cycles (such as Carnot, Bell-Coleman, etc.) and their performances using thermodynamic concepts.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2		1						3			1	
2	3	2		1					3				1	
3	3	2		1	2							3	1	
4	3	2		1					3				1	
5	3	2		2						3			2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2502	CHEMICAL REACTION ENGINEERING I	3	1	0	4

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Apply reaction kinetics principles in designing batch reactors and derive rate equations.

CO2: Design different types of ideal reactors for homogeneous chemical reactions and demonstrate various combinations of reactors to achieve maximum performance.

CO3: Analyze proper reactors among the single and multiple reactor combinations, and outline the importance of recycle reactor.

CO4: Interpret the isothermal/non-isothermal homogeneous reactor data and identify the heat exchange equipment required for the reaction.

CO5: Analyze the non-ideal flow behaviour in the reactors and analyze the basic models that explain the non-ideal flow conditions.

CO-PO-PSO Mapping

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3								3			1	
2	3	3	3							3			1	
3	3	3	3							3			1	
4	3	3	3							3			1	
5	3	3								3			1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2503	MASS TRANSFER I	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Determine the diffusion coefficients and rate of mass transfer in all three phases viz. solid, liquid, and gaseous phases.

CO2: Solve for the mass transfer coefficients and flux in different flow conditions.

CO3: Design humidification equipment based on material and energy balances.

CO4: Calculate the process parameters used for designing dryers

CO5: Calculate the process parameters used for designing crystallizers.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2								3		3	1	
2	3	2								3		3	1	
3	3	3	3							3		3	3	
4	3	2	1							3		3	1	
5	3	2	1							3		3	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2504	PROCESS INSTRUMENTATION, DYNAMICS	3	0	0	3
	AND CONTROL				

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

CO1: Describe the standard measuring instruments used in the chemical industries and their principles.

CO2: Analyze the static and dynamic behaviour of chemical processing systems and employ Laplace Transforms to develop the models for open-loop systems.

CO3: Develop block diagram using transfer functions for a closed-loop system.

CO4: Interpret the frequency response data and do the stability analysis of control systems.

CO5: Analyze and design advanced control systems for chemical processes.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2

1	3	3											2	
2	3	3	2		2								2	
3	3	3	3		2								2	
4	3	3	3		2								2	
5	3	2	3		3								2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2511	HEAT TRANSFER LABORATORY	0	0	3	1.5

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

CO1: Evaluate the performance of bare and finned tube exchangers.

CO2: Estimate the performance of different heat exchangers used in chemical industries such as tubular, shell-and-tube, and packed bed heat exchangers.

CO3: Compare the performance of coil and jacketed arrangements of heating.

CO4: Calculate and compare the performance of horizontal and vertical condensers.

CO5: Estimate the heat load required for the evaporation process.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3		3					2	2			2	
2	3	3		3					2	2			2	
3	3	3		3					2	2			2	
4	3	3		3					2	2			2	
5	3	3		3					2	2			2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2512	PROCESS DYNAMICS AND CONTROL LABORATORY	0	0	3	1.5

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

CO1: Apply the control system to industrial parameters like that- fluid flow, level, pressure, temperature problems.

CO2: Analyze the performance and characteristics of a second order system.

CO3: Develop characteristics of control valves.

CO4: Evaluate performance of Advanced Control systems.

CO5: Implement optimal values for PID controllers for any application.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	3	2				2	1			1	
2	3	3	2	3	2				2	1			1	
3	3	3	2	3	2				2	1			1	
4	3	3	2	3	2				2	1			1	
5	3	3	2	3	2				2	1			1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2601	CHEMICAL REACTION ENGINEERING II	2	1	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Develop the reaction mechanism and develop the rate equations for heterogeneous reactions.

CO2: Analyse the performance of different kinds of non-catalytic reactors by applying the knowledge on gas-solid non-catalytic reactions.

CO3: Discuss appropriate preparation, testing, and characterisation of catalysts.

CO4: Analyse the performance of different kinds of catalytic reactors by applying the knowledge on gas-solid catalytic reactions.

CO5: Design of gas-liquid reactors by applying the knowledge on gas-liquid reactions.

CO-PO-PSO Mapping

COs	POs	PSOs

	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3								3			1	
2	3	3	3							3			1	
3	3	3	3							3			1	
4	3	3	3							3			1	
5	3	3								3			1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2602	INDUSTRIAL PROCESS PLANT SAFETY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Describe potential industrial hazards and need for safety measures

CO2: Apply appropriate safety guidelines to overcome the various hazards in the workplace.

CO3: Analyze the risk associated with radiation, explosion and fire using ISO guidelines

CO4: Devise suitable hazard identification method for accident analysis

CO5: Apply HAZOP analysis to various case studies

CO-PO-PSO MAPPING

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						1	3							2
2						2	3							2
3						3	3				2			2
4		3				3			3					2
5									3	3				2

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2603	MASS TRANSFER II	3	1	0	4

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Design of gas absorption columns by applying the concept of height determinations using HTU and NTU.

CO2: Design of distillation columns by applying the knowledge on vapour – liquid equilibrium.

CO3: Calculate the number of stages required for separating liquid mixture using extraction principles.

CO4: Calculate the number of stages required for separation using leaching process.

CO5: Analyze the adsorption mechanism, operation and outline the basic concepts of

membrane separation.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3							3		3	3	
2	3	3	3							3		3	3	
3	3	2	1							3		3	1	
4	3	2	1							3		3	1	
5	3	3	2							3		3	2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2604	PROCESS ENGINEERING ECONOMICS	2	1	0	3

COURSE OUTCOMES:

CO1: Compute the plant cost analysis including depreciation and capital recovery.

CO2: Prepare the financial statements and balance sheet by applying the accounting principles.

CO3: Summarize the essentials of economic balance for process industries

CO4: Illustrate the basic principles and functions of management, and Management information system.

CO5: Summarize production planning and Quality control

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2							3					
2											2			
3	2	1									3			2

4							3			3				
5							3		2	2				

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2611	MASS TRANSFER LABORATORY	0	0	3	1.5

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Apply Fick's law of diffusion to determine the diffusivity.

CO2: Conduct a drying test to evaluate the drying characteristic curve of solid material.

CO3: Determine the mass transfer coefficient using various mass transfer equipment.

CO4: Verify the Rayleigh's equation and evaluate the performance of packed and steam distillation.

CO5: Evaluate the extraction efficiency for liquid extractor and leaching equipment.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2		2									3	
2	3	2		2									3	
3	3	2		2									1	
4	3	3		3									1	
5	3	3		3									2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2612	CHEMICAL REACTION ENGINEERING AND THERMODYNAMICS LABORATORY	0	0	3	1.5

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Apply knowledge on batch and semi batch reactor for performing kinetic studies.

CO2: Apply knowledge on types of flow reactor for performing kinetic studies.

CO3: Analyze performance of real reactors and degree of non-ideality.

CO4: Examine the derived thermodynamic properties.

CO5: Validate the basic laws for ideal and non-ideal systems.

CO-PO-PSO Mapping

COs	POs	PSOs

	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3					1	1	2	1		2	3	2
2	3	3						1	2	1		2	3	1
3	3	3		1			1	1	2	1		2	3	1
4	2	2	3	2	2			1	2			2	1	1
5	2	2	3	2	2			1	2			2	1	1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2701	CHEMICAL PROCESS MODELING AND SIMULATION	2	1	4	5

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Discuss the several stages involved in the mathematical models used in Software/Tools.

CO2: Demonstrate the degrees-of-freedom analysis, flow-sheeting and modeling of steady-state lumped systems.

CO3: Models for unsteady-state lumped systems with initial value conditions in Software/Tools.

CO4: Develop the mathematical models distributed parameter systems of boundary values problems.

CO5: Demonstrate the model solving ability of unsteady-state distributed systems with chemical engineering examples in aspen plus software.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2			2					3			1	
2	3	2		1	2								1	
3	3	2		1	2				3				1	
4	3	2		1	2								1	
5	3	2		1	2								1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2702	PROCESS EQUIPMENT DESIGN	1	2	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Perform thermal design of heat transfer equipment like shell and tube and double pipe heat exchangers, and evaporators, and assess their thermal efficiency.

CO2: Demonstrate skills in basic design and drawing of cooling towers and different dryers.

CO3: Apply the concepts involved in phase separation and design separation columns such as distillation, extraction, absorption, and adsorption columns.

CO4: Demonstrate the skills in mechanical design of packed bed reactors, pressure vessels, storage tanks and their auxiliary devices.

CO5: Design plant layouts with proper schematic representation of pipelines, fittings and relevant structures.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3							3		3	2	
2	3	3	3							3		3	2	
3	3	3	3							3		3	2	
4	3	3	3			2				3		3	2	
5	3	3	3			2				3		3	2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2703	TRANSPORT PHENOMENA	2	1	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Use the concepts of transport processes and their mechanisms.

CO2: Deduct equations for steady-state momentum transport processes at a microscopic and macroscopic level.

CO3: Deduct equations for steady-state heat transport processes at a microscopic and macroscopic level.

CO4: Deduct equations for steady-state mass transport processes at a microscopic and macroscopic level.

CO5: Analyse transport equations in turbulence and discuss the boundary layer concepts.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3								3			2	1
2	3	3								3			2	1
3	3	3								3			2	1
4	3	3								3			2	1
5	3	3								3			2	1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2717	PROJECT PHASE I	0	0	6	3

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Formulate a real-world problem, identify the requirement and develop the design solutions.

CO2: Express the technical ideas, strategies and methodologies. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.

CO3: Test and validate through conformance of the developed prototype and analysis the cost effectiveness. Prepare report and present the oral demonstrations

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2716	INDUSTRIAL TRAINING / INTERNSHIP	0	0	0	2

Students shall undergo training in R&D institutions / Academics / Industries for a minimum period of 15 days. At the end of internship students must submit a report for internal evaluation.

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2818	PROJECT PHASE II	0	0	16	8

COURSE OUTCOME:

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

HUMANITIES I ELECTIVES (II SEMESTER)

COURSE CODE	COURSE TITLE	L	T	P	C
UEN2241	LANGUAGE AND COMMUNICATION	2	0	2	3

COURSE OUTCOMES:

At the end of this course, students will be able,

CO1: To improve their communicative competency across all skills of language.

CO2: To improve their writing ability in writing for persuasion and convincing someone.

CO3: To attend job interviews more confidently,

CO4: To improve social communication sensitive to gender and other prejudices.

CO5: To do better in the spoken component of the placement tasks

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1									2	3		2
2									2	3		2
3									2	3		2
4									2	3		2
5									2	3		2

COURSE CODE	COURSE TITLE	L	T	P	C
UEN2242	FUNDAMENTALS OF LINGUISTICS	2	0	2	3

COURSE OUTCOMES:

At the end of this course, the student will be,

CO1: To understand what is linguistics

CO2: To explore some basic issues and questions related to language

CO3: To understand the subtle difference between the use of English in Indian and western tradition.

CO4: To Familiarize themselves with the unique features of language in technology

CO5: To Understand the basics of how children acquire languages

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1									2	3		2
2									2	3		2
3									2	3		2
4									2	3		2
5									2	3		2

COURSE CODE	COURSE TITLE	L	T	P	C
UHS2243	FILM APPRECIATION	2	0	2	3

COURSE OUTCOMES:

At the end of the course, the students will be able to understand

CO1: the process of the development of film as an art and entertainment form.
 CO2: the evolution of the language of cinema as it evolved over a century.
 CO3: the script writing techniques of a film and appreciate the various nuances.
 CO4: the evolution of film industry from the past to present
 CO5: how to appreciate all aspects of the film.

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1									2	3		2
2									2	3		2
3									2	3		2
4									2	3		2
5									2	3		2

COURSE CODE	COURSE TITLE	L	T	P	C
UHS2241	HUMAN RELATIONS AT WORK	2	0	2	3

COURSE OUTCOMES:

At the end of the course the students:

CO1: will enhance their awareness about human relations at work and its relationship with self.
 CO2: become aware of the processes involved in interaction with people at work.
 CO3: Will understand the importance of psychological and physical health in maintaining human relations at work.
 CO4: will be able to understand the ways and means to improve human relations at work.
 CO5: will realize the importance of safeguarding themselves from any exploitation.

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1						2		2	3	2		2
2						2		2	3	2		2
3						2		2	3	2		2
4						2		2	3	2		2
5						2		2	3	2		2

COURSE CODE	COURSE TITLE	L	T	P	C

UHS2242	APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE	3	0	0	3

COURSE OUTCOMES:

At the end of the course the students will be able to:

- CO1: Raise their awareness on applications of psychology to everyday issues of life,
CO2: Deal more efficiently with different issues in society, workplace and human behavior.
CO3: Apply principles of psychology in their own personal and professional lives.
CO4: Use the psychological principles for their own human development.
CO5: Appreciate the impact of Psychology on human life

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1						2		2	3	2		2
2						2		2	3	2		2
3						2		2	3	2		2
4						2		2	3	2		2
5						2		2	3	2		2

COURSE CODE	COURSE TITLE	L	T	P	C
UEN2243	UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE	2	0	2	3

COURSE OUTCOMES:

- CO1: Improvement in the awareness of various traditions.
CO2: Not only understand not just the diversity found between various traditions but also celebrate them.
CO3: strengthen their analytical capability.
CO4: improve their language skills and also the ability to express complex ideas.
CO5: understand the relationship between life and literature

CO-PO-PSO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1									2	3		2
2									2	3		2
3									2	3		2
4									2	3		2
5									2	3		2

MANAGEMENT ELECTIVES (V SEMESTER)

COURSE CODE	COURSE TITLE	L	T	P	C
UBA2541	PRINCIPLES OF MANAGEMENT	3	0	0	3

COURSE OUTCOMES:

CO1: Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling .

CO2: Have same basic knowledge on international aspect of management.

CO3: Ability to understand management concept of organizing.

CO4: Ability to understand management concept of directing.

CO5: Ability to understand management concept of controlling.

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1											2	1
2									2		3	1
3									2		2	1
4					3					2	2	1
5											1	1

COURSE CODE	COURSE TITLE	L	T	P	C
UBA2542	TOTAL QUALITY MANAGEMENT	3	0	0	3

COURSE OUTCOMES:

CO1: Ability to apply TQM concepts in a selected enterprise.

CO2: Ability to apply TQM principles in a selected enterprise.

CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.

CO4: Ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.

CO5: Ability to apply QMS and EMS in any organization.

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1						3		2	1		1	1
2						3			2		1	1
3					2	3			1		1	1

4						3	1		1		1	1
5						3	2		1		1	1

COURSE CODE	COURSE TITLE	L	T	P	C
UBA2545	OPERATION RESEARCH	3	0	0	3

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

- Learned to translate a real-world problem, given in words, into a mathematical Formulation.
- An understanding of the role of algorithmic thinking in the solution of operations research problems.
- Be able to build and solve Transportation Models and Assignment Models, maximal flow problem, minimum spanning tree and shortest path problem.
- Able to handle issues in various Inventory models.
- The students acquire capability in applying and using of queuing models for day today problem

CO-PO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	1	1	1			1	1	1	3	3	1	
2	2	2	1	1	1			1	1	1	3	3	1	
3	3	2	1	1	1			1	1	1	3	3	1	
4	2	2	1	1	1			1	1	1	3	3	1	
5	2	2	1	1	1			1	1	1	3	3	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UBA2543	WORK ETHICS, CORPORATE SOCIAL RESPONSIBILITY AND GOVERNANCE	3	0	0	3

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

- Understand ethical issues in workplace and have good practices in professional duties.
- Learn roles and responsibilities in professional career as a team worker
- Understand the legal aspects in Indian constitutional for protection of societal values
- Analyze the economical development by industry with importance to environment protection
- Understand need of good Governance in a corporate with ethical organizational behavior.

CO-PO Mapping

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
1								3	1	1		2
2								3	1	1		2
3						3	2	3	1	1		2
4							2	3	1	1	3	2
5								3	1	1	2	2

PROFESSIONAL ELECTIVES

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2421	AIR POLLUTION AND CONTROL	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Understand the types of air pollutants, their sources and effects.

CO2: Describe sampling techniques for common air pollutants such as SO_x, NO_x, hydrocarbons and particulate matter and apply it in air quality monitoring.

CO3: Analyze the plume behavior for different atmospheric stability conditions and discuss the theories of stack plume dispersion.

CO4: Calculate the efficiency of particulate matter and common gaseous pollution control equipment.

CO5: Outline the air pollution from major industries like mining, cement, petroleum and metallurgical industries, and also from automobiles.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					3	3	1				1		1
2	2					3	3	1				1		1
3	2					3	3	1				1		1
4	2					3	3	1				1		1
5	2					3	3	1				1		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2422	BASIC INDUSTRIAL BIOTECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

- CO1: Explain the basic concepts of upstream and downstream processing in Industrial bioprocess.
- CO2: Summarize the production processes for primary metabolites.
- CO3: Summarize the production processes for secondary metabolites.
- CO4: Elaborate on the production processes for bioproducts such as enzymes, biofuels, and dietary supplements.
- CO5: Elaborate on the production processes for recombinant bioproducts.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2									2		2	3	2
2	2									2		2	3	2
3	2									2		2	3	2
4	2									2		2	3	3
5	2									2		2	3	2

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2423	FUELS AND COMBUSTION	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

- CO1: Classify types of fuels and outline the various properties of liquid, solid and gaseous fuels.
- CO2: Discuss the origin, maintenance, and application of coal in various industries.
- CO3: Explain the origin, composition, and steps involved in the processing of crude oil.
- CO4: Discuss the various gaseous fuel availability and compare their applications.
- CO5: Perform combustion calculations and compare the performance of combustion equipments.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					1								1
2	2						2							1
3	2						2	1						1
4	2	2					2	1						1
5	2	2	2	2		1	2	1	3	3	2	2	2	1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2424	ELEMENTS OF NANOSCIENCE AND NANOTECHNOLOGY	3	0	0	3

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Discuss the fundamental concepts of nanotechnology like dimensionality and properties of nanoscale, surface stress, and surface defects.

CO2: Classify different types of nanomaterials used in chemical and bioprocess industries.

CO3: Apply various methods to synthesis nanomaterials

CO4: Analyze the various characterization techniques for nanomaterials.

CO5: Apply nanotechnology in chemical, biotechnology, and energy fields.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2									2				1
2	2									2				1
3	3								3	2				1
4	3								3	2				1
5	3					2	3		3	2				3

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2425	INSTRUMENTAL METHODS OF ANALYSIS	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Explain the fundamental concepts of electromagnetic radiation and their application in optical instruments.

CO2: Discuss the theory, instrumentation and applications of UV-Vis Spectrophotometers.

CO3: Discuss the theory, instrumentation and applications of IR Spectrophotometers.

CO4: Define the interaction between matter and radiation and describe the theory and application of solid characterization techniques such X-ray diffraction, SEM, and thermal gravimetric analysis.

CO5: Classify chromatographic techniques and explain their working principles and mode of separation involved.

CO-PO-PSO Mapping

COs	POs	PSOs

	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	1									1	2	
2	3	1	2	1	1	1	1				1	2		2
3	3	1	2	1	1	1	1				1	2		2
4	2	1	2	2	2	1	1				1	2		2
5	2	1	2	2	2	1	2				1	2		2

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2426	FOOD TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students would be able to:

CO1: Acquire the general aspects of the food industry and its need in India and the world.

CO2: Outline the constituents of food material and discuss the quality and control measures on their deteriorative factors.

CO3: Describe the necessity of preliminary food processing methods and preservative operations to minimize food deterioration.

CO4: Differentiate various food preservative techniques and their usage in the food industry.

CO5: Summarize the production methodologies adapted for different types of common food products and discuss their utilization in the world.

CO-PO-PSO Mapping

COs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1				2		2					3	3		1		
2						2	3					3		1		
3	1				1		3							2		
4	2						3					2		2		
5	2											2		1		
COURSE CODE		COURSE TITLE											L	T	P	C
UCH2427		ENVIRONMENTAL ENGINEERING											3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to:

CO1: List the consequences of population growth with respect to the environment and energy.

CO2: Explain the application of chemical engineering processes in abatement of Environmental pollution.

CO3: Determine the recycling methodologies and their economic recovery for a cleaner environment.

CO4: Outline on clean technologies for effluent treatment.

CO5: Analyze on the role of government, Industries and mass exchange network synthesis in pollution prevention.

CO-PO-PSO Mapping

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					3	3	1				1		1
2	2					3	3	1				1		1
3	2					3	3	1				1		1
4	2					3	3	1				1		1
5	2					3	3	1				1		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2521	WASTEWATER TREATMENT	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to:

CO1: List the types of constituents present in the wastewater and their health effects.

CO2: Discuss the types of reactors for treating different kinds of wastewater and selection of appropriate types of reactors for the wastewater treatment.

CO3: Illustrate the different kinds of chemical unit processes in wastewater treatment.

CO4: Categorize the different kinds of biological processes in the wastewater treatment.

CO5: Analyze the different types of advanced wastewater treatment technologies.

CO-PO-PSO Mapping

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					3	3	1				1		1
2	2					3	3	1				1		1
3	2					3	3	1				1		1
4	2					3	3	1				1		1
5	2					3	3	1				1		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2522	BIOPROCESS PRINCIPLES	3	0	0	3

COURSE OUTCOMES:

At the end of the course the students will be able to:

- CO1: Summarize the operation of fermentation process including the basic configuration of fermenter.
- CO2: Articulate on media design and optimization for fermentation process.
- CO3: Elaborate on the sterilization techniques, kinetics, and design of sterilization equipment.

CO4: Apply metabolic stoichiometry and energetics for calculating product yield and efficiency of microbial growth.

CO5: Analyze the kinetics models related to the microbial growth and product formation.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2									2		2		1
2	2									2		2		1
3	2									2		2		1
4	2									2		2		1
5	2									2		2		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2523	ENERGY, ENVIRONMENT AND IMPACT ASSESSMENT	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

CO1: Describe the earth energy systems and the potential impacts of human activity on them.

CO2: Discuss the three principal components of the terrestrial ecosystem, namely energy, Environment, and Climate Change.

CO3: Examine the concepts and methodologies of environmental impact assessment.

CO4: Outline the international protocols and agreements on climate change and energy crisis.

CO5: Analyze the various case studies on environmental impact assessment and plan to mitigate the adverse impacts of a project on the environment.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					3	3	1				1		1
2	2					3	3	1				1		1
3	2					3	3	1				1		1
4	2					3	3	1				1		1
5	2					3	3	1				1		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2524	SYNTHESIS AND APPLICATIONS OF NANOMATERIALS	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, students will be able to:

- CO1: Summarize about the synthesis of nanomaterials.
- CO2: Examine the different chemical routes for the preparation of nanomaterials.
- CO3: Examine the physical approach of nano material synthesis.
- CO4: Analyze various nanoporous materials in water purification.
- CO5: Apply various nanomaterials in the field of energy, materials and environmental remediation.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						1				2				2
2										3				
3										3				
4						2	3			3				2
5	3					2	3			2				3

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2525	PULP AND PAPER TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

- CO1: Describe the essential aspects of the pulp and paper industry
- CO2: Discuss the different types of wood yard operations
- CO3: Explain the different types of paper-making process
- CO4: Discuss the surface treatment and finishing of paper and paper board
- CO5: Describe the role of process control in quality assurance

CO-PO-PSO Mapping

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		2				3						1	1
2	2		3				2						1	1
3	1	1	2				2						1	1
4	1	1	2				2						1	1
5	1	1	2				2						1	1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2526	CARBON CAPTURE UTILIZATION AND STORAGE	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Describe the importance and challenges in the CO₂ capture process.

CO2: Articulate the novel solvents and sorbents for CO₂ capture process.

CO3: Categorize the biological methods of CO₂ capture process.

CO4: Devise the suitable CO₂ conversion techniques.

CO5: Identify the effective ways for CO₂ utilization and storage.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						1	3			2		2		2
2	3				2		3						2	
3	3					3	3						2	
4	3						3							2
5						1	3							2

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2527	DRUGS AND PHARMACEUTICAL TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Articulate on development of drugs, organic therapeutic agents and their economics.

CO2: Apply the chemical principles of drug metabolism, pharmaco-kinetics and pharmaco-dynamics.

CO3: Categorize the chemical conversion process of manufacturing drugs and their applications.

CO4: Summarize the unit processes involved in manufacturing of drugs.

CO5: Apply suitable analytical methods for testing and quality control of various drugs.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2			1			1					1		1
2	2			1			1							1
3	2			1			1							1
4	2			1			1							1
5	2			1	1		1					1		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2621	SOLID WASTE MANAGEMENT	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Understand the importance of municipal solid waste management and utilize the characteristics of solid waste to make a suitable decision on waste management options.

CO2: Explain a plan for effective collection and transfer of solid waste.

CO3: Demonstrate different methods of solid waste processing and perform preliminary calculations for energy recovery systems.

CO4: Select the suitable principles and method for effective operation of solid waste disposable techniques.

CO5: Classify hazardous wastes and explain the techniques suitable for hazardous waste handling.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2		1			3	3	1				1		1
2	2		1			3	3	1				1		1
3	2		1			3	3	1				1		1
4	2		1			3	3	1				1		1
5	2		1			3	3	1				1		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2622	BIOPROCESS ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Describe different operational modes of bioreactors and appropriate conditions for their use in the industry.

CO2: Determine oxygen mass transfer coefficients in bioreactors and discuss the considerations in bioreactor scale-up.

CO3: Explain the design of reactors for enzyme immobilization processes.

CO4: Demonstrate the skills to develop and solve mathematical models in bioprocess engineering with the help of computer softwares.

CO5: Describe the strategies and challenges in recombinant cell cultivation.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2						3							1
2	2	2	2				3							1
3	2	2	2				3							1
4	2	2	2				3							1
5	2	2	2				3							1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2623	BIO-ENERGY TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Explain the types of biomass availability for energy generation and analyze the biomass characterization data.

CO2: Outline the design specifications and operational problems in bio-methanation production and apply the concepts of chemical kinetics.

CO3: Explain the chemical and biological processes involved in the production of ethanol and methanol from biomass.

CO4: Discuss the biomass combustion systems for domestic and industrial usage.

CO5: Describe the application of pyrolysis and gasification in bio-energy production from biomass.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2									2		2		1
2	2									2		2		1
3	2									2		2		1
4	2									2		2		1
5	2									2		2		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2624	POLYMER AND NANOCOMPOSITES	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Describe the synthesis, properties and classification of Nano fillers

CO2: Discuss the polymer nanocomposites processing and its properties

CO3: Explain the various synthesis and modification methods of polymer nanocomposites.

CO4: Discuss the properties, structure and crystallization behavior of biodegradable polymer nanocomposites.

CO5: Summarize the applications of polymer nanocomposites in high temperature systems and also in the production of light emitting materials.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2									2				1
2	2									2				1
3	3								3	2				1
4	3								3	2				1
5	3					2	3		3	2				3

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2625	MULTIPHASE FLOW	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Relate the basic types of multiphase systems and its applications in process industries.

CO2: Identify the type of flow-pattern and flow regimes for fluid-fluid (gas-liquid and liquid-liquid) and fluid-solids systems.

CO3: Develop one dimensional Steady state models in multiphase flows.

CO4: Interpret Drift Flux models for two phase systems.

CO5: Formulate and estimate flow properties for phase change systems.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1											1	
2	2	1											1	
3	3	2										3	2	
4	3	2								3		3	2	
5	3	3								3		3	2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2626	OPTIMIZATION OF CHEMICAL PROCESSES	3	0	0	3

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Apply fundamental concepts of mathematics to formulate optimization models for chemical engineering problems.

CO2: Evaluate the performance of numerical methods to optimize the unimodal functions.

CO3: Analyze the significance and application of multivariable optimization techniques.

CO4: Analyze the linear and non-linear programming in chemical engineering problems.

CO5: Evaluate the performance of numerical methods and optimization techniques in chemical engineering processes.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3										2	
2		2		3	2				1	1			2	
3	2	3	3	3	3	3			2	2			2	
4	2	3	3	3	3	3			2	2			2	
5	1	2	3	3	3	3			1	1			2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2627	CARBON TRADING AND CARBON FOOT PRINT	3	0	0	3

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to

CO1: Describe the global CO₂ emissions scenario and importance of controlling the emissions.

CO2: Summarize the carbon trading mechanisms

CO3: Evaluate the carbon foot print calculation and carbon credits.

CO4: Develop the strategies for the carbon management.

CO5: Apply carbon foot print analysis to some important case studies.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						1	3			2				2
2						1	3			2				
3										3	3			
4						2	3			3				
5						2	3		3	3				2

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2721	GREEN CHEMISTRY AND ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course, the students will be able to:

CO1: Describe global environmental issues and apply the risk assessment techniques in the engineering profession.

CO2: Explain pollution prevention methods and assess the impact of chemical structure of pollutant on the ambient atmosphere.

CO3: Apply green chemistry pathways and the pollution prevention steps while handling chemical reactors, separator devices and storage tanks manufacturing.

CO4: Analyze process energy integration and mass integration using a case study relevant to chemical engineering.

CO5: Select a life cycle assessment framework for various energy and product technologies in the chemical industry.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					3	3	1				1		2
2	2					3	3	1				1		2
3	2					3	3	1				1		2
4	2					3	3	1				1		2
5	2					3	3	1				1		2

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2722	DOWNSTREAM PROCESSING	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Comprehend the bioprocess principles and describe various cell disruption techniques to recover products

CO2: Select suitable unit operations for solid-liquid separation.

CO3: Identify and describe a suitable process for the isolation of product at laboratory and pilot scale.

CO4: Explain the basic concepts of chromatographic separation technique used for product purification

CO5: Analyze and assess the various unit operations used for final product formulation.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2												1	
2	2	1											1	
3	2	1										2	2	
4	2	1								2		2	1	
5	3	2								3		3	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2723	FUEL CELLS	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Describe the working principles and performance of fuel cells. (k1)

CO2: Classify the various types of fuel cells with their merits and demerits (k2)

CO3: Predict the fuel cell efficiency based on thermodynamic principles (k3)

CO4: Interpret the reaction kinetics of fuel cell operation (k2)

CO5: Apply the fuel cell concepts in domestic, automobile and industrial sectors (k3)

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1			2		3		3	3			1	
2	2	3	3	3	3				3	3			1	
3	3	3	3	3	3				3	3			1	
4	2	3	3	3	3				3	2			1	
5	3	3	3	3	3				3	3			1	

COURSE CODE	COURSE TITLE	L	T	P	C

UCH2724	INDUSTRIAL NANOTECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Summarize the importance of nanotechnology in the electronics industry and energy sector.

CO2: Explain the significance of nano-biotechnology in the biomedical industry with examples.

CO3: Examine how nanotechnology is used in the production of smart chemicals like catalysts, nanocomposites, and nanoporous zeolites.

CO4: Identify the importance of nanotechnology in the agriculture and food sectors.

CO5: Discuss different types of nanomaterials used in the textile and cosmetic industries.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					1	3			2				3
2	3					2	3			3				3
3	3					2	3			3				3
4	2					1	3			2				3
5	2					1	3			2				3

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2725	CHEMICAL PRODUCT DESIGN	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Identify the need for the chemical product design and discuss the basic templates used in the industry.

CO2: Create, screen and analyze the ideas for improving performance indices of a product design.

CO3: Select an idea based on the risk assessment and discuss the importance of intellectual property rights.

CO4: Perform a case study and establish final product specifications.

CO5: Describe the methods to obtain micro -and macro-structured chemical products and select a unit operation to separate specialty chemicals.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3			3							3	3	3
2	3	3			3							3	3	3

3	3	2			3		3					3	3	3	
4	3	3			3			3			3	3	3	3	
5	3	3			3							3	3	3	
COURSE CODE		COURSE TITLE										L	T	P	C
UCH2726		POLYMER TECHNOLOGY										3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Summarize the properties and application of natural polymers.

CO2: Describe the different types of polymerization.

CO3: Illustrate the suitable raw materials for the manufacture of synthetic polymers.

CO4: Classify polymers based on configuration, end use etc.

CO5: Discuss the polymer recycling process.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	2		1	1					1	2	2
2	2	2	2	2		1	1					1	2	2
3	2	2	2	2		1	1					1	2	2
4	2	2	2	2		1	1					1	2	2
5	2	2	2	2	1	1	1					1	2	2

COURSE CODE	COURSE TITLE											L	T	P	C
UCH2727	ADSORPTION											3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Compare adsorption with other separation techniques and decide when to choose it.

CO2: Describe the principles of adsorption and apply different adsorption equilibrium models for single and multicomponent systems.

CO3: Use adsorbents for single and multicomponent systems through batch and continuous dynamic models.

CO4: Select the procedures adapted for synthesizing and regenerating different types of adsorbents commonly used in the chemical industry.

CO5: Infer characterization results of an adsorbent from various characterization techniques and describe the choices of adsorbents in chemical industries.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2

1	2					3	3	1				1		1
2	2	2		1		3	3	1				1		2
3	2	2		1		3	3	1				1		2
4	2					3	3	1				1		1
5	2					3	3	1				1		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2728	PINCH TECHNOLOGY	3	0	0	3

COURSE OUTCOMES: On successful completion of this course, the students will be able to:

CO1: Interpret the pinch and quantify the energy requirement for a piece of equipment in a chemical plant.

CO2: Examine the composite curves and locate the pinch point for a heat exchanger network.

CO3: Examine and Minimize energy requirements for a heat exchanger network.

CO4: Implement pinch technique for batch and continuous processes and do sensitivity analysis.

CO5: Examine and Optimize energy requirements for a large chemical plant by compartmentalizing appropriately.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2										1	
2	3	3	2										1	
3	3	3	2										1	
4	3	3	2										1	
5	3	3	2										1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2735	RECOMBINANT DNA TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to:

CO1: Articulate on the concept of DNA, RNA and the central dogma of life.

CO2: Summarize the concepts and applications of recombinant DNA Technology.

CO3: Elaborate on different types of vectors for cloning and expression.

CO4: Explain principle, types and applications of DNA amplification and sequencing technologies.

CO5: Elaborate on various applications of Genetic Engineering.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2									2		2		
2	2									2		2		1
3	2	1								2		2		1
4	2									2		2		1
5	2						3			2		2		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2729	ALTERNATIVE FUELS	3	0	0	3

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1: Understand the need for alternative fuels.

CO2: Summarize the performance of the engine on application of alcohols, biodiesel and vegetable oils as fuels.

CO3: Predict the engine performance, emission cost and safety on using hydrogen, biogas, LPG & CNG as alternative fuels.

CO4: Analyze the advantages and limitations of electric, hybrid, fuel cell and solar cars.

CO5: Categorize various synthetic fuels and their applications.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					3	3	1				1		2
2	2					3	3	1				1		2
3	2					3	3	1				1		2
4	2					3	3	1				1		2
5	2					3	3	1				1		2

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2731	NANOBIOTECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to:

CO1: Summarize the concepts of nanotechnology and its biological applications.

CO2: Elaborate on nanobiomaterials surface modification and production methods.

CO3: Summarize the concepts of bionanotechnology and its applications.

CO4: Articulate on the applications of nanobiomaterials in various medicinal and healthcare applications.

CO5: Articulate on the applications of nanobiomaterials in food and cosmetics.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2	1								2		2		1
3	2													
4	2	1								2		2		1
5	2						3			2		2		1

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2732	FLUIDIZATION ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On Successful completion of this course, the students will be able to:

CO1: Summarize the fundamentals of fluidization engineering.

CO2: Articulate on the different types of fluidized beds.

CO3: Design catalytic and non-catalytic fluidized bed system.

CO4: Analyze the heat and mass transfer in fluidized beds

CO5: Explain the concepts of multistage fluidization.

CO-PO-PSO Mapping

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1								2		2	1	
2	2	1								2		2	1	
3	3	3	3							3		3	3	
4	3	3	2							3		3	2	
5	2	1								2		2	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2733	INDUSTRIAL INSTRUMENTATION	3	0	0	3

COURSE OUTCOMES :

On successful completion of the course the students will be able to:

CO1: Articulate the characteristics of the measurement system.

CO2: Analyze the role of various components of pressure measuring instruments

CO3: Summarize the principle of temperature measurement techniques.

CO4: Understand the principle of flow and level measuring instruments

CO5: Categorize the methods of composition analysis by spectroscopy.

CO-PO-PSO Mapping

COs	POs	PSOs

	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2		2	2							2	1	2	
2	2		2	2							2	1	2	
3	2		2	2							2	1	2	
4	2		2	2							2	1	2	
5	2		2	2							2	1	2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2734	MODERN SEPARATION TECHNIQUES	3	0	0	3

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1: Summarize the conventional separation process and explain separation techniques based on size, surface and ionic properties.

CO2: Articulate on the concepts and fundamentals of adsorption and chromatography techniques.

CO3: Explain the basic concepts, principle and applications of various membrane separation processes.

CO4: Apply the concept of electric field influenced separation processes.

CO5: Appraise the significance of various advanced separation techniques used in industries.

CO-PO-PSO Mapping

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2								3		3	2	
2	2	1												
3	2	1										2	1	
4	3	2								3		3	2	
5	3	2								3		3	2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2821	PROCESS INTENSIFICATION	3	0	0	3

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1: Explain the scope for process intensification in chemical processes.

CO2: Apply methodologies for process intensification through micro reaction technology.

CO3: Apply process intensification methodologies in Mixing operations.

CO4: Solve process challenges using intensification technologies.

CO5: Evaluate the best enhanced fields in energy based process intensification.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3								2	
2	3	3	3	3	3								1	
3	3	3	3	3	3								1	
4	3	3	3	3	3								1	
5	2	2	3	3	2								1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2822	ELECTROCHEMICAL ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On successful completion of the course the students will be able to,

CO1: Summarize the principles of electrochemistry and mechanism involved in electrochemical systems

CO2: Apply the concepts of mass transfer in electrochemical systems.

CO3: Interpret the mechanism of corrosion control measures.

CO4: Illustrate the different electrochemical processes.

CO5: Interpret different types of electrodes in electrochemical reactor/ reactions.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	3	3					2				1	
2	3	3	3						3				1	
3	2	3	3	3					2				1	
4	3	3	3						3				1	
5	2	3	3	3					3				1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2823	FRONTIERS OF CHEMICAL ENGINEERING	3	0	0	3

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1: Describe the role of process intensification for sustainable development.

CO2: Summarize the concepts of chemical product design.

CO3: Explain the benefits of various types of renewable energy resources.

CO4: Discuss on the improved properties of various engineered materials.

CO5: Summarize the bioengineering principles and their advanced applications.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2			1						1		2
2	3	2	2			2						1		2
3	2	2	3			2						1		2
4	2					2						1		2
5	2					2						1		2

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2824	PETROLEUM REFINING AND PETROCHEMICALS	3	0	0	3

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Summarize on the classification, composition and testing methods of crude oil/products for developing the refining process.

CO2: Describe cracking and reforming processes for enhancing the quality of petroleum products.

CO3: Articulate on various processes for Isomerization, Alkylation and Polymerization of petroleum products.

CO4: Apply the various treatment processes for improving the quality of petroleum products.

CO5: Explain the different processes involved in the production of petrochemical products.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	2				
2	2								2	2			2	
3	3								3	3			2	
4	3								3	3			2	
5	3								3	3			2	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2825	MEMBRANE SEPARATIONS TECHNOLOGY	3	0	0	3

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Discuss the basic principles and applications of membrane separation processes

CO2: Acquire knowledge on different types of membrane and its modules used in separation processes.

CO3: Articulate on the concepts of conventional membrane separation process and to calculate design parameters.

CO4: Explain various advanced membrane separation techniques.

CO5: Analyze the application of various membrane separation processes in various industries and wastewater treatment plant.

CO-PO-PSO Mapping

COs to POs Mapping																
COs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2											2	1			
2	2															
3	3	2	1							3		3	2	1		
4																
5	3		2			3	3			3		3	2	1		
COURSE CODE		COURSE TITLE											L	T	P	C
UCH2826		ENERGY TECHNOLOGY											3	0	0	3

COURSE OUTCOMES:

CO1: Categorize energy sources and assess the energy demand and impact of energy production on the environment.

CO2: Articulate energy management through technology developments in conventional

power plants.

CO3: Summarize the developments in renewable energy technologies.

CO4: Summarize the developments in biomass energy conversion and its utilization.

CO5: Articulate on energy conservation, implementation strategies and auditing.

CO-PO-PSO Mapping

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	3						2				1	
2	2	3	3	3	2				2				1	
3	3	3	3						2				1	
4	1	2	3		1				1				1	
5	2	3	3	3					1				1	

COURSE CODE	COURSE TITLE	L	T	P	C
UCH2827	PROCESS PLANT UTILITIES	3	0	0	3

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Justify the importance of requisites of industrial water.

CO2: Articulate on the properties of steam and different methods of steam generation.

CO3: Summarize the methods of refrigeration and types of refrigerants used in industry.

CO4: Categorize different types of compressor and humidification equipment's used in process industries.

CO5: Summarize the types of fuel used in chemical process industries for power generation and various waste disposal methods.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1		1			3		2	2		3	3	3
2	3	3		1			3		3	3		3	2	1
3	3	3		1			3		3	3		3	3	3
4	3	3		1			3		3	3		3	3	3
5	3	3	2	1		3	3	3	3	3		3	3	3

R2018 – B.E Civil Engineering

Sl.No	Course Code	Course Name	CO Code	Course Outcomes (COs)
1	C101	UEN 1176 Communicative English	C101.1	Apply reading strategies to comprehend articles of a general kind in magazines and newspapers
			C101.2	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English
			C101.3	Comprehend conversations and short talks delivered in English in both formal and informal contexts
			C101.4	Write short essays of a general kind and personal letters and emails in English
2	C102	UMA 1176 Algebra and Calculus	C102.1	Obtain the expansion of trigonometric functions using De-Moivre's theorem.
			C102.2	Determine the Eigen values and Eigen vectors and diagonalize the given matrix.
			C102.3	Evaluate the circle of curvature, evolutes and envelope of a given curve.
			C102.4	Find Taylor's expansion for functions of two variables, solve problems using Jacobians and find the extreme points of a function of two variables.
			C102.5	Solve problems using beta and gamma functions and evaluate problems in double integral and triple integral
3	C103		C103.1	Analyze crystal structures and the influence of imperfections on their properties.

		UPH 1176 Engineering Physics	C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
			C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
			C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.
4	C104	UCY 1176 Engineering Chemistry	C104.1	Classify polymers based on their method of synthesis, properties and application. Describe the preparation and properties of the common types of plastics used for engineering applications.
			C104.2	Understand and apply the thermodynamic laws to solve complex engineering problems.
			C104.3	Learn the laws of photochemistry; Understand the principle and instrumentation of different spectroscopic techniques and their practical applications.
5	C105	UGE 1176 Problem Solving and Programming in Python	C105.1	Think logically to solve programming problems and write solutions in pseudo code
			C105.2	Understand and develop simple Python programs using conditionals and loops
			C105.3	Decompose a program into functions and learn usage of strings
			C105.4	Represent compound data using Python lists, tuples, dictionaries
			C105.5	Perform input/output with files
6	C106	UGE 1177 Engineering Graphics	C106.1	Able to draw Plane curves and freehand sketching
			C106.2	Able to draw Projection of points, lines and plane surfaces

			C106.3	Able to draw Projection of solids
			C106.4	Able to draw Projection of sectioned solids and development of surfaces
			C106.5	Able to draw Isometric and perspective projection
7	C107	UGE 1197 Programming in Python lab	C107.1	To write, test, and debug simple Python programs
			C107.2	To implement Python programs with conditionals and loops
			C107.3	Use functions for structuring Python programs
			C107.4	Represent compound data using Python lists, tuples, and dictionaries
			C107.5	Read and write data from/to files in Python
8	C108	UGS 1197 Physics and Chemistry Lab	C108.1	Obtain basic Knowledge about physics concepts applied in optics, thermal physics and properties of matter.
			C108.2	Obtain basic Knowledge about in determination of water quality parameters and determination of molecular weight of a polymer by vacometry.
9	C109	UEN 1276 Technical English	C109.1	Apply reading strategies to comprehend technical texts and write area- specific texts effortlessly
			C109.2	Listen and comprehend lectures and talks in science and technology
			C109.3	Speak appropriately and effectively in varied formal and informal contexts.
			C109.4	Write technical documents like reports, emails, resume and winning job applications

10	C110	UMA 1276 Complex Function and Laplace Transform	C110.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations.
			C110.2	Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function.
			C110.3	Obtain the Laplace Transforms of standard functions.
			C110.4	Solve Differential Equations of Second order and Simultaneous linear equations with constant coefficients of first order using Laplace Transform.
11	C111	UPH 1251 Physics for Civil Engineering	C111.1	Gain knowledge on classical and quantum free electron theories and the formation of energy band structures.
			C111.2	Acquire knowledge on magnetic and superconducting materials and their applications.
			C111.3	Acquire knowledge on application of illuminance principles to lighting and photo elastic method of testing.
			C111.4	Gain knowledge on the effective design of building based on heating and cooling load requirements.
			C111.5	Understand the structure-property relationship of new materials and their realization in various domains.
12	C112	UCY 1276 Environmental Science	C112.1	To understand the fundamentals of ecosystems and the importance of biodiversity
			C112.2	To understand the importance of natural resources and the social issues arising due to overexploitation of natural resources and the growing human population.

			C112.3	To understand the causes, effects and control measures of various types of environmental pollution.
			C112.4	To know the role of Government machineries and individual in preventing environmental degradation as well as in disaster management and the role of information technology as a tool for environmental management and sustainability.
13	C113	UEE 1252 Basic Electrical and Electronics Engineering	C113.1	Understand and apply the techniques used to solve electric circuits. Explain the construction and working of measuring instruments
			C113.2	Explain the construction and working of electrical machines
			C113.3	Explain the construction and working of semiconductor devices and circuits
			C113.4	Understand and apply the techniques used to solve digital circuits
			C113.5	Explain the construction and working of communication engineering applications
14	C114	UCE 1201 - Engineering Mechanics for Civil Engineering	C114.1	Analyse force systems in structures using scalar and vector analytical techniques
			C114.2	Analyse the rigid body in equilibrium
			C114.3	Evaluate the properties of surfaces and solids
			C114.4	Solve problems of friction on surfaces and apply fundamental concepts of dynamics of particles to analyse simple problems
			C114.5	Apply fundamental concepts of dynamics of particles to calculate dynamic forces exerted in rigid body
15	C115		C115.1	Acquire the fundamental Knowledge of Civil Engineering Drafting and Drawing

		UCE 1211 - Computer Aided Building Drawing Lab	C115.2	Draft the plan, elevation and sectional views of Residential buildings using Autocad software.
			C115.3	Draft the plan, elevation and sectional views of Industrial buildings using Autocad software.
16	C116	UGE 1297 Design Thinking and Engineering Practices Lab - II	C116.1	Familiar with the tools and basic operations in civil engineering practices like carpentry and plumbing
			C116.2	Familiar with the tools and basic operations in mechanical engineering practices like drilling, sheet metal forming and machine dismantle and assembly.
17	C201	UCE1301 - Mechanics of Solids I	C201.1	Calculate stress, strain, deformation, principal stresses and principal planes.
			C201.2	Determine Shear force and bending moment in beams and stress variations.
			C201.3	Calculate the slope and deflection of beams by different methods.
			C201.4	Apply basic equation of torsion in design of circular shafts and design of helical springs.
			C201.5	Analyze the pin jointed plane and space trusses
18	C202	UCE1302 - Mechanics of Fluids	C202.1	Understand the fundamentals of Fluid mechanics and gain knowledge in fluid statics
			C202.2	Understanding the concepts of fluid kinematics and dynamics
			C202.3	Understanding the concept of dimensional homogeneity and model laws
			C202.4	Familiarity with the different losses that occur in fluid flow and its computation
			C202.5	Exposure to Boundary Layer Flow

19	C203	UCE1303 - Surveying	C203.1	The use of various surveying instruments and mapping
			C203.2	Measuring Horizontal angle and vertical angle using different instruments
			C203.3	Methods of Levelling and setting Levels with different instruments
			C203.4	Determine survey errors
			C203.5	Describe the modern surveying methods
20	C204	UCE1304 - Construction Materials	C204.1	To compare the properties of most common and advanced building materials.
			C204.2	Demonstrate the typical and potential applications of lime, cement and aggregates
			C204.3	Describe about concrete mix and its properties
			C204.4	Describe the types and properties of steel, timber and other materials
			C204.5	Appreciate the importance of modern materials for construction
21	C205	UCE1305 - Engineering Geology	C205.1	Exemplify the composition of the earth's interior and weathering process to compute the process of rock formation
			C205.2	Elucidate the physical properties of rock minerals to group depending upon its usage
			C205.3	Illustrate the different types of rock, differentiating upon its origin
			C205.4	Acquaint with the geophysical testing methods and attitudes of earth bed to explore in the field
			C205.5	Interpolate the geological condition to assess the suitability of land for heavy structure
22	C206		C206.1	Handling basic survey instruments including Theodolite, Tacheometry, Total Station and GPS

		UCE1311 - Surveying Lab	C206.2	Have adequate knowledge to carryout Triangulation and Astronomical surveying including general field marking for various engineering projects and location of site
23	C207	UCE1312 - Construction Materials lab	C207.1	Students knows the techniques to characterize various aggregates, bricks and tiles through relevant tests. To know the behaviour of materials under various forces and their characteristics
			C207.2	To learn the behaviour of concrete. Learn and understand the components of structural materials. Interpret the test results and to understand the alternatives for the same work.
24	C208	UMA1376 - Transforms Techniques and Partial Differential Equations	C208.1	Solve engineering problems using Fourier series
			C208.2	Understand and solve partial differential equations of first and higher order
			C208.3	Use Fourier series techniques to solve partial differential equations
			C208.4	Apply Fourier transform techniques to solve some of the physical problems of engineering.
			C208.5	Apply Z - transform techniques to solve some of the physical problems of engineering.
25	C209	UCE1401 - Mechanics of Solids II	C209.1	Determine the strain energy and compute the deflection of determinate beams, frames and trusses using energy principles.
			C209.2	Analyze propped cantilever, fixed beams and continuous beams using theorem of three moment equation for external loadings and support settlements.
			C209.3	Find the load carrying capacity of columns and stresses induced in columns and cylinders
			C209.4	Determine principal stresses and planes for an element in three-dimensional state of stress and study various theories of failure
			C209.5	Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and find the stresses in curved beams

26	C210	UCE1402 - Applied Hydraulic Engineering	C210.1	Explain the basic concepts of uniform open channel flow and types of flow.
			C210.2	Apply the concepts of gradually varied flow regimes and compute hydraulic profile for varied flow.
			C210.3	Describe rapidly varied flow regimes like hydraulic jumps and surges
			C210.4	Elucidate the various classification and performance of turbines.
			C210.5	Elucidate the various classification and performance of pumps.
27	C211	UCE1403 - Geotechnical Engineering I	C211.1	Classify the soil and assess the engineering properties, based on index properties.
			C211.2	Understand the permeability and seepage concepts in soils
			C211.3	Understand and identify the settlement in soils.
			C211.4	Determine the shear strength of soil
			C211.5	Analyse both finite and infinite slopes.
28	C212	UCE1404 - Construction Techniques Equipments & Practices	C212.1	The various construction techniques
			C212.2	The stages involved during construction of building and construction materials
			C212.3	Construction of foundation for complicate structures.
			C212.4	Construction of special type of super structures (bridges, tall structures etc)
			C212.5	Different equipments used for construction
29	C213		C213.1	The various requirements of cement, aggregates and water for making concrete

		UCE1421 - Concrete Technology	C213.2	The effect of admixtures on properties of concrete
			C213.3	The concept and procedure of mix design as per IS method
			C213.4	The properties of concrete at fresh and hardened state
			C213.5	The importance and application of special concretes
30	C214	UCE1422 - Remote Sensing Techniques & GIS	C214.1	Understand the components of Remote Sensing and how EMR interacts with the atmosphere and the earth.
			C214.2	Explain the different types of remote sensing platforms and sensors.
			C214.3	Interpret a remote sensing image to extract relevant information.
			C214.4	Understand the components of GIS and management of GIS data.
			C214.5	Describe the GIS data entry models, storage, analysis and applications.
31	C215	UMA1451 - Numerical Methods in Civil Engineering	C215.1	Introduce the basic concepts of empirical laws and curve fitting
			C215.2	Introduce the numerical techniques of interpolation in various intervals in real life situations.
			C215.3	Acquaint the student with understanding of numerical techniques of differentiation and integration with plays an important role in engineering and technology disciplines.
			C215.4	Acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

			C215.5	Understand the knowledge of various techniques and methods of solving various types of partial differential equations.
32	C216	UCE1411 - Strength of Materials Lab	C216.1	knowledge in the area of testing of materials
			C216.2	Behaviour and properties of different materials under various actions of forces.
33	C217	UCE1412 - Hydraulic Engineering Lab	C217.1	Measure flow in pipes and determine frictional losses.
			C217.2	Develop characteristics of pumps and turbines.
34	C301	UCE1501 - Structural Analysis - I	C301.1	Analyse the continuous beams and indeterminate pin-jointed and rigid frames by strain energy method.
			C301.2	Identify, analysis & solve beams and frames using slope deflection method
			C301.3	Analyse and solve beams and frames using moment distribution method
			C301.4	Ability to solve statically indeterminate structures using matrix (flexibility) method
			C301.5	Apply the classical approach to solve the indeterminate structure using matrix stiffness method.
35	C302	UCE1502 - Geotechnical Engineering II	C302.1	Demonstrate understanding on the site investigation methods and sampling.
			C302.2	Exhibit knowledge on bearing capacity and testing methods.
			C302.3	Design shallow footings.
			C302.4	Determine the load carrying capacity and settlement of pile foundation.

			C302.5	Determine the earth pressure on retaining walls and analysis for stability.
36	C303	UCE1503 - Reinforced Cement Concrete Design	C303.1	To understand the various design methodologies for the design of RC elements and design of beams using working stress method
			C303.2	Analysis and design of concrete beams by limit state method including the effect of shear, bond and torsion.
			C303.3	Analyse and design the various types of slabs by limit state method.
			C303.4	To design columns for axial, uniaxial and biaxial eccentric loadings
			C303.5	Design of isolated column footing, combined footing and pile cap by limit state method.
37	C304	UCE1504 - Water Supply Engineering	C304.1	Demonstrate understanding on the structure of drinking water supply system, including temporal and spatial water sources, quantity and quality of water and understanding of water quality criteria and standards, and their relation to public health.
			C304.2	Apply the knowledge of water supply conveyance system to design intake structures, transmission mains and pumping systems.
			C304.3	Plan and design of unit processes and unit operations for primary water treatment
			C304.4	Apply the principles of advanced water treatments to design and evaluate water supply project alternatives.
			C304.5	Analyze water distribution networks and plan the various distribution layouts and plumbing systems
38	C305	UCE1522 - Urban Planning	C305.1	Demonstrate an understanding of the basic concepts of urban planning and development and appreciate its significance in modern India.

		and Development	C305.2	Apply the knowledge on principles of planning, surveys and analysis in developing an urban area plan.
			C305.3	Summarize the process of development of regional, master plan and analyse case studies.
			C305.4	Explain the significance of standards in implementing and financing of urban projects and get familiar with the norms for development of smart cities.
			C305.5	Review the norms, legal aspects and stakeholders' role in planning an urban area.
39	C306	UCE1524 - Hydrology(E)	C306.1	Understanding the hydro meteorological data collection and analysis.
			C306.2	Understanding and estimating the abstractions of precipitation
			C306.3	Understanding the flood and drought
			C306.4	Estimation of reservoir capacity.
			C306.5	Study of Ground water hydrology
40	C307	UCE1511 - Soil Mechanics lab	C307.1	Identify the index properties of the soil and classify the soil
			C307.2	Access the density and permeability characteristics
			C307.3	Evaluate the engineering properties of the soil
41	C308	UCE1512 - Advanced Surveying Lab	C308.1	Evaluate the relevance and use of engineering fundamentals in field surveying and communicate the observations and computations effectively through reports and presentations.

			C308.2	Plan and conduct engineering surveys depending upon the site conditions and project requirements.
			C308.3	Plot the topographic map of a given area.
42	C309	UCE1601 - Structural Analysis - II	C309.1	Draw influence lines for statically determinate structures and calculate critical stress resultants.
			C309.2	Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.
			C309.3	Analyse the three hinged, two hinged and fixed arches.
			C309.4	Analyse the cables and suspension bridges with stiffening girders
			C309.5	Apply the concept of plastic theory of structures in the analysis of indeterminate beams and frames.
43	C310	UCE1602 - Design of Steel Structures	C310.1	Classify the concepts of various design philosophies
			C310.2	Design common bolted and welded connections for steel structures
			C310.3	Design tension members and understand the effect of shear lag
			C310.4	Compute the design concept of axially loaded columns and column base connections.
			C310.5	Compute specific problems related to the design of laterally restrained and unrestrained steel beams.
44	C311	UCE1603 - Transportation Engineering I	C311.1	Explain the course of action of highway planning and alignment.
			C311.2	Design the various geometric elements of a highway.

			C311.3	Design flexible and rigid pavements conforming to IRC standards.
			C311.4	Assess the properties of highway construction materials and explain the pavement construction practices.
			C311.5	Evaluate the pavement condition and develop a suitable pavement maintenance management system.
45	C312	UCE1604 - Wastewater Engineering	C312.1	Explain the concepts of sewage characteristics, estimate sewage generation, and design sewer systems including sewage pumping stations
			C312.2	Perform the design of the unit operations and processes that are used in primary sewage treatment.
			C312.3	Perform the design of the unit operations and processes that are used in secondary sewage treatment.
			C312.4	Elucidate the various standard methods for disposal of sewage and self-purification of streams.
			C312.5	Explain the characteristics of sludge and assess the various methods of sludge treatment and disposal
46	C313	UCE1605 - Irrigation and Water Resources management	C313.1	Assess crop water requirements.
			C313.2	Describe impounding structures and methods of irrigation.
			C313.3	Illustrate the methods and management of irrigation.
			C313.4	Estimate water requirements and plan a reservoir system.
			C313.5	Explain the process of water resources planning and management.

47	C314	UCE1611 - Irrigation and Environmental Engineering Drawing	C314.1	Envisage, design and draw the components of irrigation structures.
			C314.2	Envisage, design and draw the component units of a water supply plant.
			C314.3	Envisage, design and draw the component units of a sewage treatment plant.
48	C315	UCE1612 - Water & Wastewater Analysis lab	C315.1	Characterize wastewater and conduct treatability studies
			C315.2	Analyze for common ions in water and wastewater
			C315.3	Suggest the type of treatment required and amount of dosage required for the treatment
			C315.4	Examine the conditions for the growth of micro-organisms
49	C316	UCE1621 - Ground Improvement Techniques	C316.1	Gain knowledge on methods and selection of ground improvement techniques.
			C316.2	Understand dewatering techniques and design for simple cases.
			C316.3	Get knowledge on insitu treatment of cohesionless and cohesive soils.
			C316.4	Understand the concept of earth reinforcement and design of reinforced earth.
			C316.5	Get to know types of grouts and grouting technique.
50	C317	UCE1622 - Design of Reinforced Concrete and Brick Masonry Structures	C317.1	Understanding the concept of Brick masonry structures
			C317.2	Understand the fundamentals of design and detailing of Cantilever and Counterfort Retaining walls
			C317.3	Understanding the concepts of Structural design and detailing of Rectangular and circular water tanks.

			C317.4	To have an exposure to IRC Codes and design culverts and Bridges.
			C317.5	Familiarity with the design and detailing of staircases, Flat slabs and principles of foundations.
51	C318	UCE1623 - Contract Laws and Regulation	C318.1	Explain contract documents, its elements and features.
			C318.2	Describe the contents of tender documents and application procedures.
			C318.3	Analyse arbitration and related bye laws.
			C318.4	Discuss legal provisions related to realty, property planning and taxation.
			C318.5	Discuss regulations related to labour welfare.
52	C401	UCE1701 - Construction Economics and Project management	C401.1	Demonstrate understanding on the economics involved in Construction Industry.
			C401.2	Exhibit knowledge on various planning techniques with respect to the project.
			C401.3	Design construction activity charts based on the project requirements
			C401.4	Determine variance with respect to planned vs scheduled and executed cost.
			C401.5	Demonstrate understanding the effect of safety and quality in the construction cost.
53	C402	UCE1702 - Structural Design and Drawing	C402.1	Analyse, design and detailing of the retaining walls.
			C402.2	Design of the RCC flat slab, Slab Bridge and steel bridge.
			C402.3	Apply the IS codal provision for the design of liquid storage structures.
			C402.4	Ability to design the components of the industrial structures

			C402.5	Design and drawing of the plate and gantry girders as per codal specification
54	C403	UCE1703 - Estimation and Quantity Surveying	C403.1	Estimate the quantities for buildings.
			C403.2	Rate Analysis for all Building works, canals, and Roads and Cost Estimate.
			C403.3	Understand types of specifications, principles for report preparation, tender notices types.
			C403.4	Gain knowledge on types of contracts.
			C403.5	Evaluate valuation for building and land.
55	C404	UCE1704 - Transportation Engineering II	C404.1	Describe the elements of permanent way and design the track geometrics.
			C404.2	Select appropriate methods for the construction and maintenance of railway track and other infrastructure.
			C404.3	Summarize the concepts and elements in planning and site selection for an airport and design an optimum airport layout.
			C404.4	Design the runway, taxiway and related infrastructure in an airport.
			C404.5	Explain the concepts and elements in planning the harbour infrastructure.
56	C405	UCE1721 - Design of Prestressed Concrete Structures	C405.1	Understand the behaviour of prestressed concrete members and able to analyze the prestressed concrete beams.
			C405.2	Design the prestressed concrete members for flexure and shear as per the relevant design code (IS1343).
			C405.3	Analyze for deflection of prestressed concrete members and design the anchorage zone.

			C405.4	Analyze and design of composite beams and continuous beams.
			C405.5	Design of prestressed concrete structures - sleepers, Tanks, pipes and poles
57	C406	UCE1724 - Structural Dynamics and Earthquake Engineering	C406.1	Apply the theory of vibration and basics of structural dynamics to study the response of the structures.
			C406.2	Evaluate the response of SDOF and MDOF systems subjected to free and forced vibrations.
			C406.3	Explain the different aspects related to seismology and terms related to it
			C406.4	Acquire knowledge in the response of the building components and structures under earthquake loading.
			C406.5	Apply the basic principles for seismic design concept for the reinforced concrete masonry and buildings.
58	C407	UCE1716 - Industrial Training	C407.1	Appreciate the need of being professional and ethical engineers.
			C407.2	Communicate effectively with the host, peers, and the team members of the company
			C407.3	Present the industrial training experience using good oral and written presentation skills
			C407.4	Work in group and show teamwork and leadership skills when required
			C407.5	Appreciate the social, cultural, and environmental responsibility of a professional engineer
			C407.6	Portray correct attitude and commitment to perform the assigned tasks
59	C408		C408.1	Identify the problem statement and draw the plan and specification

		UCE1717 - Innovative Design Project	C408.2	Model and analyse the problem as per the loading conditions considered using manual methods and software
			C408.3	Design the structural elements based on the analysis results and detailing of reinforcement carried out as per codal specifications
			C408.4	Preparation of project reports and presentation.
60	C409	UCE1821 - Maintenance, repair and Rehabilitation of Structures	C409.1	Explain the importance of maintenance and assessment method of distressed structures.
			C409.2	Examine the strength and durability properties, their effects due to climate and temperature.
			C409.3	Appreciate the recent developments in concrete.
			C409.4	Apply techniques for repair and protection methods.
			C409.5	Develop methodology for repair, rehabilitation and retrofitting of structures and demolition methods.
61	C412	UGE1526 - Professional Ethics	C412.1	Comprehend the importance of human values and the way to improve it through meditation and yoga.
			C412.2	Learn the concepts of Engineering ethics and various associated theories
			C412.3	Understand the concept of Engineering as Experimentation
			C412.4	Distinguish the concepts of safety, responsibility and rights
			C412.5	Recognize global ethical issue
62	C410		C410.1	Explain the design principles and stages of loading in precast construction.

		UCE1826 - Prefabricated Structures	C410.2	Describe panel systems, slabs, connections used in precast construction and design the elements.
			C410.3	Design cross section of prefabricated structural elements based on efficiency of material used.
			C410.4	Comprehend the different types of walls used in precast construction, sealants, and design of joints.
			C410.5	Suggest design for abnormal loads in prefabricated structures.
63	C411	UCE1827 - Industrial Structures	C411.1	Illustrate the requirements of various industries and structures and also planning of various industrial components.
			C411.2	Study the various functional requirements of industrial structures.
			C411.3	Design of special steel structures like bunkers, silos, crane girders, chimneys and pre-engineered buildings.
			C411.4	Design of special RC structures like corbels, silos, bunkers, chimneys and cooling towers.
			C411.5	Acquire the principles beyond the prefabrication of structures and prestressing
64	C413	UCE1818 - Project Work	C413.1	Appreciate the method of undertaking literature review in the chosen area and identifying the problem statement.
			C413.2	Understand and apply general research and /or development methodology.
			C413.3	Work in groups in carrying out and producing solutions to complex engineering problems.
			C413.4	Prepare project reports and make organized presentations.

R2018 – Program Outcomes (POs)

Engineering Graduates will be able to:

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to solve complex engineering problems.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

R2018 – Program Specific Outcomes (PSOs)

PSO1	Graduates will excel in the core areas of civil engineering such as structural, geotechnical, water resources and environmental engineering
PSO2	Graduates will be able to develop and design sustainable civil infrastructures considering present challenges

**B.E COMPUTER SCIENCE AND ENGINEERING
R2021**

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	UEN2176	Technical English	C101.1	Read and comprehend texts (technical) effectively
			C101.2	Write proposals, reports, emails, letters, SOPs meeting professional expectations
			C101.3	Improve vocabulary (use of right collocations, idioms and phrases etc)
			C101.4	Enhance grammatical competency for writing and speaking
			C101.5	Improve ability to listen and comprehend at deeper levels
C102	UMA2176	Matrices and Calculus	C102.1	Reduce quadratic form to canonical form by orthogonal transformation and identify the nature of the quadratic form
			C102.2	Analyse the convergence of a given infinite series
			C102.3	Find evolute of a given curve and envelope of family of curves
			C102.4	Find the extrema of function of two variables
			C102.5	Evaluate the double and triple integrals
C103	UPH2176	Engineering Physics	C102.6	Application of extreme points of functions and multiple integrals in engineering problems
			C103.1	Analyze crystal structures and the influence of imperfections on their properties.
			C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
			C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
C104	UCY2176	Engineering Chemistry	C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication
			C104.1	Apply the Principles of Electrochemistry for Qualitative Analysis
			C104.2	Detect/Identify various types of corrosion under severe to normal corrosive environments and provide appropriate solution

			C104.3	Construct phase diagram of one and two component system and analyse its properties for application purposes
			C104.4	Explain the synthesis, properties and applications of industrially important engineering materials
C105	UGE2176	Problem Solving and Programming in Python	C105.1	Solve programming problems and express solutions using algorithmic constructs
			C105.2	Develop simple programs using basic constructs and conditional statements
			C105.3	Develop programs using looping constructs, functions and strings
			C105.4	Use lists and tuples to develop programs
			C105.5	Construct programs using dictionaries and perform Input/Output operations using files
C106	UGE2177	Engineering Graphics	C106.1	Draw Plane curves and perform Free hand sketching of three - dimensional objects
			C106.2	Draw the Orthographic projections of points, lines and plane surfaces
			C106.3	Draw the Projections of solids
			C106.4	Draw the Projections of sectioned solids and Development of surfaces
			C106.5	Draw the Isometric and Perspective projections of solids
C107	UGS2197	Physics and Chemistry Lab	C107.1	Analyse ions like Fe ²⁺ , Fe ³⁺ , H ⁺ using different instruments
			C107.2	Determine the Molecular weight and Degree of Polymerisation using viscometer
			C107.3	Understand the principles and procedures of pHmetry, potentiometry and conductometry
C108	UGE2197	Programming in Python Lab	C108.1	Develop Python programs using conditions, loops and functions
			C108.2	Solve problems using strings, lists and tuples
			C108.3	Construct programs using dictionaries and perform Input/Output operations using files
C109	UMA2276	Complex Functions and Laplace Transforms	C109.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations
			C109.2	Solve problems using integration techniques, find Taylor's and Laurent's Series expansions
			C109.3	Obtain the Laplace Transforms and inverse transforms of standard functions.

			C109.4	Solve Differential Equations using different techniques
			C109.5	Evaluate Line, Surface and Volume integrals
			C109.6	Apply Complex integration, Laplace transforms, Ordinary differential equations, and vector calculus in engineering problems
C110	UEE2276	Basic Electrical and Electronics Engineering	C110.1	Solve and analyse DC and AC circuits.
			C110.2	Explain the operating principle of AC and DC machines.
			C110.3	Know the concepts electrical power utilization.
			C110.4	Describe the working principle of various electronic devices and its applications
			C110.5	Describe the working principle of various sensors and transducers.
C111	UCS2265	Fundamentals and Practice of Software Development (TCP)	C111.1	Formulate the problem elaborating the requirements and identifying the scope and boundaries
			C111.2	Apply engineering fundamentals in computer science to advanced industrial applications or products
			C111.3	Design and develop solutions adapting novel technologies, tools, and techniques
			C111.4	Communicate effectively through reflections, reports, and presentations
			C111.5	Work in teams to develop modules and integrate them
			C111.6	Analyze the impact on health, safety, society, environment as well as underlying legal and ethical considerations whichever are applicable
			C111.7	Solve programming problems using basic constructs in C programming language
C112	UCY2276	Environmental Science	C112.1	The structure and functions of the ecosystems and diversity among life forms within an ecosystem
			C112.2	The importance of various natural resources and its sustainable use
			C112.3	The various environmental issues such as pollution, population explosion etc and suggest remedial measures
			C112.4	The role of engineering techniques to minimize environmental stress
			C112.5	The role of various environmental machineries and to ensure proper environmental regulation
C113	UCS2202	Foundations of Data Science	C113.1	Demonstrate the need for data science and data preparation process
			C113.2	Develop Python programs to perform analysis on data

			C113.3	Apply statistical techniques to explain and analyze data
			C113.4	Interpret various statistical inferences
			C113.5	Apply machine learning algorithms to solve problems
C114	UGE2297	Design Thinking and Engineering Practices Lab	C114.1	Draw pipeline plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household woodwork
			C114.2	Practice machining to make holes on different materials; fabricate sheet metal components
			C114.3	Dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model of various components
			C114.4	Construct domestic electrical circuits and verify their output parameters
			C114.5	Construct electronics circuits and verify their output
C201	UMA2377	Discrete Mathematics	C201.1	Write simple proofs using Propositional and First Order Logics
			C201.2	Solve problems using different counting techniques
			C201.3	Prove simple graph properties
			C201.4	Explain basic concepts in group theory such as semigroups, monoids and groups
			C201.5	Solve problems in partial ordering relations, equivalence relations and lattices
			C201.6	Application of Graph theory and Boolean algebra in engineering problems
C202	UHS2376	Universal Human Values: Understanding Harmony	C202.1	Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
			C202.2	Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body
			C202.3	Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society
			C202.4	Understand the harmony in nature and existence and work out their mutually fulfilling participation in nature
			C202.5	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work

C203	UCS2301	Digital Principles and System Design	C203.1	Solve Boolean functions using KMap
			C203.2	Analyze and construct Combinational Circuits
			C203.3	Analyze and construct Synchronous Sequential Circuits
			C203.4	Analyze and construct Asynchronous Sequential Circuits
			C203.5	Build various memories and Boolean functions using Programmable Logic Devices
C204	UCS2302	Data Structures	C204.1	Develop programs using arrays, linked lists for various applications and analyse their time complexity
			C204.2	Develop programs using stacks and queues
			C204.3	Apply the operations of unbalanced and balanced trees to develop solutions to various problems
			C204.4	Solve problems using graph data structure
			C204.5	Apply sorting and hashing algorithms to solve various computing problems
			C204.6	Choose appropriate data structure to solve the given problem
C205	UCS2303	Object Oriented Programming	C205.1	Use classes and objects for problem solving
			C205.2	Develop programs using inheritance and interfaces
			C205.3	Apply the concepts of polymorphism and exception handling
			C205.4	Build applications using generic programming
			C205.5	Apply the concepts of generic collections
C206	UCS2311	Digital Design Lab	C206.1	Use Boolean simplification techniques to design a combinational circuit using logic gates and MSI devices
			C206.2	Build different functional units in a digital computer system and model using VHDL/ Verilog HDL
			C206.3	Build sequential circuits and model using VHDL/ Verilog HDL
C207	UCS2312	Data Structures Lab	C207.1	Solve the applications using linear and nonlinear data structures applying best practices in programming
			C207.2	Apply searching, sorting, and hashing techniques to solve the given problems
			C207.3	Choose suitable data structure and solve the given problem
C208	UCS2313	Object-Oriented Programming Lab	C208.1	Develop applications in Java using classes and methods
			C208.2	Develop applications using object-oriented concepts

			C208.3	Select real-world problems in teams by applying the appropriate features of object-oriented programming paradigm with best practices and document its methodology
C209	UMA2476	Probability Statistics and	C209.1	Identify standard distributions and apply them
			C209.2	Solve problems in two dimensional random variables and find the correlation between them
			C209.3	Identify and apply the suitable testing of hypothesis under normal, t, F and chi square distribution
			C209.4	Solve problems in analysis of variance
			C209.5	Analyze quality control by applying control chart methods
			C209.6	Apply random variables, and design experiments and control charts in engineering problems
C210	UHS2476	Indian Constitution	C210.1	Understand the history and philosophy of the Indian constitution
			C210.2	Realize the powers and functions of the Indian government
			C210.3	Acquire awareness of the structure and functions of local administration
			C210.4	Enhance knowledge about the organization and composition of the judiciary
			C210.5	Explore the distribution of financial powers and emergency provisions
C211	UCS2401	Computer Organization and Architecture	C211.1	Explain the basics structure of computers, operations and instructions
			C211.2	Design arithmetic and logic unit
			C211.3	Explain pipelined execution and design its control unit
			C211.4	Design various memory systems and understand I/O communication
			C211.5	Explain parallel processing architectures
			C211.6	Examine a multi-functional ALU as per the requirement by applying best practices of system design
C212	UCS2402	Operating Systems	C212.1	Outline the basic services and functionalities of operating systems
			C212.2	Analyze various scheduling algorithms, and explain process synchronization, deadlock prevention and avoidance schemes
			C212.3	Apply different memory management schemes
			C212.4	Apply various disk management schemes and illustrate the functionalities of file systems
			C212.5	Compare and contrast Linux, Windows and mobile operating systems

C213	UCS2403	Design and Analysis of Algorithms (TCP)	C213.1	Analyze asymptotic running time for various kinds of algorithms
			C213.2	Analyze the time and space complexity of Divide-and-Conquer and Backtracking algorithms
			C213.3	Evaluate Dynamic Programming and Greedy techniques for a given problem
			C213.4	Use iterative improvement and branch-and-bound design techniques
			C213.5	Explain the concepts of NP completeness
C214	UCS2404	Database Management Systems	C214.1	Explain the database concepts and apply ER models for a database application
			C214.2	Apply SQL for relational data model
			C214.3	Apply database programming techniques, database design theory and normalization
			C214.4	Apply concurrency control and recovery mechanisms for transaction processing systems
			C214.5	Explain the concepts of Distributed and NOSQL databases
C215	UCS2412	Operating Systems Lab	C214.6	Design the database schema by analyzing the data for a real time application with documentation
			C215.1	Analyze the performance of various CPU scheduling algorithms
			C215.2	Develop programs to implement deadlock avoidance algorithms, semaphores and IPC
C216	UCS2411	Database Lab	C215.3	Develop programs to implement various page replacement algorithms, file organization and file allocation strategies (
			C216.1	Construct queries using SQL in database creation and manipulation
			C216.2	Develop PL/SQL blocks using database programming constructs
C301	UCS2501	Computer Networks	C216.3	Design a database schema and develop an application using IDE that interacts with a DBMS server via API
			C301.1	Describe the principles, design, terminology and concepts of the network models
			C301.2	Select the protocols of data link layer and apply error control mechanisms
			C301.3	Choose the core functions of network layer protocols and apply them for data communication
			C301.4	Select the Transport Layer Protocols suitable for transmission of data
			C301.5	Illustrate the Application Layer Protocols and their basic functionalities

C302	UCS2502	Microprocessors, Microcontrollers, and Interfacing	C302.1	Summarize the basic architecture, operations and apply the programming concepts of microprocessor 8086
			C302.2	Outline the design of basic and multiprocessor systems and their bus timings
			C302.3	Build 8086 interfaces with memory, I/O and other peripheral chips
			C302.4	Summarize the basic architecture and operation of microcontroller 8051
			C302.5	Apply programming concepts to implement microcontroller interfaces for different applications
C303	UCS2503	Software Engineering	C303.1	Choose an appropriate process model and estimate project cost and effort required by applying software engineering principles
			C303.2	Identify and analyze the requirements and construct their models
			C303.3	Apply systematic procedure for software design
			C303.4	Compare and contrast the various testing and maintenance activities
			C303.5	Make use of agile development and Devops
			C303.6	Identify unethical issues and apply ethical practices for a given case study
C304	UCS2504	Foundations of Artificial Intelligence (TCP)	C304.1	Explain different types of environments and agents
			C304.2	Analyze and solve AI problems using search techniques
			C304.3	Solve AI problems using logics and inference techniques
			C304.4	Solve AI problems using uncertain knowledge and probabilistic reasoning
			C304.5	Explain the concepts of Natural Language Processing and Robotics and assess the importance of AI using a suitable application
C305	UCS2511	Networks Lab	C305.1	Develop socket programs using TCP and UDP, to implement various application protocols
			C305.2	Develop socket programs to implement the functionalities of various layers in TCP / IP protocol suite
			C305.3	Analyze the performance of various protocols using a network simulator tool
C306	UCS2512	Microprocessors Lab	C306.1	Develop 8086 assembly language programs for arithmetic, logical, string operations and BIOS interrupt concepts
			C306.2	Build different I/O interfaces with 8086
			C306.3	Apply 8051 assembly language programming concepts for arithmetic and logical operations
C307a	UCS2521	Big Data Technologies	C307a.1	Illustrate big data analytics and related technologies

			C307a.2	Build distributed data processing applications using Apache Hadoop and Spark
			C307a.3	Develop a streaming application using Apache Spark
			C307a.4	Experiment with Apache Kafka for processing stream data
			C307a.5	Develop an application using Big Data Frameworks by applying best practices and demonstrate the work
C307b	UCS2523	Image Processing and Analysis	C307b.1	Explain the fundamentals of digital image processing, such as digitization, sampling, quantization
			C307b.2	Apply the techniques of smoothing, sharpening and enhancement in both spatial and frequency domain
			C307b.3	Explain the restoration concepts and filtering techniques
			C307b.4	Identify the segmentation methods and apply in suitable image processing applications
			C307b.5	Develop real time applications for object recognition using the feature extraction methods
C308	UCS2601	Internet Programming	C308.1	Make use of HTML5 and CSS3 to design modern web site
			C308.2	Utilize Javascript and DOM to implement dynamic web page
			C308.3	Develop responsive web applications using Servlets and AJAX
			C308.4	Build web application using ReactJS framework
			C308.5	Develop web application using NodeJS framework
C309	UCS2602	Software Security System	C309.1	Examine symmetric and asymmetric ciphers
			C309.2	Examine the different authentication schemes
			C309.3	Outline the security mechanisms adapted in OS, Cloud and IoT
			C309.4	Explain the functionality of access control mechanism
			C309.5	Compare and contrast various security policies
C310	UCS2603	Theory of Computation	C310.1	Construct mathematical proofs related to computation and finite automata for a given language
			C310.2	Identify relationship between finite automata and regular expressions
			C310.3	Distinguish different types of grammars, analyse relationship between language and context free grammar and construct PDA for CFG
			C310.4	Construct Turing machine for a given language

			C310.5	Explain the decidability or undecidability of various problems and make use of it
C311	UCS2604	Principles of Machine Learning	C311.1	Explain the basic concepts of machine learning
			C311.2	Apply supervised algorithms for different classification problems
			C311.3	Explain the need for ensemble methods
			C311.4	Apply unsupervised and reinforcement learning techniques to various problems
			C311.5	Apply dimensionality reduction and optimisation techniques
C312	UCS2611	Internet Programming Lab	C312.1	Build web applications using traditional client/server technologies
			C312.2	Construct web application using Javascript frameworks
			C312.3	Develop and evaluate a web application for a given set of requirements on JavaScript Framework with NodeJS Server, applying suitable design options and techniques
C313	UCS2612	Machine Learning Lab	C313.1	Apply supervised and unsupervised learning techniques for various problems
			C313.2	Apply ensemble techniques to solve the problems and demonstrate the working of dimensionality reduction methods
			C313.3	Develop an open-ended solution with data privacy and ethical concerns, for a given real world problem
C314a	UCS2621	Cloud Computing	C314a.1	Summarize about the basics of Cloud Computing
			C314a.2	Apply the concept of virtualization and analyse its types
			C314a.3	Solve various design challenges in cloud environment
			C314a.4	Develop and deploy services on cloud and be able to set up a private cloud environment using opensource software
			C314a.5	Outline the security challenges in cloud environment
C314b	UCS2626	Natural Language Processing and Applications	C314b.1	Apply text pre-processing techniques and build the language models
			C314b.2	Apply basic levels of knowledge at word level and syntax level in language processing
			C314b.3	Apply computational methods in lexical and vector semantics
			C314b.4	Explain discourse processing and machine translation systems
			C314b.5	Apply learning algorithms for various NLP applications
C401	UCS2701	Distributed Systems	C401.1	Explain the foundations of distributed systems
			C401.2	Solve synchronization and state consistency problems

			C401.3	Use resource sharing techniques in distributed systems
			C401.4	Apply working model of consensus and reliability of Distributed Systems
			C401.5	Explain the fundamentals of peer-to-peer systems
			C401.6	Formulate a synchronization problem for an ad-hoc distributed system and adapt its solution
C402	UCS2702	Compiler Design (TCP)	C402.1	Construct a lexical analyzer for a sample language
			C402.2	Apply different parsing algorithms to develop the parsers for the given grammar
			C402.3	Build syntax directed translation for programming language constructs
			C402.4	Outline and develop a simple code generator
			C402.5	Make use of code optimization techniques
			C402.6	Construct a compiler for a simple language using modern tools
C403	UCS2703	Software Architecture	C403.1	Explain the various architectural views and quality attributes
			C403.2	Apply suitable architectural styles based on the software quality requirements
			C403.3	Analyze the alternate architectural solutions based on the definition of ADL's
			C403.4	Construct new architectures based on the quality attribute requirements
			C403.5	Analyze the architectural decisions for building data intensive and IoT systems in teams and apply best practices with clear documentation
C404	UCS2717	Project Work Phase I	C404.1	Formulate complex engineering problems and choose suitable technologies and tools required to solve them effectively (K4)
			C404.2	Analyse the related literature on the proposed problem and its feasibility (K4)
			C404.3	Design high level solutions by applying software engineering principles (K6)
			C404.4	Divide the work appropriately among the team members to manage time and complexity
			C404.5	Document and present the solution
			C404.6	Analyse the issues pertaining to society, health, safety, legal, environment, culture applicable to the project and examine the impact of the proposed solution on these issues.
			C404.7	Apply best practices and follow ethics in developing the solutions
C405	UCS2716	Industrial Training / Internship	C405.1	Apply principles of engineering in solving complex engineering problems
			C405.2	Model problems and find engineering solution
			C405.3	Adapt to emerging technologies in solving engineering problems

C406	UCS2818	Project Work Phase II	C405.4	Demonstrate the ability to communicate effectively
			C405.5	Develop self-confidence, team work skills, and life-long learning
			C405.6	Develop knowledge of social, ethical, cultural, global and environmental issues.
			C406.1	Use suitable technologies and tools to solve complex engineering problems effectively
			C406.2	Analyse the related literature on the proposed problem and its feasibility
			C406.3	Construct suitable solutions by applying software engineering principles
			C406.4	Divide the work appropriately among the team members to manage time and complexity
			C406.5	Evaluate the performance of the solution using appropriate metrics
			C406.6	Analyse the impact of the proposed solution on the issues pertaining to society, health, safety, legal, environment, culture and apply ethical principles.
			C406.7	Apply ethical principles in developing the solutions and present the solution with good documentation

R2021 - B.E COMPUTER SCIENCE AND ENGINEERING

Program Outcomes (POs)

On successful completion of the B.E degree program in Computer Science and Engineering, our graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. Engineer and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

On successful completion of the B.E degree program in Computer Science and Engineering, our graduates will be able to:

1. Investigate challenging problems across various domains with appropriate computational techniques, construct solutions systematically and evaluate their effectiveness.
2. Apply software engineering principles and practices for building high quality innovative software systems by adopting contemporary and emerging information processing technologies.

B.E COMPUTER SCIENCE AND ENGINEERING

R2018

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	UEN1176	Communicative English	C101.1	Apply reading strategies to comprehend articles of a general kind in magazines and newspapers
			C101.2	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English
			C101.3	Comprehend conversations and short talks delivered in English in both form a land informal context
			C101.4	Write short essays of a general kind and personal letters and emails in English
C102	UMA1176	Algebra and Calculus	C102.1	Obtain the expansion of trigonometric functions using De-Moivre's theorem
			C102.2	Determine the Eigen values and Eigen vectors and diagonalize the given matrix
			C102.3	Evaluate the circle of curvature, evolute and envelope of a given curve
			C102.4	Find Taylor's expansion for functions of two variables, solve problems using Jacobians
			C102.5	and find the extreme points of a function of two variables
			C102.6	Solve problems using beta and gamma functions and evaluate problems in double integral and triple integral
C103	UPH1176	Engineering Physics	C103.1	Analyze crystal structures and the influence of imperfections on their properties
			C103.2	Demonstrateandexplainthegeneralconceptsofelasticandthermalpropertiesof materials
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics
			C103.4	Analyze the applications of acoustics and ultrasonic to engineering and medical disciplines
			C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication
C104	UCY1176	Engineering Chemistry	C104.1	The knowledge gained on water treatment techniques, polymers, phase rule, fuels and electrochemistry and corrosion will facilitate better understanding of engineering processes and applications for further learning

C105	UGE1176	Problem Solving and Programming in Python	C105.1	Think logically to solve programming problems and write solutions in pseudo code
			C105.2	Understand and develop simple Python programs using conditionals and loops
			C105.3	Decompose a program into functions
			C105.4	Represent compound data using Python lists, tuples, dictionaries.
			C105.5	Perform input/output with files
C106	UGE1177	Engineering Graphics	C106.1	Familiarize with the fundamentals and standards of Engineering graphics
			C106.2	Perform freehand sketching of basic geometrical constructions and multiple views of objects
			C106.3	Project orthographic projections of lines and plane surfaces
			C106.4	Draw projections and solids and development of surfaces
			C106.5	Visualize and to project isometric and perspective sections of simple solids. Read a building drawing
C107	UGE1197	Programming in Python Lab	C107.1	To write, test, and debug simple Python programs
			C107.2	To implement Python programs with conditionals and loops
			C107.3	Use functions for structuring Python programs
			C107.4	Represent compound data using Python lists, tuples, and dictionaries
			C107.5	Read and write data from/to files in Python
C108	UGS1197	Physics and Chemistry Lab	C108.1	Demonstrate the ability to formulate, conduct, analyze and interpret the results of experiments related to study/determination of the physical properties of materials like elasticity, compressibility, and viscosity
			C108.2	Demonstrate the ability to formulate, conduct, analyze and interpret the results of experiments related to study/determination of the optical properties of materials such as diffraction, interference and Numerical aperture
			C108.3	Demonstrate the ability to formulate, conduct, analyze and interpret the results of experiments related to study/determination of thermal and electrical properties of materials such as conductivity and band gap
			C108.4	Evaluate the quality of water
			C108.5	Determine the metals and ions present in any given sample using various analytical techniques
			C108.6	Measure properties such as conductance of solutions, redox potentials

C109	UEN1276	Technical English	C109.1	Apply reading strategies to comprehend technical texts and write area specific texts effortlessly
			C109.2	Listen and comprehend lectures and talks in science and technology
			C109.3	Speak appropriately and effectively in varied formal and informal contexts
			C109.4	Write technical documents like reports, emails, resume and winning job applications
C110	UMA1276	Complex Functions and Laplace Transforms	C110.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations
			C110.2	Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function
			C110.3	Obtain the Laplace Transforms of standard functions
			C110.4	Solve Differential Equations of Second order and Simultaneous linear equations with constant coefficients of first order using Laplace Transform
			C110.5	Solve problems using divergence and curl and evaluate line, Surface and Volume integrals
C111	UPH1276	Physics for Information Science	C111.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures
			C111.2	Acquire knowledge on basics of semiconductor physics and its application to PN junction devices
			C111.3	Gain knowledge on magnetic properties of materials and their applications to data storage
			C111.4	Relate the use of optical materials to display devices
			C111.5	Understand quantum mechanics of nanostructures and their application to Nano electronics and Spintronics
C112	UCY1276	Environmental Science	C112.1	Understand the importance of the environment and describe the structure and functions of an ecosystem
			C112.2	Identify the value and need for conservation of biodiversity
			C112.3	Know the importance of natural resources and its equitable use for sustainable lifestyles. Explain the causes, effects and control measures of different types of pollution. Understand various environmentally related social issues and their solutions
			C112.4	Recall the tools for environmental regulations

			C112.5	Relate the role of environment in human population growth and development Get knowledge about various techniques used for environmental monitoring and management
C113	UEE1276	Basic Electrical, Electronics and Measurement Engineering	C113.1	Understand the essentials of electric circuits and analysis
			C113.2	Understand the basic operation of electric machines and transformers Introduction of renewable sources and common domestic loads.
			C113.3	Introduction to measurement and metering for electric circuits
C114	UCS1201	Programming in C	C114.1	Write pseudo-code for solving programming problems
			C114.2	Represent data with suitable structured data types
			C114.3	Develop C programs using appropriate programming constructs.
			C114.4	Organize programs into functions and files
C115	UGE1297	Design Thinking and Engineering Practices Lab	C115.1	Ability to fabricate carpentry components
			C115.2	Ability to make the pipe connections including plumbing works
			C115.3	Ability to use welding equipments to join the structures
			C115.4	Ability to fabricate electrical circuits
			C115.5	Ability to fabricate electronics circuits
C116	UCS1211	Programming in C Lab	C116.1	Implement C programs, compile, debug, and execute
			C116.2	Implement programs in C with correct data representation and appropriate programming constructs
			C116.3	Compare arrays and pointers in C
			C116.4	Use structures and files in C
			C116.5	Develop programs modularly and refine incrementally
C201	UMA1377	Discrete Mathematics	C201.1	Write simple proofs using Propositional and First Order Logics
			C201.2	Write simple proofs using mathematical induction
			C201.3	Prove simple graph properties
			C201.4	Explain basic concepts in group theory such as semigroups, monoids and groups
			C201.5	Solve problems in partial ordering relations, equivalence relations and lattices
C202	UCS1301	Digital Principles and System Design	C202.1	Simplify Boolean functions using KMap
			C202.2	Analyze and design Combinational Circuits

			C202.3	Analyze and design Sequential Circuits
			C202.4	Understand various memories and implement Boolean functions using Programmable Logic Devices
			C202.5	Write HDL code for combinational and Sequential Circuits
C203	UCS1302	Data Structures	C203.1	Elucidate and implement various operations of List
			C203.2	Develop applications using stack and queue
			C203.3	Implement the operations of balanced and unbalanced trees
			C203.4	Develop applications using shortest path and traversal algorithms of graph
			C203.5	Choose suitable searching and sorting algorithms to solve various computing problems
C204	UCS1303	Object Oriented Programming using Java	C204.1	Solve problems using classes and objects
			C204.2	Develop programs using inheritance and interfaces
			C204.3	Apply the concepts of polymorphism
			C204.4	Design applications using generic programming
			C204.5	Develop algorithms using generic collections
C205	UCS1304	UNIX and Shell Programming	C205.1	Work in UNIX environment using command line
			C205.2	Handle files system proficiently
			C205.3	Use vi editor with proficiency
			C205.4	Work with the bash shell
			C205.5	Write Shell programs
C206	UEC1351	Principles of Communication Engineering	C206.1	Apply analog and digital communication techniques
			C206.2	Design analog and digital communication systems
			C206.3	Use pulse communication techniques & application
			C206.4	Analyze Source and Error control coding
			C206.5	Analyze the performance of spread spectrum systems
C207	UCS1311	Digital Design Lab	C207.1	Understand basic gates and universal gates to design a digital circuit
			C207.2	Design and implement various combinational circuits using logic gates
			C207.3	Design and implement various combinational circuits using MSI devices
			C207.4	Design and implement various sequential circuits
			C207.5	Simulate various combinational and sequential circuits using HDL
C208	UCS1312	Data Structures Lab	C208.1	Implement linear and nonlinear data structures to solve a given problem

			C208.2	Implement nonlinear data structures and use them for various applications
			C208.3	Analyze a problem statement and suggest an appropriate linear/ nonlinear data structure for solving it
			C208.4	Implement sorting, searching and hashing algorithms
			C208.5	Implement hashing technique for data storage and retrieval
			C209.1	Develop applications in Java using classes and methods
C209	UCS1313	Object Oriented Programming using Java Lab	C209.2	Apply inheritance and interface concepts to write programs
			C209.3	Write Java programs using polymorphic methods and objects
			C209.4	Develop applications using generic methods and generic programming
			C209.5	Apply appropriate features of object-oriented programming paradigm to design mini project
C210	UMA1478	Probability and Statistics	C210.1	Identify standard distributions and apply them
			C210.2	Solve problems in two-dimension random variables and find the correlation between them
			C210.3	Identify and apply the suitable testing of hypothesis under normal and t and F distribution
			C210.4	Solve problems in analysis of variance
			C210.5	Analyze quality control by applying control chart methods.
C211	UCS1401	Computer Organization and Architecture	C211.1	Understand the basics structure of computers, operations and instructions
			C211.2	Design arithmetic and logic unit
			C211.3	Understand pipelined execution and design control unit
			C211.4	Design of various memory systems and understand I/O communication
			C211.5	Understand parallel processing architectures
C212	UCS1402	Operating Systems	C212.1	Describe the basic services and functionalities of operating systems
			C212.2	Analyze various scheduling algorithms, and understand the different deadlock, prevention and avoidance schemes
			C212.3	Understand the different memory management schemes
			C212.4	Understand the functionality of file systems
			C212.5	Compare and contrast Linux, Windows and mobile operating systems
C213	UCS1403	Design and Analysis of Algorithms	C213.1	Design algorithms for various computing problems
			C213.2	Analyze the time and space complexity of algorithms

			C213.3	Compare the different algorithm design techniques for a given problem
			C213.4	Modify existing algorithms to improve efficiency
			C213.5	Understand the limitations of algorithmic power
C214	UCS1404	Database Management Systems	C214.1	Understand the database concepts and apply ER models to any real world application
			C214.2	Apply data definition and complex SQL queries
			C214.3	Design databases systematically and develop database software for various real time applications
			C214.4	Apply transaction processing, concurrency control and recovery mechanisms for practical problems
			C214.5	Understand the concepts of NOSQL databases
			C214.6	Design the database schema by analyzing the data for a real time application with documentation
C215	UCS1405	Software Engineering	C215.1	Understand principles of software engineering and choose an appropriate process model
			C215.2	Manage project schedule, estimate project cost and effort required
			C215.3	Perform requirements analysis and modeling
			C215.4	Apply systematic procedure for software design
			C215.5	Compare and contrast the various testing and maintenance activities
			C215.6	Model the requirements and build structured design using software engineering principles
C216	UCS1411	Operating Systems Lab	C216.1	Profile the performance of various CPU Scheduling Algorithms
			C216.2	Implement Deadlock avoidance and Detection Algorithms
			C216.3	Implement Semaphores and IPC
			C216.4	Profile the performance of the various Page Replacement Algorithms
			C216.5	Implement File Organization and File Allocation Strategies
C217	UCS1412	Database Lab	C217.1	Use data definitions and manipulation commands
			C217.2	Write complex SQL Queries
			C217.3	Implement Database programming using PL/SQL
			C217.4	Design a database for real-time applications

			C217.5	Implement and analyze the use of Tables, PL/SQL for a realistic database application using a Front-end tool
C218	UEN1498	Interpersonal Skills	C218.1	Listen and respond appropriately
			C218.2	Participate in group discussions
			C218.3	Make effective presentations
			C218.4	Participate confidently and appropriately in conversations both formal and informal.
			C218.5	Face campus interviews adequately
C301	UCS1501	Computer Networks	C301.1	Understand the principles, design, terminology and concepts of the network models
			C301.2	Learn the protocols of data link layer and apply error control mechanisms
			C301.3	Understand the core functions of network layer protocols and apply them for data communication
			C301.4	Learn the purpose of Transport Layer Protocols such as UDP and TCP
			C301.5	Understand the Application Layer Protocols and their basic functionalities
C302	UCS1502	Microprocessors and Interfacing	C302.1	Understand the basic architecture, operation, programming of microprocessor 8086
			C302.2	Understand the design of basic and multiprocessor systems and their bus timings
			C302.3	Design the 8086 interfaces with memory, I/O and other peripheral chips
			C302.4	Understand the basic architecture and operation of microcontroller 8051
			C302.5	Apply programming concepts to implement microcontroller interfaces for different applications
C303	UCS1503	Theory of Computation	C303.1	Construct automata, regular expression for any given pattern
			C303.2	Understand the need of formal languages, and grammars
			C303.3	Design pushdown automata for any CFL
			C303.4	Design Turing machines for any Languages
			C303.5	Explain the Decidability or Undecidability of various problems
C304	UCS1504	Artificial Intelligence	C304.1	Identify, formulate, understand, and solve AI problems using search techniques
			C304.2	Elucidate the concept of Knowledge Representation and inference using logics
			C304.3	Elucidate the concept of Knowledge Representation and inference under uncertainty

			C304.4	Elucidate the concept of learning in AI applications
			C304.5	Implement various search, inference and learning algorithms in AI
C305	UCS1505	Introduction to Cryptographic Techniques	C305.1	Describe and implement classical and symmetric ciphers
			C305.2	Describe the authentication schemes and hash algorithms
			C305.3	Understand the number theoretic foundations of cryptography
			C305.4	Compare and contrast various public key cryptographic techniques
			C305.5	Illustrate various public key cryptographic techniques
C306	UCS1511	Networks Lab	C306.1	Implement various protocols using TCP and UDP
			C306.2	Compare the performance of different transport layer protocols
			C306.3	Use simulation tools to analyze the performance of various network protocols
			C306.4	Analyze various routing algorithms
			C306.5	Implement error correction codes
C307	UCS1512	Microprocessors Lab	C307.1	Write 8086 Assembly Language Programs using arithmetic, logical and string operations
			C307.2	Implement BIOS interrupt programming using MASM
			C307.3	Design different basic I/O interfaces with 8086
			C307.4	Design different real-time interfaces with 8086
			C307.5	Write 8051 Assembly Language Programs using arithmetic and logical operations
C308a	UCS1524	Logic Programming	C308a.1	Understand the foundations of logic (K2)
			C308a.2	Understand the foundations of logic programming (K2)
			C308a.3	Write programs in PROLOG (K3)
			C308a.4	Implement AI search algorithms in PROLOG (K3)
			C308a.5	Implement a simple Expert system shell in PROLOG (K3).
C309	UCS1601	Internet Programming	C309.1	Design modern websites using HTML5 and CSS3
			C309.2	Design and implement dynamic web pages with JavaScript and DOM
			C309.3	Develop responsive web applications using Servlets and AJAX
			C309.4	Develop web applications using ReactJS framework
			C309.5	Develop web applications using NodeJS framework
C310	UCS1602	Compiler Design	C310.1	Design a lexical analyzer for a sample language
			C310.2	Apply different parsing algorithms to develop the parsers for the given grammar
			C310.3	Write syntax directed translation for programming language constructs

			C310.4	Understand and implement a simple code generator
			C310.5	Understand and implement code optimization techniques
			C310.6	Construct a compiler for a simple language using modern tools.
C311	UCS1603	Introduction to Machine Learning	C311.1	Understand the basic concepts of machine learning
			C311.2	Apply supervised algorithms for different classification problems
			C311.3	Understand the need of ensemble methods
			C311.4	Apply unsupervised and reinforcement learning techniques to various problems
			C311.5	Understand the requirement of dimensionality reduction and optimization techniques
C312	UCS1604	Object Oriented Analysis and Design	C312.1	Express software design with UML diagrams
			C312.2	Design and implement projects using OO concepts
			C312.3	Identify and map basic software requirements in UML mapping
			C312.4	Transform UML based software design into pattern-based design using design patterns
			C312.5	Test any object-oriented software against its requirements
C313	UCS1611	Internet Programming Lab	C313.1	Design websites using HTML5 and CSS3
			C313.2	Develop multi-tier web application using Servlets
			C313.3	Develop interactive web applications using AJAX
			C313.4	Develop web applications using ReactJS framework
			C313.5	Develop web applications using NodeJS framework
C314	UCS1617	Mini Project	C314.1	Understand the requirements for a given problem specification
			C314.2	Design and draw UML diagrams
			C314.3	Map design to code and implement using UML diagrams
			C314.4	Design and generate test cases
			C314.5	Design UML diagrams by applying appropriate design patterns
C315a	UCS1625	Foundations of Data Science	C315a.1	Develop Python programs to perform analysis on data
			C315a.2	Understand various probability distributions and statistical inferences
			C315a.3	Develop applications to demonstrate machine learning algorithms in practice
			C315a.4	Understand the principles of handling data streams
			C315a.5	Discuss topic and graphical modeling techniques in real world problem
C315b	UCS1626	Cloud Computing	C315b.1	Describe the design challenges in cloud environment

			C315b.2	Apply the concept of virtualization and analyse its types
			C315b.3	Experiment with virtualization of hardware resources and Virtual Machine Monitors
			C315b.4	Develop and deploy services on cloud and be able to set up a private cloud environment using opensource software
			C315b.5	Understand security challenges in cloud environment
C401	UCS1701	Distributed Systems	C401.1	Realize the foundations of Distributed Systems
			C401.2	Able to solve synchronization and state consistency problems
			C401.3	Demonstrate the resource sharing techniques in Distributed systems
			C401.4	Comprehend the working model of consensus and reliability of Distributed Systems
			C401.5	Identify the fundamentals of Peer-to-Peer Systems
			C401.6	Formulate a synchronization problem for an ad-hoc distributed system and adapt its solution
C402	UCS1702	Mobile Computing	C402.1	Identify the functionalities of various MAC protocols
			C402.2	Explain the functionalities of mobile network layer and routing in Ad hoc networks
			C402.3	Analyze the transport and application layer protocols
			C402.4	Explain the basics of mobile telecommunication system
			C402.5	Develop a mobile application
C403	UCS1703	Graphics and Multimedia	C403.1	Apply the algorithms to manipulate output primitives such as line, circle, ellipse
			C403.2	Demonstrate transformations, representations and clipping on 2D objects and map window to viewport transformations
			C403.3	Apply three Dimensional concepts like representations, geometric transformations, and projections
			C403.4	Understand the working of different illumination and color models used to render an animation scene
			C403.5	Understand different types of multimedia file formats, compression techniques and design basic 3D Scenes using Blender
C404	UCS1704	Management and Ethical Practices	C404.1	Describe basic and applied fields of Management
			C404.2	Describe and practice Managerial skills

			C404.3	Describe and practice Engineering Ethics and Human Values
			C404.4	Describe and use safety, responsibility, and rights
			C404.5	Describe ethical issues in cyber security
C405	UCS1711	Mobile Application Development Lab	C405.1	Develop mobile applications using GUI, Layouts and Event Listener
			C405.2	Develop mobile applications using Graphical primitives, Databases, Multithreading and GPS
			C405.3	Develop mobile applications using SD Card, SMS and Notification
			C405.4	Develop hybrid mobile applications
			C405.5	Develop a mobile app for simple needs
C406	UCS1712	Graphics and Multimedia Lab	C406.1	Demonstrate drawing of basic output primitives (line and circle) using algorithms and hence draw complex shapes using them
			C406.2	Illustrate basic, composite transformations and clipping on 2 dimensional objects
			C406.3	Apply transformations and projections on 3 dimensional objects and develop any scene with features including lighting, textures, shadows, changing camera angles
			C406.4	Apply basic operations on images, create GIF animated images and 2D animation sequence
			C406.5	Develop a simple 3D animation
C407a	UCS1722	Social Network Analysis	C407a.1	Explain Social network concepts, measures and data
			C407a.2	Represent social networks mathematically
			C407a.3	Understand the working of community detection algorithms for online social networks
			C407a.4	Use SNA tools for analysing social networks
			C407a.5	Apply Visualization to social networks
C407b	UCS1729	Data Warehousing and Data Mining	C407b.1	Design a Data warehouse system and perform business analysis with OLAP tools
			C407b.2	Apply suitable pre-processing techniques
			C407b.3	Apply frequent pattern and association rule mining techniques for data analysis
			C407b.4	Apply appropriate classification techniques for data analysis
			C407b.5	Apply clustering techniques using appropriate tools
C407c	UCS1821	Big Data Analytics	C407c.1	Work with big data tools and its analysis techniques
			C407c.2	Analyse data by utilising regression and classification algorithms
			C407c.3	Perform analytics on data streams

			C407c.4	Apply different mining algorithms and clustering techniques on big data
			C407c.5	Work with NoSQL databases and management
C407d	UCS1822	Agile Methodologies	C407d.1	Understand evolutionary, iterative and adaptive development methods
			C407d.2	Apply agile software process in requirement engineering
			C407d.3	Understand agile methods for project planning and development
			C407d.4	Apply agile methods for software design
			C407d.5	Apply agile based testing and quality assurance
C408	UCS1818	Project Work	C408.1	Formulate complex engineering problems and choose suitable technologies and tools required to solve them effectively
			C408.2	Analyse the related literature on the proposed problem and its feasibility
			C408.3	Construct suitable solutions by applying software engineering principles
			C408.4	Divide the work appropriately among the team members to manage time and complexity
			C408.5	Evaluate, document and present the solution
			C408.6	Analyse the issues pertaining to society, health, safety, legal, environment, culture applicable to the project and examine the impact of the proposed solution on these issues.
			C408.7	Apply best practices and follow ethics in developing the solutions

R2018 - B.E. Computer Science and Engineering

Program Outcomes (POs):

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Objectives (PSOs)

1. To analyze, design and develop computing solutions by applying foundational concepts of Computer Science and Engineering.
2. To apply software engineering principles and practices for developing quality software for scientific and business applications.
3. To adapt emerging Information and Communication Technologies (ICT) to innovate ideas and solutions for existing/novel problems.

M.E COMPUTER SCIENCE AND ENGINEERING

R2022

Code	Course Code	Course Name	CO Code	Course Outcomes
PC101	PMA2157	Linear Algebra and Estimation Theory	PC101.1	Solve the problems using the concepts of vector spaces, and subspaces
			PC101.2	Apply linear transformation to diagonalize a given matrix and hence to find the eigenvalues of the given matrix
			PC101.3	Apply statistical tests in testing hypotheses on data
			PC101.4	Evaluate the consistency, efficiency and unbiasedness of estimators and apply for problems in data science
			PC101.5	Perform exploratory analysis of multivariate data, such as multivariate normal density and Population principal components
PC102	PCP2101	Advanced Data Structures and Algorithms	PC102.1	Apply asymptotic notations and methods to find the time complexity of iterative and recursive algorithms
			PC102.2	Develop optimal algorithms using tree data structures
			PC102.3	Choose algorithms using graph data structures
			PC102.4	Determine suitable design techniques for solving problems
			PC102.5	Explain NP type problems and their reductions
PC103	PCP2102	Modern Operating Systems	PC103.1	Apply virtualization techniques and setup a cloud environment(K3).
			PC103.2	Apply scheduling algorithms for real time systems (K3).
			PC103.3	Apply resource handling techniques in real time environment (K3).
			PC103.4	Outline the alternatives and trade-offs in operating system design (K2).
			PC103.5	Make use of Containerization concepts in Linux (K3)
PC104	PCP2103	Principles of Data Science	PC104.1	Demonstrate the need and the fundamental concepts of data science. (K2)
			PC104.2	Choose appropriate functions in Python libraries for data analysis (K5)
			PC104.3	Develop Python programs for data preparation and visualizing the data. (K3)
			PC104.4	Apply statistical inferential analysis to find the properties of a population. (K3)
			PC104.5	Choose suitable Machine Learning algorithm to demonstrate data analysis in practice (K5)
PC105	PCP2104	Advanced Software Engineering	PC105.1	Make use of the UML diagrams and design software to meet the specified requirements (K3)

			PC105.2	Apply suitable software architectural styles and tactics to achieve software quality requirements(K3)
			PC105.3	Apply appropriate object-oriented design patterns to improve maintainability and software evolution (K3).
			PC105.4	Define the best practices of DevOps (K2)
			PC105.5	Summarize the MLOps Practices (K2).
			PC106.1	Ability to formulate research problem
PC106	PGE2176	Research Methodology & IPR	PC106.2	Ability to carry out research analysis
			PC106.3	Ability to follow research ethics
			PC106.4	Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
			PC106.5	Ability to understand about IPR and filing patents in R & D.
			PC107.1	Solve problems using basic data structures and sorting algorithms. (K3)
PC107	PCP2111	Advanced Data Structures and Algorithms Lab	PC107.2	Solve problems using tree and graph structures. (K3)
			PC107.3	Choose appropriate algorithm design techniques and develop efficient algorithms (K5)
PC108	PCP2112	Data Science Lab	PC108.1	Analyze the significance of python packages for data creation and manipulation (K4)
			PC108.2	Experiment the methods of data handling and visualization through NumPy, Pandas and Matplotlib modules (K3).
			PC108.3	Construct Python programs for obtaining statistical inference on data and choose suitable machine learning algorithms for real-world applications. (K5)
PC109	PCP2201	Machine Learning	PC109.1	Explain the basic concepts of machine learning (K2)
			PC109.2	Analyze linear and non-linear techniques for classification problems (K4)
			PC109.3	Apply unsupervised and reinforcement algorithms for the given problems (K3)
			PC109.4	Choose suitable machine learning and deep learning algorithms for a given application (K5)
			PC109.5	Determine appropriate solutions for real world problems using H2O.ai (K5)
PC110	PCP2202	Internet of Things	PC110.1	Explain the basics of IoT devices, protocols, communication APIs and deployment templates (K2)
			PC110.2	Design the simple IoT systems using Raspberry Pi/Arduino Pi (K3)

			PC110.3	Explain various IoT protocols (K2)
			PC110.4	Design an IoT system using cloud environments (K3)
			PC110.5	Design IoT solutions for industries. (K3).
PC111	PCP2203	Advanced Databases	PC111.1	Explain the distribution, consistency models and replication for distributed databases (K2)
			PC111.2	Apply the concepts of data lakes and ingest big data into data lake (K3)
			PC111.3	Apply the techniques of wide-column and key-value store to create databases and run the queries (K3)
			PC111.4	Apply the concepts of document and graph databases and run the queries (K3)
			PC111.5	Explain the concepts of streaming data and how to make use of Kafka (K3)
PC112	PCP2211	Machine Learning Lab	PC112.1	Develop applications using machine learning algorithms (K3)
			PC112.2	Choose suitable ML algorithm to solve the given application (K5)
			PC112.3	Apply H2O.ai library to develop an application (K3)
PC113	PCP2212	Internet of Things Lab	PC113.1	Build simple IoT systems using Arduino/Raspberry Pi and sensors (K3).
			PC113.2	Build low-cost embedded systems using various communication protocols and web APIs (K3)
			PC113.3	Develop cloud based IoT solutions for real time applications (K6).
PC114	PCP2216	Internship with Seminar	PC114.1	Demonstrate ability to survey literature, identify gaps and write well-documented report (K3)
			PC114.2	Solve social issues and engineering problems (K6)
			PC114.3	Demonstrate effective technical presentation skills
PC115	PCP2222	Natural Language Processing	PC115.1	Apply the text normalization techniques. (K3)
			PC115.2	Apply syntactic analysis in language processing (K3)
			PC115.3	Apply vector semantics for word embeddings (K3)
			PC115.4	Apply semantic analysis for words and sentences (K3)
			PC115.5	Apply extraction techniques to extract the information (K5)
PC116	PCP2225	Cloud Computing	PC116.1	Describe the design challenges in cloud (K2)
			PC116.2	Apply the concept of virtualization and its types (K3)
			PC116.3	Experiment with virtualization of hardware resources and Docker (K3)
			PC116.4	Develop and deploy services on cloud and set up a cloud environment (K3)
			PC116.5	Explain security challenges in cloud environments (K2).

PC117	PCP2229	Image Processing and Analysis	PC117.1	Explain the fundamental concepts of a digital image processing system (K2)
			PC117.2	Apply image enhancement and restoration techniques in spatial and frequency domains (K3)
			PC117.3	Make use of image segmentation techniques for object detection (K3)
			PC117.4	Analyze the multi resolution methods and image transforms for color images (K4)
			PC117.5	Apply techniques of object enhancement, detection, recognition, and classification in various applications (K3)
PC201	PCP2325	Cyber Security	PC201.1	Explain the basics of cyber security, cyber crime and law (K2)
			PC201.2	Classify various types of attacks and learn the tools to launch the attacks (K2)
			PC201.3	Apply various tools to perform information gathering (K3)
			PC201.4	Apply intrusion detection techniques to detect intrusion (K3)
			PC201.5	Apply intrusion prevention techniques to prevent intrusion (K3)
PC202	PCP2329	Edge Analytics	PC202.1	Describe the fundamentals and challenges of edge computing (K2)
			PC202.2	Explain the use and need of different hardware components of edge computing (K2)
			PC202.3	Apply the advanced concepts and frameworks of edge AI (K3)
			PC202.4	Apply the technologies used for edge analytics and developing solutions (K3)
			PC202.5	Identify the applications developed using edge architecture (K3)
PC203	PCP2336	Computer Vision	PC203.1	Apply fundamental image processing techniques required for computer vision. (K3)
			PC203.2	Apply boundary and region descriptors and hough transforms. (K3)
			PC203.3	Apply 3D vision techniques. (K3)
			PC203.4	Apply image registration and transformation of image and perform camera calibration (K3)
			PC203.5	Apply video processing techniques and develop applications using computer vision techniques. (K4)
PC204	PCP2318	Project Work Phase I	PC204.1	Formulate complex engineering problems and choose suitable technologies and tools required to solve them effectively (K4)
			PC204.2	Analyze the related literature on the proposed problem and its feasibility (K4)
			PC204.3	Design high level solutions by applying software engineering principles (K6)

			PC204.4	Develop and summarize the solution by documenting (K3).
			PC204.5	Analyze the issues pertaining to society, health, safety, legal, environment, culture applicable to the project and examine the impact of the proposed solution on these issues
			PC204.6	Apply best practices and follow ethics in developing the solutions
PC205	PCP2418	Project Work Phase II	PC205.1	Use suitable technologies and tools to solve complex engineering problems effectively (K4)
			PC205.2	Analyze the related literature on the proposed problem and its feasibility (K4)
			PC205.3	Construct suitable solutions by applying software engineering principles (K6)
			PC205.4	Evaluate the performance of the solution using appropriate metrics (K5)
			PC205.5	Analyze the impact of the proposed solution on the issues pertaining to society, health, safety, legal, environment, culture and apply ethical principles.
			PC205.6	Apply ethical principles in developing the solutions and present the solution with good documentation

R2022 - M.E. Computer Science and Engineering

Program Outcomes (POs)

The graduates of the M.E degree program in Computer Science and Engineering will be able to

PO1: Independently carry out research / investigation, and development work to solve practical problems (K6)

PO2: Read, write, and present a substantial technical report/document

PO3: Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program (K6)

PO4: Analyze, learn, and build models from real world data using machine learning techniques and deploy them (K5)

M.E COMPUTER SCIENCE AND ENGINEERING

R2018

Code	Course Code	Course Name	CO Code	Course Outcomes
PC101	PMA1177	Applied Probability and Statistics	PC101.1	To identify the standard distributions and apply them in solving problems
			PC101.2	To understand the concept of two-dimensional random variables and solve problems in finding the Joint probabilities and correlation between them
			PC101.3	Evaluate the consistency, efficiency and unbiasedness of estimators and apply for problems in data science
			PC101.4	Apply statistical tests in testing hypotheses on data
			PC101.5	Develop exploratory analysis of multivariate data, such as multivariate normal density and Population principal components
PC102	PCP1176	Advanced Data Structures and Algorithms	PC102.1	Apply asymptotic notations and methods to find the time complexity of iterative and recursive algorithms
			PC102.2	Develop optimal algorithms using tree data structures
			PC102.3	Develop optimal algorithms using graph data structures
			PC102.4	Solve problems using suitable design techniques
			PC102.5	Explain NP type problems and their reductions
PC103	PCP1101	Multicore Architecture and GPU Computing	PC103.1	Infer the salient features of different multicore architectures and how they exploit parallelism
			PC103.2	Interpret the features and issues of MIMD systems
			PC103.3	Explain the features of SIMD systems
			PC103.4	Develop programs using CUDA
			PC103.5	Apply and identify issues in CUDA programming
PC104	PCP1177	Advanced Software Engineering	PC104.1	Explain software requirements specification and model software systems using UML diagrams
			PC104.2	Apply formal models to capture requirements
			PC104.3	Apply appropriate architectural styles and design patterns
			PC104.4	Apply various testing techniques
			PC104.5	Describe agile software development methodology
			PC104.6	Summarize the benefits of DevOps practices

PC105	PCP1178	Machine Learning	PC105.1	Explain the basic concepts of machine learning
			PC105.2	Analyze linear and non-linear techniques for classification problems
			PC105.3	Apply tree and probabilistic models for the given problems
			PC105.4	Apply various dimensionality reduction techniques and evolutionary models
			PC105.5	Explain the concepts of graphical models
PC106	PCP1102	Network Design and Technologies	PC106.1	Outline the components required for designing a network
			PC106.2	Develop a network using different wireless networking technologies
			PC106.3	Experiment with various protocols of 3G, 4G and cellular networks
			PC106.4	Make use of software defined networks
			PC106.5	Analyze various networks using a simulator
PC107	PCP1197	Advanced Data Structures and Algorithms Lab	PC107.1	Solve problems using basic data structures and sorting algorithms
			PC107.2	Solve problems using tree and graph structures
			PC107.3	Analyse algorithm design techniques and develop efficient algorithms
PC108	PCP1111	Ethical Practices	PC108.1	Analyse human values and virtues
			PC108.2	Analyse the importance of ethical practices in engineering
			PC108.3	Apply ethical practices in engineering and technology
			PC108.4	Make use of the organizational environment and culture
			PC108.5	Apply best practices in engineering and analyse moral behaviour & responsibility
PC109	PCP1201	Modern Operating Systems	PC109.1	Apply various techniques related to virtualization
			PC109.2	Describe the build of Android operating system
			PC109.3	Apply scheduling algorithms in real-time applications
			PC109.4	Apply resource handling techniques in real-time environments
			PC109.5	Install and work with modern OS and comprehend its practical design
PC110	PCP1276	Internet of Things	PC110.1	Explain the basic building blocks and data management in Internet of Things
			PC110.2	Explain different IoT architectures
			PC110.3	Summarize various protocols for IoT
			PC110.4	Develop a low cost IoT system using Arduino/Raspberry-Pi
			PC110.5	Build an IoT application in a cloud environment
PC111	PCP1202	Web Application Development	PC111.1	Create a website using HTML and CSS
			PC111.2	Develop web applications using the JavaScript-based framework
			PC111.3	Develop web applications using a Python-based framework

PC112	PCP1281	Data Analytics	PC112.1	Explain how to leverage the insights from big data analytics
			PC112.2	Solve applications using statistical and data analytic methods
			PC112.3	Develop analytics using streaming data
			PC112.4	Develop applications using Hadoop-related tools and R Programming
			PC112.5	Develop databases using MongoDB, Hive, and HBase for data analysis
PC113	PCP1211	Data Analytics Lab	PC113.1	Solve big data analysis using Hadoop framework
			PC113.2	Build and apply linear and logistic regression models
			PC113.3	Examine data analysis with machine learning methods
			PC113.4	Analyse data using visualization techniques
PC114	PCP1217	Mini Project	PC114.1	Analyse the problem and design a solution
			PC114.2	Analyse and adopt new technologies for solving a given problem
			PC114.3	Solve problems using software engineering principles
PC115	PCP1215	Technical Paper Writing and Seminar	PC115.1	Construct technical reports clearly for a given topic
			PC115.2	Analyze and select a topic, collect literature, consolidate
			PC115.3	Develop an effective presentation of the literature survey and observations
PC116	PCP1278	Natural Language Processing	PC116.1	Describe the language models
			PC116.2	Explain levels of knowledge in language processing
			PC116.3	Write Python programs for text processing
			PC116.4	Apply NLP techniques to MT, IR and IE systems
PC117	PCP1279	Image Processing and Analysis	PC117.1	Design and implement enhancement and segmentation algorithms for image processing applications
			PC117.2	Perform analysis using various image features
			PC117.3	Analyze the multi resolution techniques and methods used for color images
			PC117.4	Make a positive professional contribution in the field of Digital Image Processing
PC201	PCP1377	Information Retrieval Techniques	PC201.1	Explain various IR modelling techniques
			PC201.2	Identify and design the various components of an Information Retrieval system
			PC201.3	Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval
			PC201.4	Explain various IR applications
PC202	PCP1378	Data Visualization Techniques	PC202.1	Recognize core skills for visual analysis
			PC202.2	Apply visualization techniques for various data analysis tasks

			PC202.3	Employ information dashboard design techniques
			PC202.4	Use different tools to better visualize data
PC203	PCP1379	Deep Learning	PC203.1	Explain the basics in deep neural networks
			PC203.2	Apply Convolution Neural Network for real-world problems in image processing
			PC203.3	Apply Recurrent Neural Network and its variants for text analysis
			PC203.4	Explain the concepts in autoencoders and generative models
PC204	PCP1318	Project Work Phase I	PC204.1	Formulate complex engineering problems and choose suitable technologies and tools required to solve them effectively
			PC204.2	Analyse the related literature on the proposed problem and its feasibility
			PC204.3	Design high level solutions by applying software engineering principles
			PC204.4	Implement a solution, evaluate, and deploy it
			PC204.5	Document the solution, communicate orally and elaborate in writing
PC205	PCP1418	Project Work Phase II	PC205.1	Plan the management of time and risks
			PC205.2	Compare the related literature on the proposed problem and analyse its feasibility
			PC205.3	Design a high-level solution by applying software engineering principles
			PC205.4	Implement a solution, evaluate, and deploy it
			PC205.5	Document the solution, communicate orally and elaborate in writing

R2018 - M.E. Computer Science and Engineering

Program Outcomes (POs)

The graduates of the M.E degree program in Computer Science and Engineering will be able to

PO1: Independently carry out research / investigation, and development work to solve practical problems (K6)

PO2: Read, write, and present a substantial technical report/document.

PO3: Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program (K6)

PO4: Analyze, learn, and build models from real world data using machine learning techniques and deploy them (K5)

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Electronics and Communication Engineering
B.E. Electronics and Communication Engineering

List of Course Outcomes (R2021)

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	UEN2176	TECHNICAL ENGLISH	C101.1	To read and comprehend texts (technical) effectively
			C101.2	To write proposals, reports, emails, letters, SOPs meeting professional expectations
			C101.3	To Improve Vocabulary (use of right collocations, idioms and phrases etc)
			C101.4	To enhance their grammatical competency for writing and speaking
			C101.5	To improve their ability to listen and comprehend at deeper levels
C102	UMA2176	MATRICES AND CALCULUS	C102.1	Identify the nature of quadratic form by reducing it to canonical form
			C102.2	Analyse the convergence of a given infinite series
			C102.3	Find evolute of a given curve and envelope of family of curves
			C102.4	Find the extrema of function of two variables
			C102.5	Evaluate the double and triple integrals
			C102.6	Application of extreme points of functions and multiple integrals in engineering problems
C103	UPH2176	ENGINEERING PHYSICS	C103.1	Analyze crystal structures and the influence of imperfections on their properties
			C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics
			C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines
			C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication
C104	UCY2176	ENGINEERING CHEMISTRY	C104.1	The unique properties of nano-particles and their applications
			C104.2	The principles of electrochemistry and its application for quantitative analysis
			C104.3	The various types of corrosion under normal to severe corrosive environments and their control measures

Code	Course Code	Course Name	CO Code	Course Outcomes
C105	UGE2176	PROBLEM SOLVING AND PROGRAMMING IN PYTHON	C104.4	Construction of phase diagram and its application to analyse simple eutectic systems
			C104.5	The synthesis, properties and applications of important industrial polymers
			C105.1	Solve programming problems and express solutions in pseudo code
			C105.2	Develop simple programs using basic constructs
			C105.3	Construct programs using conditions and iterations decompose a problem into functions
			C105.4	Make use of strings, lists, tuples and dictionaries data structures
			C105.5	Perform Input/Output Operations using files
C106	UGE2177	ENGINEERING GRAPHICS	C106.1	Draw Plane curves and perform Free hand sketching of three - dimensional objects
			C106.2	Draw the Orthographic projections of points, lines and plane surfaces
			C106.3	Draw the Projections of solids
			C106.4	Draw the Projections of sectioned solids and Development of surfaces
			C106.5	Draw the Isometric and Perspective projections of solids
C107	UGE2197	PROGRAMMING IN PYTHON LABORATORY	C107.1	Write, test, and debug simple Python programs
			C107.2	Build Python programs with conditionals and loops
			C107.3	Solve a problem using functions in python programming
			C107.4	Construct python programs using compound data like lists, tuples, and dictionaries
			C107.5	Build a simple application in teams using files and appropriate datatypes by applying the best programming practices
C108	UGS2197	PHYSICS AND CHEMISTRY LABORATORY	C108.1	Determine the Molecular weight and Degree of Polymerisation using viscometer
			C108.2	Analyse ions like Fe ²⁺ , Fe ³⁺ , H ⁺ using different instruments
			C108.3	Determine the Molecular weight and Degree of Polymerisation using viscometer
C109	UMA2276	COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS	C109.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations
			C109.2	Solve problems using integration techniques, find Taylor's and Laurent's Series expansions
			C109.3	Obtain the Laplace Transforms and inverse transforms of standard functions
			C109.4	Solve Differential Equations using different techniques
			C109.5	Evaluate Line, Surface and Volume integrals
			C109.6	Application of Complex integration, Laplace transforms, Ordinary differential equations, and vector calculus in engineering problems
C110	UEE2251	BASIC ELECTRICAL AND	C110.1	Explain the basic concept of three phase supply
			C110.2	Understand the basics of power generation, transmission and distribution

Code	Course Code	Course Name	CO Code	Course Outcomes
		INSTRUMENTATION ENGINEERING	C110.3	Comprehend the concepts in AC and DC motors, generators and transformers
			C110.4	Understand the operation and working of special machines
			C110.5	Choose appropriate measuring instruments for given application
C111	UEC2201	FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS	C111.1	Explain the basics of device physics and working principle of PN Junction diode
			C111.2	Describe the construction, operation and applications of BJT, FET and special PN devices
			C111.3	Apply the knowledge of biasing on BJT and FET circuits
			C111.4	Analyze the performance of small-signal BJT and FET in single stage and multi- stage amplifiers
			C111.5	Design and evaluate electronic systems using semiconductor devices and analyze its characteristics
			C111.6	Communicate effectively through reflections, reports and presentations
C112	ACY2276	ENVIRONMENTAL SCIENCE	C112.1	The structure and functions of the ecosystems and diversity among life forms within an ecosystem
			C112.2	The importance of various natural resources and its sustainable use
			C112.3	The various environmental issues such as pollution, population explosion etc and suggest remedial measures
			C112.4	The role of engineering techniques to minimize environmental stress
			C112.5	The role of various environmental machineries and to ensure proper environmental regulation
C113	UEC2202	CIRCUIT AND NETWORK ANALYSIS	C113.1	Apply the basic concepts of circuit analysis such as Kirchoff's laws, mesh current and node voltage method for analysis of DC and AC circuits
			C113.2	Apply the basic circuit analysis concepts and network theorems such as, Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, and Maximum power transfer theorem to DC and AC circuits
			C113.3	Analyze the frequency response of parallel and series resonance circuits, the concept of inductance, coupling and apply it to single and double tuned circuits
			C113.4	Analyse transient response for any RC, RL and RLC circuits
			C113.5	Analyze two port networks in terms of Z, Y, ABCD and h parameters
C114	UGE2297	DESIGN THINKING AND ENGINEERING	C114.1	Draw pipeline plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household woodwork

Code	Course Code	Course Name	CO Code	Course Outcomes
		PRACTICES LABORATORY	C114.2	Practice machining to make holes on different materials; fabricate sheet metal components
			C114.3	Dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model of various components
			C114.4	Construct domestic electrical circuits and verify their output parameters
			C114.5	Construct electronics circuits and verify their output
C115	UEC2211	CIRCUITS AND DEVICES LABORATORY	C115.1	Verify network theorems and estimate the resonant behaviour of RLC circuits
			C115.2	Analyse the characteristics of basic electronic devices
C116a	UEN2241	LANGUAGE AND COMMUNICATION	C116a.1	To improve their communicative competency across all skills of language
			C116a.2	To improve their writing ability in writing for persuasion and convincing someone
			C116a.3	To attend job interviews more confidently
			C116a.4	To improve social communication sensitive to gender and other prejudices
			C116a.5	To do better in the spoken component of the placement tasks
C116b	UEN2242	FUNDAMENTALS OF LINGUISTICS	C116b.1	Understand what is linguistics
			C116b.2	Explore some basic issues and questions related to language
			C116b.3	Understand the subtle difference between the use of English in Indian and western tradition
			C116b.4	Familiarize themselves with the unique features of language in technology
			C116b.5	Understand the basics of how children acquire languages
C116c	UHS2243	FILM APPRECIATION	C116c.1	the process of the development of film as an art and entertainment form
			C116c.2	the evolution of the language of cinema as it evolved over a century
			C116c.3	the script writing techniques of a film and appreciate the various nuances
			C116c.4	the evolution of film industry from the past to present
			C116c.5	how to appreciate all aspects of the film
C116d	UHS2241	HUMAN RELATIONS AT WORK	C116d.1	will enhance their awareness about human relations at work and its relationship with self
			C116d.2	become aware of the processes involved in interaction with people at work
			C116d.3	Will understand the importance of psychological and physical health in maintaining human relations at work
			C116d.4	will be able to understand the ways and means to improve human relations at work
			C116d.5	will realize the importance of safeguarding themselves from any exploitation
C116e	UHS2242	APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE	C116e.1	raise their awareness on applications of psychology to everyday issues of life
			C116e.2	deal more efficiently with different issues in society, workplace and human behavior
			C116e.3	Apply principles of psychology in their own personal and professional lives

Code	Course Code	Course Name	CO Code	Course Outcomes
C116f	UEN2243	UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE	C116e.4	Use the psychological principles for their own human development
			C116e.5	Appreciate the impact of Psychology on human life
			C116f.1	Improvement in the awareness of various traditions
			C116f.2	Not only understand not just the diversity found between various traditions but also celebrate them
			C116f.3	strengthen their analytical capability
			C116f.4	improve their language skills and also the ability to express complex ideas
			C116f.5	understand the relationship between life and literature
C201	UMA2353	LINEAR ALGEBRA AND NUMERICAL METHODS	C201.1	Solve the problems using the concepts of vector spaces, subspaces and linear transformation
			C201.2	Apply linear transformation to diagonalize a given matrix and hence to find the eigen values of the given matrix
			C201.3	Apply Gram-Schmidt's orthogonalization process to diagonalize a given matrix and to solve the given system of equations by least square approximations
			C201.4	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to the linear system of equations
			C201.5	Decompose the matrix using different methods such as QR and singular value Decomposition
			C201.6	Application of inner product space and numerical methods in engineering problems
C202	UHS2376	HUMANITIES II – UNIVERSAL HUMANVALUE: UNDERSTANDING HARMONY	C202.1	Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
			C202.2	Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body
			C202.3	Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society
			C202.4	Understand the harmony in nature and existence, and work out their mutually fulfilling participation in nature
			C202.5	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work

Code	Course Code	Course Name	CO Code	Course Outcomes
C203	UEC2301	ANALOG CIRCUITS	C203.1	Classify feedback amplifiers and power amplifiers
			C203.2	Design transistor based sinusoidal and non-sinusoidal signal generators
			C203.3	Implement linear and nonlinear applications using OP-AMPS
			C203.4	Demonstrate waveform generation using OP-AMP Circuits
C204	UEC2302	DIGITAL SYSTEM DESIGN	C204.1	Apply the knowledge of Boolean algebra and simplification of Boolean expressions to deduce the digital circuits
			C204.2	Design combinatorial logic circuits including arithmetic logic, selection logic and code conversion
			C204.3	Design synchronous and asynchronous sequential logic circuits
			C204.4	Design combinatorial and sequential logic circuits using VHDL
			C204.5	Evaluate relevance and use of engineering fundamentals in digital system design to advanced industrial/societal applications or products
			C204.6	Communicate effectively through reflections, reports and presentations
C205	UEC2304	OOPS AND DATA STRUCTURES	C205.1	Make use of the control structures of C++ in different applications
			C205.2	Apply the concepts of data abstraction, encapsulation and inheritance for problem solutions
			C205.3	Select suitable linear data structures for different problem solutions
			C205.4	Apply non-linear data structures to various problems
			C205.5	Demonstrate the use of various sorting algorithms
C206	UEC2376	SIGNALS AND SYSTEMS	C206.1	Analyze the properties of signals & systems
			C206.2	Apply Fourier series, Laplace transform, Fourier transform, Z-transform and DTFT in signal analysis
			C206.3	Analyze continuous time LTI systems using Fourier and Laplace Transforms
			C206.4	Analyze discrete time LTI systems using Z-transform and DTFT
C207	UEC2311	ANALOG CIRCUITS LABORATORY	C207.1	Experiment various types of amplifiers and oscillators using BJT
			C207.2	Demonstrate amplifiers and oscillators using operational amplifiers
			C207.3	Implement multivibrators and voltage regulators using ICs
			C207.4	Examine the performance of electronic circuits using PSpice
C208	UEC2312	OOPS AND DATA STRUCTURES LABORATORY	C208.1	Apply object oriented programming features in program development
			C208.2	Implement linked list, stack and queue
			C208.3	Implement trees and graphs
			C208.4	Apply suitable data structures for solving problems
C209	UEC2401	MICROCONTROLL	C209.1	Apply programming techniques in developing the ALP for 8051 microcontrollers

Code	Course Code	Course Name	CO Code	Course Outcomes
		ERS	C209.2	Develop ALP to interface timers, serial port and I/O ports with 8051 microcontroller
			C209.3	Interface different peripheral devices with 8051 microcontrollers
			C209.4	Comprehend the architecture of ARM microcontroller
			C209.5	Apply programming techniques in developing the assembly language program for ARM microcontroller and interface memory / peripherals
C210	AHS2476	INDIAN CONSTITUTION	C210.1	Understand history and philosophy of Indian constitution
			C210.2	Realize powers and functions of Indian government
			C210.3	Acquire awareness on structure and functions of local administration
			C210.4	Enhance knowledge about organization and composition of judiciary
			C210.5	Explore the distribution of financial powers and emergency provisions
C211	UEC2402	DIGITAL SIGNAL PROCESSING	C211.1	Apply discrete Fourier transform for the analysis of digital signals and systems
			C211.2	Design and realize a frequency selective digital IIR filters
			C211.3	Design and realize FIR filters
			C211.4	Characterize quantization effects in digital filters
			C211.5	Apply, analyse and evaluate the multi-rate processing and adaptive filtering in engineering applications
C212	UEE2476	CONTROL SYSTEMS ENGINEERING	C212.1	Explain the importance of transfer function in modelling physical systems
			C212.2	Analyse any system with respect to time domain
			C212.3	Analyse any system with respect to frequency domain
			C212.4	Explain the stability of the system
			C212.5	Design and analyse a compensator system to meet the desired specifications
			C212.6	Design a PID controller to improve the stability of the system
C213	UEC2403	ELECTROMAGNETIC FIELDS	C213.1	Demonstrate knowledge and understanding of fundamental electromagnetic laws and concepts
			C213.2	Discuss the understanding of the effect of materials on electric and magnetic fields
			C213.3	Analyze electric and magnetic field quantities from simple charge and current Distributions
			C213.4	Analyze electric and magnetic field from a plane wave normally incident on a Metallic dielectric material
C214	UEC2404	PRINCIPLES OF COMMUNICATION	C214.1	Demonstrate an understanding of Analog Modulation Principles
			C214.2	Comprehend and use the concepts of Random Process to the design of Communication

Code	Course Code	Course Name	CO Code	Course Outcomes
		SYSTEMS		system
			C214.3	Analyze the noise performance the noise performance of Analog Modulation systems
			C214.4	Apply the concepts of source coding techniques for the design of systems
C215	UEC2411	MICROCONTROLLERS LABORATORY	C215.1	Develop and test simple assembly language programs using 8051 instruction sets
			C215.2	Design and interface various peripheral devices with 8051
			C215.3	Develop ALP to interface different peripherals with ARM (LPC2148)
C216	UEC2412	DIGITAL SIGNAL PROCESSING LABORATORY	C216.1	Generate/record a signal and apply various signal processing algorithm
			C216.2	Implement DFT/FFT to analyse the frequency spectrum of the DT signals
			C216.3	Design FIR/IIR filters to eliminate the background noise and analyse the impact of finite word length in the designed filters
			C216.4	Analyze discrete time LTI systems using Z-transform and DTFT
C301	UEC2501	DIGITAL COMMUNICATION	C301.1	Represent and analyze analog signals through different waveform coding technique
			C301.2	Comprehend the properties and performance of Line codes
			C301.3	Apply the knowledge of ISI problems to understand the related combating Solutions
			C301.4	Compare the error probability of different digital modulation schemes
			C301.5	Apply various error control coding schemes over information bits
			C301.6	Describe spread spectrum modulation scheme and illustrate both DS and FH Systems
C302	UEC2502	TRANSMISSION LINES AND WAVEGUIDES	C302.1	Apply the knowledge of filter theory in the design of passive filters
			C302.2	Comprehend the working of lossy and lossless transmission lines in RF applications
			C302.3	Solve RF line problems and stub matching using Smith chart
			C302.4	Analyze the field components of parallel planes and waveguides
C303	UEC2503	COMMUNICATION NETWORKS	C303.1	Demonstrate various networking components and their respective roles in a communication system
			C303.2	Analyze the required functionality at each layer for a given application
			C303.3	Design and apply routing mechanisms to fulfil the networking requirements
			C303.4	Analyze the features and operations of various Quality of service protocols
			C303.5	Evaluate relevance and use of engineering fundamentals in communication networks to advanced industrial applications or products and their Impact on safety, society as well as underlying legal and ethical considerations
			C303.6	Communicate effectively through reflections, reports and presentations
C304	UEC2504	PRINCIPLES OF VLSI DESIGN	C304.1	Summarize various VLSI design principles and methodologies
			C304.2	Describe operation, characteristics, layout and fabrication of MOS Transistor and design

Code	Course Code	Course Name	CO Code	Course Outcomes
				CMOS Inverter
			C304.3	Apply design concepts to realize CMOS Combinational Logic Circuits and Sequential Logic Circuits
			C304.4	Analyze various architectures of Arithmetic Building Blocks and implement testing techniques to CMOS VLSI Circuits
C305	UEC2511	ANALOG AND DIGITAL COMMUNICATION LABORATORY	C305.1	Construct circuits to experiment the Amplitude and Frequency modulation methods
			C305.2	Demonstrate their knowledge in baseband signalling schemes through the implementation of PCM, DM and line coding schemes
			C305.3	Simulate an end-to-end communication link and analyze the effect of noise on the performance of the entire system
			C305.4	Apply various error control coding schemes over information bits
			C305.5	Demonstrate their knowledge in spread spectrum modulation techniques
C306	UEC2512	VLSI DESIGN LABORATORY	C306.1	Write HDL code for digital integrated circuits, import HDL code & verify the functionality of the logic modules into FPGA Trainer Boards
			C306.2	Design and simulate CMOS Digital Circuits using EDA tools
			C306.3	Perform post layout simulation using EDA tools
C307a	UBA2541	PRINCIPLES OF MANAGEMENT	C307a.1	Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling
			C307a.2	Have same basic knowledge on international aspect of management
			C307a.3	Ability to understand management concept of organizing
			C307a.4	Ability to understand management concept of directing
			C307a.5	Ability to understand management concept of controlling
C307b	UBA2542	TOTAL QUALITY MANAGEMENT	C307b.1	Ability to apply TQM concepts in a selected enterprise
			C307b.2	Ability to apply TQM principles in a selected enterprise
			C307b.3	Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA
			C307b.4	Ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR
			C307b.5	Ability to apply QMS and EMS in any organization
C307c	UBA2543	WORK ETHICS, CORPORATE SOCIAL	C307c.1	Understand ethical issues in workplace and have good practices in professional duties
			C307c.2	Learn roles and responsibilities in professional career as a team worker
			C307c.3	Understand the legal aspects in Indian constitutional for protection of societal values

Code	Course Code	Course Name	CO Code	Course Outcomes
		RESPONSIBILITY AND GOVERNANCE	C307c.4	Analyze the economical development by industry with importance to environment protection.
			C307c.5	Understand need of good Governance in a corporate with ethical organizational behavior
C308a	UEC2521	INFORMATION THEORY AND CODING	C308a.1	Measure the performance of the information over a channel
			C308a.2	Design and implement various coding techniques in communication systems
			C308a.3	Analyze the information capacity of different types of channel
			C308a.4	Analyze the Rate Distortion functions and features of different Quantizers
C308b	UEC2522	ADVANCED DIGITAL SIGNAL PROCESSING	C308b.1	Acquire knowledge on power spectral density and apply to discrete time random signals and systems
			C308b.2	Analyze non-parametric and parametric methods for spectrum estimation
			C308b.3	Analyze signal modelling techniques to discrete time random process
			C308b.4	Apply linear estimation and prediction techniques to discrete random signals for signal separation, detection and estimation
			C308b.5	Apply optimum filtering techniques for discrete random signals
			C308b.6	Apply the concepts of compressed sensing for signal processing applications
C308c	UEC2523	COMPUTER ARCHITECTURE AND ORGANIZATION	C308c.1	Explain the basic structure of computers, operations and instructions
			C308c.2	Design arithmetic and logic unit
			C308c.3	Explain pipelined execution and design its control unit
			C308c.4	Design of various memory systems and understand I/O communication
			C308c.5	Explain parallel processing architectures
			C308c.6	Design a multi-functional ALU as per the requirement in teams by applying best practices of system design
C308d	UEC2524	MEMS AND NEMS	C308d.1	Familiarize the basics of micro/nano electromechanical structures, devices and systems including their theoretical foundations, applications and advantages
			C308d.2	Recognize the use of materials in micro/nano fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA
			C308d.3	Analyze the key performance aspects of micro/nano electromechanical transducers including sensors and actuators
			C308d.4	Explore the techniques for characterization and packaging requirements of MEMS/NEMS
C309	UEC2601	WIRELESS COMMUNICATION	C309.1	Comprehend the impact of noise and interference in wireless communications
			C309.2	Determine the appropriate fading channel models based on the design parameters
			C309.3	Analyze and design diversity and equalization techniques

Code	Course Code	Course Name	CO Code	Course Outcomes
C310	UEC2602	SYSTEM DESIGN FOR IoT	C309.4	Understand the design of multiple access and multi-carrier systems
			C309.5	Analyze the performance of multi antenna systems and different wireless standards
			C310.1	Interpret the fundamental concepts of IoT
			C310.2	Develop IoT Architecture for a particular application scenario
			C310.3	Identify the correct protocol for a specific application
			C310.4	Identify the security issues possible with IoT systems
			C310.5	Design a portable IoT using Raspberry Pi, Analyze applications of IoT in real time Scenario
C311	UEC2603	MICROWAVE AND ANTENNA ENGINEERING	C311.1	Identify and explain the operation of microwave sources and devices
			C311.2	Comprehend antenna parameters and the radiation mechanism of simple antennas to complex antenna structures
			C311.3	Design antennas for given specifications and perform array synthesis
			C311.4	Acquire knowledge on the operation of antennas designed for specific applications
			C311.5	Evaluate antenna and microwave parameters using appropriate systems and techniques
C312	UEC2604	MACHINE LEARNING	C312.1	Describe the fundamental framework of machine learning
			C312.2	Explain the core concepts of Supervised, Unsupervised, Evolutionary and Reinforcement learning
			C312.3	Apply dimensionality reduction techniques for machine learning problems
			C312.4	Explain the artificial neural network and DNN for machine learning applications
			C312.5	Design and implement various machine learning algorithms to solve real-world Applications for societal transformations
			C312.6	Communicate effectively through reflections, reports and presentations for better Teamwork
C313a	UEC2621	INTRODUCTION TO RADAR AND SATELLITE COMMUNICATION	C313a.1	Acquire knowledge on the fundamentals of radar systems
			C313a.2	Analyse various types of radars and its operational functions
			C313a.3	Acquire knowledge on the fundamentals of satellite orbits and earth segment
			C313a.4	Interpret the multiple access schemes for satellite communication
C313b	UEC2622	DIGITAL IMAGE AND VIDEO PROCESSING	C313b.1	Extract images for better understanding of the color information
			C313b.2	Apply transformation on images to develop further understanding
			C313b.3	Apply morphology techniques and BLOB detection
			C313b.4	Apply algorithms for segmentation in video
			C313b.5	Solve object tracking in video

Code	Course Code	Course Name	CO Code	Course Outcomes
C313c	UEC2623	ADVANCED MICROCONTROLLERS	C313c.1	Summarize the key features of RISC architecture
			C313c.2	Comprehend the enriched instruction set of ARM processor
			C313c.3	Summarize the architectural features of ARM Cortex M processor
			C313c.4	Implement the salient features of ARM Cortex M Processor in embedded system design and development
			C313c.5	Summarize the architectural features of MSP 430 Microcontrollers
C313d	UEC2624	NANO ELECTRONICS	C313d.1	Familiarize the basics of nano electronics including quantum wires, dots and wells
			C313d.2	Comprehend the mechanism behind quantum electronic devices
			C313d.3	Analyze the key performance aspects of tunneling and superconducting nano electronic devices
			C313d.4	Explore the development of nanotubes and nanostructure devices
C314	UEC2611	MICROWAVE AND ANTENNAS LABORATORY	C314.1	Characterize microwave components using S parameters
			C314.2	Operate vector network analyzer for microwave measurements
			C314.3	Design antennas and analyze its characteristics
			C314.4	Determine antenna parameters using real-time measurements
C315	UEC2612	SYSTEM DESIGN FOR IoT LABORATORY	C315.1	Use Raspberry Pi for IoT systems
			C315.2	Apply IoT principles and design tools for developing IoT systems
			C315.3	Comprehensively record and report the measured data
			C315.4	Establish connectivity between IoT system and cloud
			C315.5	Implement control applications using IoT
C401	UEC2701	HIGH FREQUENCY COMMUNICATION SYSTEMS	C401.1	Identify the fiber optic communications system and components for networking
			C401.2	Explain the merits of fiber optic networks and multiplexing of light signals
			C401.3	Design free space light communication against atmospheric effects
			C401.4	Art the need for mm Wave Communications systems
			C401.5	Design applications involving mm Wave systems for high bit rate communications
C402	UEC2711	HIGH FREQUENCY COMMUNICATION LABORATORY	C402.1	Implement and demonstrate various digital modulation, transmission and signal processing techniques using NI Hardware platform
			C402.2	Design multicarrier communications using NI USRP platform
			C402.3	Simulate and construe the impact of fading and diversity techniques in wireless Systems
			C402.4	Design and simulate realistic channel models for advanced wireless standards
			C402.5	Analyse the performance of simple optical link by measurement of losses and Analyzing the mode characteristics of fiber

Code	Course Code	Course Name	CO Code	Course Outcomes
C403a	UEC2721	UNDERWATER ACOUSTIC SYSTEM	C403a.1	Summarize the properties of underwater acoustic signal
			C403a.2	Analyze the characteristics of noises in the sea
			C403a.3	Apply the principles of SONAR and acoustic modem
			C403a.4	Acquire knowledge on the challenges in underwater signal processing and sensor networks
C403b	UEC2722	SPEECH TECHNOLOGY	C403b.1	Model speech production system and describe the fundamentals of speech
			C403b.2	Extract and compare various speech features
			C403b.3	Choose an appropriate statistical speech model for a given application
			C403b.4	Build a speech and speaker recognition system
			C403b.5	Build a text-to-speech synthesis system
C403c	UEC2723	EMBEDDED AND REAL TIME OPERATING SYSTEMS	C403c.1	Use the concepts of embedded computing for system design
			C403c.2	Describe the architecture and programming of ARM processor
			C403c.3	Develop and optimize software for embedded systems
			C403c.4	Analyze the concepts of real time Operating system design
			C403c.5	Realize the applications of Distributed Embedded Systems
C403d	UEC2724	MIC AND RF SYSTEMS DESIGN	C403d.1	Interpret the concepts of power divider and couplers at microwave frequencies
			C403d.2	Design microwave filters and amplifier elements
			C403d.3	Design RF and microwave oscillators and mixers
			C403d.4	Describe the application of microwave components in systems
C404a	UEC2725	WIRELESS ADHOC AND SENSOR NETWORKS	C404a.1	Identify the necessity of Ad Hoc networks and Wireless Sensor Networks
			C404a.2	Examine the MAC issues in Ad Hoc and Wireless Sensor Networks
			C404a.3	Describe the sensor node architecture, network and protocol architectures
			C404a.4	Identify the suitable routing algorithm based on the network and user requirement
			C404a.5	Analyze transport layer and security issues possible in ad hoc and sensor networks
			C404a.6	Familiarize with the OS used in WSN and build basic modules using NesC
C404b	UEC2726	OPTIMIZATION IN WIRELESS COMMUNICATION	C404b.1	Summarize concepts of convex sets and functions
			C404b.2	Formulate problems in wireless Communication
			C404b.3	Characterize solutions to convex optimization problems
			C404b.4	Solve optimization problems in MIMO Detection and beamforming
C404c	UEC2727	ASIC and FPGA BASED DESIGN	C404c.1	Explain the features of ASIC Design and various implementation methods of ASIC Design
			C404c.2	Apply design concepts to construct the logic cells and programmable elements
			C404c.3	Describe the architectures of programmable logic block, programmable input-output Block and programmable interconnect of Xilinx, Altera and Actel FPGA/CPLD

Code	Course Code	Course Name	CO Code	Course Outcomes
C404d	UEC2728	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	C404c.4	Apply the concepts of logic synthesis to implement an ASIC Design for a specific target
			C404c.5	Analyze performance of the ASIC using the concepts of simulation, verification and testing
			C404d.1	Define and explain various terms, ideas, issues and methods in the field of EMI/EMC
			C404d.2	Analyze electromagnetic field coupling through apertures
			C404d.3	Critically examine the need for standards and why limits prescribed by different Standards could be widely different
C405a	UEC2729	WIRELESS TECHNOLOGIES	C404d.4	Evaluate the impact of EMI on wireless and broadband technologies
			C405a.1	Build and design wireless networks based on the 3G standards
			C405a.2	Illustrate the concepts behind LTE standard
			C405a.3	Explain the wireless data network related components and its functions
C405b	UEC2731	COMMUNICATION NETWORK SECURITY	C405a.4	Demonstrate advanced knowledge on 5G technologies
			C405b.1	Acquire knowledge on different types of classical, public key cryptographic algorithms, and authentication algorithms
			C405b.2	Apply block ciphers for software and hardware applications
			C405b.3	Analyse various key management techniques
C405c	UEC2732	MIXED SIGNAL DESIGN	C405b.4	Acquire Knowledge on network and Internet security
			C405c.1	Design and analyze sample and hold and design sampling switches
			C405c.2	Design and analyze switched capacitor banks and analog comparators for data Converters
			C405c.3	Design DAC circuits and analyze its performance through its the various parameters
			C405c.4	Design ADC circuits and analyze its performance through its the various parameters
C405d	UEC2733	DIGITAL SIGNAL INTEGRITY	C405c.5	Design MOSFET based amplifier and comparator circuits for data converters
			C405d.1	Apply the fundamental concepts of signal integrity in high speed PCBs
			C405d.2	Identify and resolve crosstalk
			C405d.3	Interpret the frequency dependence of dielectrics
C406	UEC2718	PROJECT WORK PHASE I	C405d.4	Explain the design considerations in channel and I/O circuits
			C406.1	Appreciate the method of undertaking extensive literature review in the chosen area and in identifying a problem statement.
			C406.2	Understand and apply general research and/or development methodology.
			C406.3	Work in groups in carrying out and producing solutions to complex engineering problems.
			C406.4	Apply the engineering and management principles for efficient project management.
C407a	UEC2821	COGNITIVE RADIO	C406.5	Prepare project reports and make organized presentations.
			C407a.1	Acquire knowledge on the concepts and challenges of cognitive radio

Code	Course Code	Course Name	CO Code	Course Outcomes
			C407a.2	Comprehend various standardization activities of cognitive radio
			C407a.3	Apply detection techniques for cognitive radio spectrum sensing
			C407a.4	Implement MAC and Network layer protocols for dynamic spectrum sharing
			C407a.5	Identify the role of cognitive radio for public safety networks and spectrum markets
C407b	UEC2824	INTRODUCTION TO COMPUTERVISION	C407b.1	Describe image formation and fundamental image processing techniques required for computer vision
			C407b.2	Outline feature detectors and implement image matching techniques
			C407b.3	Evaluate motion estimation techniques
			C407b.4	Analyse importance of depth estimation and 3D construction
			C407b.5	Apply Deep learning models for computer vision applications
C407c	UEC2822	CMOS ANALOG IC DESIGN	C407c.1	Design and analyze current and voltage reference and biasing circuits
			C407c.2	Design and analyze CMOS single stage amplifiers based on their performance metrics
			C407c.3	Design and analyze CMOS Differential amplifiers based on their performance metrics
			C407c.4	Design and analyze feedback topologies and frequency response of amplifiers
			C407c.5	Design CMOS operational amplifiers and analyze its performance metrics
C407d	UEC2823	SENSORS, ACTUATORS AND INTERFACES	C407d.1	Classify various sensors & actuators and acquire knowledge of the performance characteristics of sensors and actuators
			C407d.2	Analyze the statistical measurements of sensors subject to different types of errors
			C407d.3	Measure and apply the sensors for various physical parameters
			C407d.4	Apply & Interface sensors and actuators for various real time engineering applications
C408	UEC2818	PROJECT WORK PHASE II	C408.1	Appreciate the method of undertaking extensive literature review in the chosen area and in identifying a problem statement.
			C408.2	Understand and apply general research and/or development methodology.
			C408.3	Work in groups in carrying out and producing solutions to complex engineering problems.
			C408.4	Apply the engineering and management principles for efficient project management.
			C408.5	Prepare project reports and make organized presentations.

Program Educational Objectives (PEOs)

- PEO1 Core Knowledge Development:** Be competent in applying electronics and communication engineering principles to develop socially and environmentally acceptable engineering solutions
- PEO2 Professional development:** Have fulfilling career in electronic and communication engineering or associated industries or higher education and research, or as entrepreneurs
- PEO3 Attitude towards lifelong-learning:** Enhance the ability and attitude to adapt to evolving technological and social challenges

Program Specific Outcomes (PSOs)

- PSO1** Design, develop and analyze electronic systems through application of relevant mathematics and engineering principles
- PSO2** Design, develop and analyze communication systems through application of fundamentals from wireless communication network, signal processing, and RF & electromagnetics
- PSO3** Adapt to emerging electronics and communication technologies and develop innovative solutions for existing and newer problems

Program Outcomes (POs)

- PO1 Engineering knowledge:** Acquire the knowledge of mathematics, science, engineering fundamentals, and electronics and communication engineering, with an ability to understand, analyze and apply to the solution of engineering problems.
- PO2 Problem analysis:** Identify, formulate, research literature, analyse and solve electronics and communication engineering problems.
- PO3 Design/development of solutions:** Design solutions for electronics and communication engineering problems with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4 Conduct investigations of complex problems:** Design and conduct experiments, analyse and interpret data, and synthesize information to provide valid conclusions.
- PO5 Modern tool usage:** Apply appropriate techniques, resources, and modern hardware and software engineering tools to solve electronics and communication engineering problems.
- PO6 The engineer and society:** Apply reasoning to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7 Environment and sustainability:** Demonstrate the understanding of the impact of the professional engineering solutions in societal and environmental contexts, and need for sustainable development.
- PO8 Ethics:** Demonstrate the knowledge of professional and ethical responsibilities.
- PO9 Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10 Communication:** Comprehend and communicate confidently and effectively in both verbal and written form.
- PO11 Project Management and Finance:** Apply the engineering and management principles for efficient project management.
- PO12 Life-long Learning:** Recognize the need and acquire confidence for independent and life-long learning.

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Electronics and Communication Engineering
B.E. Electronics and Communication Engineering

List of Course Outcomes (R2018)

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	UEN1176	COMMUNICATIVE ENGLISH	C101.1	Apply reading strategies to comprehend articles of a general kind in magazines and newspapers
			C101.2	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English
			C101.3	Comprehend conversations and short talks delivered in English in both formal and informal contexts
			C101.4	Write short essays of a general kind and personal letters and emails in English
C102	UMA1176	ALGEBRA AND CALCULUS	C102.1	Obtain the expansion of trigonometric functions using De-Moivre's theorem
			C102.2	Determine the Eigen values and Eigen vectors and diagonalizable the given matrix
			C102.3	Evaluate the circle of curvature, evaluate and envelope of a given curve
			C102.4	Find Taylor's expansion for functions of two variables, solve problems using Jacobians and find the extreme points of a function of two variables
			C102.5	Solve problems using beta and gamma functions and evaluate problems in double integral and triple integral
C103	UPH1176	ENGINEERING PHYSICS	C103.1	Analyze crystal structures and the influence of imperfections on their properties
			C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics
			C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines
			C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication

Code	Course Code	Course Name	CO Code	Course Outcomes
C104	UCY1176	ENGINEERING CHEMISTRY	C104.1	The knowledge gained on water treatment techniques, Polymers, Phase rule, Fuels and electrochemistry and Corrosion will facilitate better understanding of engineering processes and applications for further learning
C105	UGE1176	PROBLEM SOLVING AND PROGRAMMING IN PYTHON	C105.1	Think logically to solve programming problems and write solutions in pseudo code
			C105.2	Understand and develop simple Python programs using conditionals and loops
			C105.3	Decompose a program into functions
			C105.4	Represent compound data using Python lists, tuples, dictionaries
			C105.5	Perform input/output with files
C106	UGE1177	ENGINEERING GRAPHICS	C106.1	Familiarize with the fundamentals and standards of Engineering graphics
			C106.2	Perform freehand sketching of basic geometrical constructions and multiple views of objects
			C106.3	Project orthographic projections of lines and plane surfaces
			C106.4	Draw projections and solids and development of surfaces
			C106.5	Visualize and to project isometric and perspective sections of simple solids
			C106.6	Read a building drawing
C107	UGE1197	PROGRAMMING IN PYTHON LAB	C107.1	To write, test, and debug simple Python programs
			C107.2	To implement Python programs with conditionals and loops
			C107.3	Use functions for structuring Python programs
			C107.4	Represent compound data using Python lists, tuples, and dictionaries
			C107.5	Read and write data from/to files in Python
C108	UGS1197	PHYSICS AND CHEMISTRY LABORATORY	C108.1	The physical properties of materials like elasticity, compressibility, and viscosity.
			C108.2	The optical properties of materials such as diffraction, interference and Numerical aperture.
			C108.3	Thermal and electrical properties of materials such as conductivity and band gap.
			C108.4	Evaluate the quality of water
			C108.5	Determine the metals and ions present in any given sample using various analytical techniques
			C108.6	Measure properties such as conductance of solutions, redox potentials
C109	UEN1276	TECHNICAL ENGLISH	C109.1	Apply reading strategies to comprehend technical texts and write area- specific texts effortlessly
			C109.2	Listen and comprehend lectures and talks in science and technology
			C109.3	Speak appropriately and effectively in varied formal and informal contexts
			C109.4	Write technical documents like reports, emails, resume and winning job applications

Code	Course Code	Course Name	CO Code	Course Outcomes
C110	UMA1276	COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS	C110.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations
			C110.2	Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function
			C110.3	Obtain the Laplace Transforms of standard functions
			C110.4	Solve Differential Equations of Second order and Simultaneous linear equations with constant coefficients of first order using Laplace Transform
			C110.5	Solve problems using divergence and curl and evaluate line, Surface and Volume integrals
C111	UPH1277	PHYSICS FOR ELECTRONICS ENGINEERING	C111.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures
			C111.2	Acquire knowledge on basics of semiconductor physics and its application to simple devices like PN junction devices
			C111.3	Relate the magnetic and superconducting phenomena to their applications
			C111.4	Demonstrate an understanding of dielectric materials, their operational limits and applications
			C111.5	Understand the structure-property relationship of various nano and opto electronic materials and their realization in various domains
C112	UEE1253	BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING	C112.1	Understand the concept of three phase power circuits and measurement
			C112.2	Comprehend the concepts in electrical generators, motors and transformers
			C112.3	Choose appropriate measuring instruments for given application
C113	UEC1201	CIRCUIT ANALYSIS	C113.1	Learn and understand the basic concepts of circuit analysis such as Kirchoff's laws, mesh current and node voltage method for analysis of DC and AC circuits and network topology
			C113.2	Apply the basic circuit analysis concepts and network theorems such as, Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem and Maximum power transfer theorem to DC and AC circuits
			C113.3	Understand and characterize the frequency response of parallel and series resonance circuits, the concept of inductance, coupling and apply it to single and double tuned circuits
			C113.4	Understand the transient response of RC, RL and RLC circuits and characterize two port networks in terms of Z, Y, ABCD and h-parameters

Code	Course Code	Course Name	CO Code	Course Outcomes
			C113.5	Understand the concepts of network synthesis of one port network in Foster and Cauer forms
C114	UEC1202	ELECTRONIC DEVICES	C114.1	Understand the basics of electron ballistics and semiconductor physics
			C114.2	Explain the basics of device physics and working principle of PN Junction diode
			C114.3	Describe the construction, operation and applications of BJT, JFET and MOSFET
			C114.4	Understand the device physics of metal-semiconductor junctions and working principle of special semiconductor devices
			C114.5	Explain the construction and working principle of power semiconductor devices and optoelectronic and display devices
C115	UGE1297	Design Thinking and Engineering Practice Laboratory	C115.1	Ability to fabricate carpentry components
			C115.2	Ability to make the pipe connections including plumbing works.
			C115.3	Ability to use welding equipment's to join the structures.
			C115.4	Ability to fabricate electrical circuits
			C115.5	Ability to fabricate electronics circuits
C116	UEC1211	CIRCUITS AND DEVICES LAB	C116.1	Analyze the characteristics of basic electronic devices
			C116.2	Verify KVL & KCL, Thevenin & Norton theorem, Superposition, Maximum power and Reciprocity theorems
			C116.3	Design RLC and transient RL & RC circuits in PSPICE
C201	UMA1351	LINEAR ALGEBRA AND NUMERICAL METHODS	C201.1	Solve the problems using the concepts of vector spaces, subspaces and linear transformation
			C201.2	Apply linear transformation to diagonalise a given matrix and hence to find the eigen values of the given matrix
			C201.3	Apply Gram-Schmidt's orthogonalization process to diagonalise a given matrix and to solve the given system of equations by least square approximations
			C201.4	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to the linear system of equations
			C201.5	Decompose the matrix using different methods such as QR and singular value decomposition
C202	UEC1301	ELECTRONIC CIRCUITS – I	C202.1	Apply the knowledge of biasing on BJT and FET circuits
			C202.2	Analyze the performance of small-signal BJT and FET in single stage and multi stage amplifiers
			C202.3	Understand the frequency response characteristics of BJT and FET amplifiers
			C202.4	Apply the knowledge gained in the design of electronic circuits

Code	Course Code	Course Name	CO Code	Course Outcomes
C203	UEC1302	DIGITAL SYSTEM DESIGN	C203.1	Understand Boolean algebra and illustrate logic minimization
			C203.2	Design combinatorial logic circuits including arithmetic logic, selection logic and code conversion
			C203.3	Design sequential logic circuits including counters, shift registers and pipeline data path circuits
			C203.4	Design finite state machines: conceptualization, algorithmic translation, state diagram to sequential logic circuits
			C203.5	Design combinational and sequential logic circuits using VHDL
C204	UEC1303	SIGNALS AND SYSTEMS	C204.1	Analyze the properties of signals & systems
			C204.2	Apply Fourier series, Laplace transform, Fourier transform, Z-transform and DTFT in signal analysis
			C204.3	Analyze continuous time LTI systems using Fourier and Laplace Transforms
			C204.4	Analyze discrete time LTI systems using Z-transform and DTFT
C205	UCS1351	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES	C205.1	Design problem solutions using Object Oriented Techniques
			C205.2	Apply the concepts of data abstraction, encapsulation and inheritance for problem solutions
			C205.3	Use the control structures of C++ appropriately
			C205.4	Critically analyze the various algorithms
			C205.5	Apply the different data structures to problem solutions
C206	UEC1304	ELECTROMAGNETIC FIELDS	C206.1	Demonstrate knowledge and understanding of fundamental electromagnetic laws and concepts
			C206.2	Display an understanding of the effect of materials on electric and magnetic fields
			C206.3	Analyze electric and magnetic field quantities from simple charge and current distributions
			C206.4	Analyze electric and magnetic field from a plane wave normally incident on a metallic dielectric material
C207	UCS1371	OOP AND DATA STRUCTURES LAB	C207.1	Apply object oriented programming features in program development
			C207.2	Write recursive functions
			C207.3	Implement linked lists, stacks, queues
			C207.4	To use data structures for solving problems
C208	UEC1311	ANALOG AND DIGITAL CIRCUITS LAB	C208.1	Design and test BJT/JFET amplifiers
			C208.2	Differentiate cascode and cascade amplifiers
			C208.3	Analyze the limitation in bandwidth of single stage and multistage amplifiers

Code	Course Code	Course Name	CO Code	Course Outcomes
C209	UMA1477	PROBABILITY THEORY AND STOCHASTIC PROCESSES	C208.4	Measure the CMRR in differential amplifier
			C208.5	Simulate and analyze amplifier circuits using PSpice
			C208.6	Design and test the digital logic circuits
			C209.1	Identify standard distributions and apply them
			C209.2	Solve problems in two dimension random variables and find the correlation between them
			C209.3	To analyze different types of random processes
			C209.4	Find the relation between Auto correlation function and Power density spectrum
			C209.5	Find the response of random inputs to linear time invariant systems
C210	UCY1276	ENVIRONMENTAL SCIENCE	C210.1	Understand the importance of the environment and describe the structure and functions of an ecosystem
			C210.2	Identify the value and need for conservation of bio-diversity
			C210.3	Know the importance of natural resources and its equitable use for sustainable life styles
			C210.4	Explain the causes, effects and control measures of different types of pollution
			C210.5	Understand various environmentally related social issues and their solutions
			C210.6	Recall the tools for environmental regulations
			C210.7	Relate the role of environment in human population growth and development
			C210.8	Get knowledge about various techniques used for environmental monitoring and management
C211	UEC1401	ELECTRONIC CIRCUITS II	C211.1	Acquire knowledge on the concept of feedback in amplifiers and oscillators
			C211.2	Design and analyze feedback amplifiers and oscillators
			C211.3	Analyze the performance of tuned amplifiers
			C211.4	Design and analysis of wave shaping circuits and multivibrators
			C211.5	Analysis and design of power amplifiers and DC converters
C212	UEC1402	DIGITAL SIGNAL PROCESSING	C212.1	Apply discrete Fourier transform for the analysis of digital signals and systems
			C212.2	Design and realize a frequency selective digital IIR filters
			C212.3	Design and realize FIR filters
			C212.4	Characterize quantization effects in digital filters
			C212.5	Apply the concepts of multirate processing, adaptive filtering in engineering applications
C213	UEC1403	LINEAR INTEGRATED CIRCUITS	C213.1	Design linear and nonlinear applications of Op-amps
			C213.2	Demonstrate applications using analog multiplier and PLL
			C213.3	Design ADC and DAC using Op-amps

Code	Course Code	Course Name	CO Code	Course Outcomes
C214	UEC1404	PRINCIPLES OF COMMUNICATION SYSTEMS	C213.4	Synthesize waveforms using Op-amp Circuits
			C213.5	Design circuits using special function ICs
			C214.1	Design AM communication systems.
			C214.2	Design Angle modulated communication systems
			C214.3	Apply the concepts of Random Process to the design of Communication systems
			C214.4	Analyze the noise performance of AM and FM systems
			C214.5	Apply the concepts of source coding techniques for the design of Communication systems
C215	UEC1411	ELECTRONIC CIRCUITS II AND LIC LAB	C215.1	Analyze various types of feedback amplifiers
			C215.2	Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators
			C215.3	Design amplifiers and oscillators using operational amplifiers
			C215.4	Design filters using op-amp and performs an experiment on frequency response
			C215.5	Design of voltage regulator using ICs
			C215.6	Analyze the performance of active filters, multivibrators, and Schmitt trigger using PSpice
C216	UEC1412	DIGITAL SIGNAL PROCESSING LAB	C216.1	Carry out simulation of various time-domain operations of DSP systems
			C216.2	Implement DFT/FFT to analyse the frequency spectrum of the DT signals
			C216.3	Demonstrate their abilities towards DSP processor based implementation of FIR and IIR filters
			C216.4	Analyse the impact of finite word length effect on DSP systems
			C216.5	Design adaptive filters and multi-rate systems for various applications of DSP
C301	UEC1501	DIGITAL COMMUNICATION	C301.1	Digitally represent analog signals through sampling & quantization
			C301.2	Apply the knowledge of ISI problems and derive Nyquist Criteria for zero ISI
			C301.3	Compare error probability of different digital modulation schemes
			C301.4	Describe spread spectrum modulation scheme and Illustrate both DS and FH systems
			C301.5	Apply various error control coding schemes over information bits
C302	UEC1502	MICROPROCESSOR , MICROCONTROLLER AND INTERFACING	C302.1	Understand the architecture of 8086 microprocessor and 8051 microcontroller
			C302.2	Apply programming techniques in developing the assembly language program for microprocessor applications
			C302.3	Apply programming techniques in developing the assembly language program for microcontroller applications
			C302.4	Understand various types of interfacing devices with other peripheral devices

Code	Course Code	Course Name	CO Code	Course Outcomes
			C302.5	Design and Construct Microprocessor and Microcontroller based Systems
C303	UEC1503	TRANSMISSION LINES AND WAVEGUIDES	C303.1	Construct simple filters using the knowledge of passive filter theory
			C303.2	Develop a transmission line model
			C303.3	Comprehend the working of transmission line at radio frequencies
			C303.4	Analyze the problems in RF line and stub matching using Smith chart
			C303.5	Characterize the wave propagation in parallel plates and wave guides
C304	UCS1551	COMPUTER ARCHITECTURE AND ORGANISATION	C304.1	Understand the basics structure of computers, operations and instructions
			C304.2	Design arithmetic and logic unit
			C304.3	Understand pipelined execution and design control unit
			C304.4	Understand parallel processing architectures
			C304.5	Understand the design of various memory systems and I/O communication
C305	UEE1551	CONTROL SYSTEMS ENGINEERING	C305.1	Understand the importance of mathematical modeling of systems
			C305.2	Analyze control systems with respect to time domain and frequency domain
			C305.3	Verify the stability of the system
			C305.4	Design compensators to meet the desired specifications
			C305.5	Implement P, PI and PID controllers for a given application
C306	UEC1511	ANALOG AND DIGITAL COMMUNICATION LAB	C306.1	Simulate & validate the various functional modules of a communication system
			C306.2	Demonstrate their knowledge in baseband signaling schemes through simulation of digital modulation schemes
			C306.3	Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system
			C306.4	Simulate end-to-end communication Link
C307	UEC1512	MICROPROCESSOR AND MICROCONTROLLER LAB	C307.1	Develop and execute simple assembly language programs using 8086 and 8051 instruction sets
			C307.2	Interface different I/O interfaces with 8086 and 8051
			C307.3	Develop assembly language programs to program 8051's internal resources
C308	UEN1597	PROFESSIONAL COMMUNICATIONS LAB	C308.1	Make effective presentations
			C308.2	Participate confidently in Group Discussions
			C308.3	Attend job interviews and be successful in them
			C308.4	Develop adequate Soft Skills required for the workplace
C309a	UEC1521	INFORMATION THEORY AND	C309a.1	Design source coding systems
			C309a.2	Design and implement coding techniques

Code	Course Code	Course Name	CO Code	Course Outcomes
		CODING	C309a.3	Evaluate the information capacity of discrete memoryless channels and determine the capacity
			C309a.4	Analyze rate distortion theory
C309b	UEC1522	ADVANCED DIGITAL SIGNAL PROCESSING	C309b.1	Understand the power spectral density and apply to discrete random signals and systems
			C309b.2	Analyze non- parametric methods and parametric methods for spectral estimation
			C309b.3	Analyze signal modeling techniques to discrete random signals
			C309b.4	Apply linear estimation and prediction techniques to discrete random signals for signal separation, detection and estimation
			C309b.5	Apply optimum filtering techniques for discrete random signals
			C309b.6	Apply the concepts of compressed sensing for signal processing applications
C309c	UEC1523	SPEECH SIGNAL PROCESSING	C309c.1	Understand the fundamentals of speech production and apply the same in building spoken language systems
			C309c.2	Apply time and frequency domain properties in speech-based applications
			C309c.3	Understand the significance of non-parametric spectrum estimation technique
			C309c.4	Apply linear prediction in extracting speech features
			C309c.5	Apply signal processing techniques for building robust speech-based systems
C309d	UEC1524	SOFT COMPUTING TECHNIQUES	C309d.1	Choose suitable soft computing techniques for various applications
			C309d.2	Design learning algorithms for neural network in pattern classification and regression problems
			C309d.3	Use fuzzy logic in decision making systems
			C309d.4	Apply Genetic Algorithms for optimization of engineering problems
			C309d.5	Integrate various soft computing techniques for complex engineering problems
C309e	UEC1525	NANO ELECTRONICS	C309e.1	Understand the basics of nano electronics including quantum wires, dots and wells
			C309e.2	Use the mechanism behind quantum electronic devices
			C309e.3	Analyze the key performance aspects of tunneling and superconducting nano electronic devices
			C309e.4	Apply the knowledge in the development of nanotubes and nanostructure devices
C310	UEC1601	PRINCIPLES OF VLSI DESIGN	C310.1	Learn various design principles and design methodologies of VLSI design
			C310.2	Understand construction, operation, characteristics, layout and fabrication of MOS Transistor and CMOS Inverter
			C310.3	Design and develop the layouts for CMOS Combinational & Sequential Logic Circuits and Subsystem Design
			C310.4	Understand various methods used to test CMOS Combinational & Sequential Logic

Code	Course Code	Course Name	CO Code	Course Outcomes
				Circuits and Subsystems
C311	UEC1602	WIRELESS COMMUNICATIONS	C311.1	Determine the types and appropriate fading channel models based on the design parameters
			C311.2	Analyze and design multiple access and modulation techniques for wireless systems
			C311.3	Analyze and design equalization techniques
			C311.4	Understand the modulation and coding in the design of multi-carrier systems
			C311.5	Determine the transceiver techniques including multi antenna systems
C312	UEC1603	SYSTEM DESIGN FOR IoT	C312.1	Interpret the fundamental concepts of IoT
			C312.2	Develop IoT Architecture for a particular application scenario
			C312.3	Identify the correct protocol for a specific application
			C312.4	Identify the security issues possible with IoT systems
			C312.5	Design a portable IoT using Raspberry Pi, Analyze applications of IoT in real time scenario
C313	UEC1604	COMMUNICATION NETWORKS	C313.1	Identify various networking components and their respective roles in a communication system
			C313.2	Choose the required functionality at each layer for given application
			C313.3	Trace the flow of information from one node to another node in the network
			C313.4	Design, calculate and apply subnet masks and addresses and identify routing mechanisms to fulfill networking requirements
			C313.5	Analyze the features and operations of various application layer protocols such as HTTP and Email
C314	UEC1605	MACHINE LEARNING	C314.1	Distinguish between various learning methods
			C314.2	Implement machine learning algorithms for a given application
			C314.3	Suggest a learning algorithm for a given problem and modify machine learning algorithms
			C314.4	Apply graphical models appropriately
			C314.5	Understand and apply neural network-based learning algorithm
C315	UEC1611	VLSI DESIGN LAB	C315.1	Write HDL code for basic as well as advanced digital integrated circuits.
			C315.2	Import and verify the functionality the logic modules into FPGA Trainer.
			C315.3	Design, Simulate and Extract the layouts of Digital Building Blocks using EDA tools.
C316	UEC1612	SYSTEM DESIGN FOR IoT LAB	C316.1	Use Raspberry Pi for IoT systems
			C316.2	Apply IoT principles and design tools for developing IoT systems
			C316.3	Comprehensively record and report the measured data

Code	Course Code	Course Name	CO Code	Course Outcomes
C317a	UEC1621	SPEECH TECHNOLOGY	C316.4	Establish connectivity between IoT system and cloud
			C316.5	Implement control applications using IoT
			C317a.1	Model speech production system and describe the fundamentals of speech
			C317a.2	Extract and compare different speech parameters
			C317a.3	Choose an appropriate statistical speech model for a given application
			C317a.4	Build a speech and speaker recognition system
C317b	UEC1622	SENSORS, ACTUATORS, AND INTERFACE ELECTRONICS	C317a.5	Build a text-to-speech synthesis system
			C317b.1	Select sensors for the measurement of physical variables for real time applications
			C317b.2	Use sensors for optoelectronic applications
			C317b.3	Understand and apply actuators for engineering applications
C317c	UEC1623	INTRODUCTION TO MEMS AND NEMS	C317b.4	Interface different sensors for engineering applications
			C317c.1	Understand the basics of micro/nano electromechanical structures, devices and systems including their theoretical foundations, applications and advantages
			C317c.2	Recognize the use of materials in micro/nano fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA
			C317c.3	Analyze the key performance aspects of micro/nano electromechanical transducers including sensors and actuators
C317d	UEC1624	ADVANCED MICROCONTROLLERS	C317c.4	Understand the techniques for characterization and packaging requirements of MEMS/NEMS
			C317d.1	Explain the features and important specifications of modern microprocessors
			C317d.2	Explain the salient features of CISC microprocessors based on IA-32 bit and IA-64 bit architectures
			C317d.3	Explain the salient features of RISC processors based on ARM architecture and different application profiles of ARM core
			C317d.4	Explain the features and important specifications of modern microcontrollers
			C317d.5	Explain about ARM – M3 architecture and its salient features
C317e	UEC1625	WIRELESS ADHOC AND SENSOR NETWORKS		Implement designs using MSP430 and ARM processors
			C317e.1	Identify the necessity of Ad Hoc networks and Wireless Sensor Networks
			C317e.2	Examine the MAC issues in Ad Hoc and Wireless Sensor Networks
			C317e.3	Describe the sensor node architecture, network and protocol architectures
			C317e.4	Identify the suitable routing algorithm based on the network and user requirement
			C317e.5	Understand the transport layer and security issues possible in Ad Hoc and sensor networks

Code	Course Code	Course Name	CO Code	Course Outcomes
			C317e.6	Understand the OS used in Wireless Sensor Networks and build basic modules using NesC
C401	UEC1701	HIGH FREQUENCY COMMUNICATION SYSTEMS	C401.1	Understand the fiber optic communications system and the components of networking
			C401.2	Explain the merits of fiber optic networks and multiplexing of light signals
			C401.3	Design free space light communication against atmospheric effects
			C401.4	Appraise the need for mmWave communications systems
			C401.5	Design applications involving mmWave systems for high bit rate communications
C402	UEC1702	MICROWAVE ENGINEERING AND ANTENNAS	C402.1	Explain the radiation mechanism of simple antennas to complex antenna structures
			C402.2	Perform array synthesis
			C402.3	Identify and explain the operation of microwave sources and devices
			C402.4	Understand antenna and microwave measurement systems and techniques.
C403	UEC1703	PROFESSIONAL ETHICS AND MANAGEMENT PRACTICES	C403.1	Reflect on the importance of ethics in professional sphere
			C403.2	Display an understanding of the fundamental aspects of management
			C403.3	Critically reflect on aspects such as organizational culture, employee motivation and organizational strategy
C404	UEC1711	WIRELESS COMMUNICATION LAB	C404.1	Implement various digital modulation, detection schemes using NI Hardware platform
			C404.2	Design multicarrier systems based on NI USRP platform
			C404.3	Perform simulation and interpret results for fading models and diversity techniques
			C404.4	Construct simulation model for advanced wireless transmission techniques
C405	UEC1712	MICROWAVE AND ANTENNAS LAB	C405.1	Characterize microwave components using S parameters
			C405.2	Handle vector network analyzer for microwave measurements
			C405.3	Design antennas and analyze its characteristics
			C405.4	Perform real time measurement of antenna parameters
C406a	UEC1721	CMOS ANALOG IC DESIGN	C406a.1	Understand the fundamentals of analog IC design
			C406a.2	Design CMOS single stage amplifiers, differential and operational amplifiers for the desired specifications
			C406a.3	Analyze various performance parameters such as gain, bandwidth and noise figure of CMOS single stage amplifiers, differential and operational amplifiers
			C406a.4	Understand the fundamentals and architectures of CMOS data converters
C406b	UEC1722	DIGITAL IMAGE AND VIDEO PROCESSING	C406b.1	Process images for better understanding of the information present
			C406b.2	Apply image transforms to develop further understanding on frequency domain
			C406b.3	Apply image processing techniques for restoration and object segmentation

Code	Course Code	Course Name	CO Code	Course Outcomes
			C406b.4	Develop algorithms for image feature extraction and classification
			C406b.5	Estimate motion components for video processing
C406c	UEC1723	DIGITAL SIGNAL INTEGRITY	C406c.1	Apply the fundamental concepts of signal integrity in high speed PCBs
			C406c.2	Identify and resolve crosstalk
			C406c.3	Interpret the frequency dependence of dielectrics
			C406c.4	Design a system with reduced interference effects
C406d	UEC1724	MIC AND RF SYSTEMS DESIGN	C406d.1	Understand the concepts of transmission lines at microwave frequencies
			C406d.2	Design impedance matching circuits using lumped and distributed elements
			C406d.3	Design active and passive microwave components
			C406d.4	Understand the application of microwave components in systems
C406e	UEC1725	EMBEDDED AND REAL TIME OPERATING SYSTEMS	C406e.1	Acquire knowledge on basic components of embedded system design
			C406e.2	Understand the architectural strength of ARM processor
			C406e.3	Acquire knowledge on fundamentals of RTOS and its various scheduling policies
			C406e.4	Apply the features of RTOS in the process of application development
C407a	UEC1726	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	C407a.1	Demonstrate knowledge of the various sources of electromagnetic interference
			C407a.2	Display an understanding of the effect of how electromagnetic fields couple through apertures, and solve simple problems based on that understanding
			C407a.3	Explain the EMI mitigation techniques of shielding and grounding
			C407a.4	Explain the need for standards and EMC measurement methods
			C407a.5	Discuss the impact of EMC on wireless and broadband technologies
C407b	UEC1727	COMPUTER VISION	C407b.1	Implement fundamental image processing techniques required for computer vision
			C407b.2	Perform shape analysis and Implement boundary tracking techniques
			C407b.3	Apply 3D vision techniques
			C407b.4	Apply Deep learning for computer vision applications
			C407b.5	Develop applications using computer vision techniques
C407c	UEC1728	COGNITIVE RADIO	C407c.1	Understand fundamental concepts and challenges of cognitive radio.
			C407c.2	Describe the spectrum regulation and standardization activities of cognitive radio.
			C407c.3	Apply detection techniques for cognitive radio spectrum sensing.
			C407c.4	Implement MAC and Network layer protocols for dynamic spectrum access in cognitive radio.
			C407c.5	Understand the applicability of cognitive radio for public safety, spectrum markers

Code	Course Code	Course Name	CO Code	Course Outcomes
				Internet of Things.
C407d	UEC1729	ASIC AND FPGA BASED DESIGN	C407d.1	Understand the basics of ASIC Design, various ASIC Design Methodologies
			C407d.2	Understand the construction of combinational and sequential logic cells
			C407d.3	Learn the different types of programming technologies the architectures of Xilinx, Altera and Actel FPGA families
			C407d.4	Learn the steps involved in sequential and combinational logic synthesis, structural, static timing analysis, and gate level Simulation and testing methods
			C407d.5	Comprehend various steps involved in ASIC physical design partitioning; floor planning, and placements and routing
C407e	UEC1731	WIRELESS TECHNOLOGY	C407e.1	Apply Digital cellular concepts in the design of Cellular networks
			C407e.2	Build and Design the wireless networks based on the IEEE 802.16 standard
			C407e.3	Explain the LTE related components and its functions
			C407e.4	Demonstrate advanced knowledge of networking and performance of data networks and define performance metrics
			C407e.5	Explain the concepts behind the cognitive wireless networks and next generation networks
C408	UEC1718	PROJECT WORK	C408.1	Appreciate the method of undertaking extensive literature review in the chosen area and in identifying a problem statement.
			C408.2	Understand and apply general research and/or development methodology.
			C408.3	Work in groups in carrying out and producing solutions to complex engineering problems.
			C408.4	Apply the engineering and management principles for efficient project management.
			C408.5	Prepare project reports and make organized presentations.
C409a	UEC1821	COMMUNICATION NETWORK SECURITY	C409a.1	Learn different types of classical cipher and public key cryptographic algorithms
			C409a.2	Understand and learn to use block ciphers for both software and hardware applications
			C409a.3	Understand and apply the MAC and Hash authentication algorithms for wireless network applications
			C409a.4	Analyze different types of attacks existing in wireless networks and learn to mitigate them
			C409a.5	Understand and apply cryptographic algorithms in FPGA
			C409a.6	Understand quantum cryptography and block chaining technology
C409b	UEC1822	MIXED SIGNAL DESIGN	C409b.1	Understand and design sample/hold circuits, and analog Comparators
			C409b.2	Understand and analyze Digital to Analog converters

Code	Course Code	Course Name	CO Code	Course Outcomes
C409c	UEC1823	INTRODUCTION TO RADAR AND SATELLITE COMMUNICATION	C409b.3	Understand and analyze Analog to Digital converters
			C409b.4	Understand and analyze Power Amplifiers and data converter interfaces
			C409c.1	Understand the radar fundamentals and analysis of the radar signals
			C409c.2	Understand design of radar transmitters and receivers
			C409c.3	To learn various radars like MTI, Doppler and tracking radars and their comparison
			C409c.4	Demonstrate a clear understanding of the satellite communication
			C409c.5	Study the various segments in satellite communication with broadcast and access techniques
			C409c.6	Understand the GPS system and its operation with applications.
C409d	UEC1824	OPTIMIZATION IN WIRELESS COMMUNICATION	C409d.1	Apply the basic concepts of vector and matrix algebra, including linear dependence / independence, basis and dimension of a subspace, rank and nullity, for the analysis of wireless systems
			C409d.2	Recognize problems in wireless systems that can be formulated as convex optimization
			C409d.3	Explain the role of convex optimization in MIMO and cooperative communications
			C409d.4	Develop a research project in the area of wireless communications
C409e	UEC1825	UNDERWATER COMMUNICATION	C409e.1	Understand the properties of underwater acoustic signal
			C409e.2	Understand the characteristics of noises in sea
			C409e.3	Understand the principles of SONAR and acoustic modem
			C409e.4	Understand the challenges in underwater signal processing and sensor networks
C410	UEC1818	PROJECT WORK	C410.1	Appreciate the method of undertaking extensive literature review in the chosen area and in identifying a problem statement.
			C410.2	Understand and apply general research and/or development methodology.
			C410.3	Work in groups in carrying out and producing solutions to complex engineering problems.
			C410.4	Apply the engineering and management principles for efficient project management.
			C410.5	Prepare project reports and make organized presentations.

Program Educational Objectives (PEOs)

- PEO1 Core Knowledge Development:** Be competent in applying electronics and communication engineering principles to develop socially and environmentally acceptable engineering solutions
- PEO2 Professional development:** Have fulfilling career in electronic and communication engineering or associated industries or higher education and research, or as entrepreneurs
- PEO3 Attitude towards lifelong-learning:** Enhance the ability and attitude to adapt to evolving technological and social challenges

Program Specific Outcomes (PSOs)

- PSO1** Design, develop and analyze electronic systems through application of relevant mathematics and engineering principles
- PSO2** Design, develop and analyze communication systems through application of fundamentals from wireless communication network, signal processing, and RF & electromagnetics
- PSO3** Adapt to emerging electronics and communication technologies and develop innovative solutions for existing and newer problems

Program Outcomes (POs)

- PO1 Engineering knowledge:** Acquire the knowledge of mathematics, science, engineering fundamentals, and electronics and communication engineering, with an ability to understand, analyze and apply to the solution of engineering problems.
- PO2 Problem analysis:** Identify, formulate, research literature, analyse and solve electronics and communication engineering problems.
- PO3 Design/development of solutions:** Design solutions for electronics and communication engineering problems with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4 Conduct investigations of complex problems:** Design and conduct experiments, analyse and interpret data, and synthesize information to provide valid conclusions.
- PO5 Modern tool usage:** Apply appropriate techniques, resources, and modern hardware and software engineering tools to solve electronics and communication engineering problems.
- PO6 The engineer and society:** Apply reasoning to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7 Environment and sustainability:** Demonstrate the understanding of the impact of the professional engineering solutions in societal and environmental contexts, and need for sustainable development.
- PO8 Ethics:** Demonstrate the knowledge of professional and ethical responsibilities.
- PO9 Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10 Communication:** Comprehend and communicate confidently and effectively in both verbal and written form.
- PO11 Project Management and Finance:** Apply the engineering and management principles for efficient project management.
- PO12 Life-long Learning:** Recognize the need and acquire confidence for independent and life-long learning.

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Electronics and Communication Engineering
M.E. Applied Electronics

List of Course Outcomes (R2018)

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	PMA1176	ADVANCED APPLIED MATHEMATICS	C101.1	Understand the concepts on vector spaces, linear transformation, inner product spaces, eigen values and generalized eigen vectors. Apply various methods in linear algebra to solve system of linear equations.
			C101.2	Develop a fundamental understanding of linear programming models and apply the simplex method for solving linear programming problems.
			C101.3	Solve numerical solution of differential equations by single and multistep methods.
			C101.4	Understand two dimensional random variables, correlations and regression.
			C101.5	Understand the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.
C102	PAE1101	STATISTICAL SIGNAL PROCESSING	C102.1	Understand and apply the concepts of special random processes in digital system designing
			C102.2	Choose appropriate spectrum estimation techniques for a given random process
			C102.3	Analyze signal modeling techniques to discrete random signals
			C102.4	Apply linear estimation and prediction techniques to discrete random signals for signal separation, detection and estimation
			C102.5	Apply optimum filtering techniques for processing non-stationary signals
C103	PAE1176	ADVANCED DIGITAL SYSTEM DESIGN	C103.1	Design and analyze synchronous and asynchronous sequential circuits.
			C103.2	Design asynchronous hazard free sequential circuits.
			C103.3	Apply appropriate testing algorithms to detect the fault.
			C103.4	Analyze combinational, sequential circuits using Verilog.
			C103.5	Design and Analyze sequential circuits in high end FPGAs with SoC architecture.
C104	PAE1177	SENSORS, ACTUATORS AND SYSTEM	C104.1	Explain the definitions and terminologies used in a measurement system
			C104.2	Explain the performance characteristics of the measurement system
			C104.3	Explain the resistive and reactive sensors

Code	Course Code	Course Name	CO Code	Course Outcomes
		INTERFACE	C104.4	Discuss and analyse the Self-generating sensors
			C104.5	Compare different types of sensors and actuators and learn their applications
			C104.6	Evaluate digital sensors and semiconductor device sensors and interface sensors for various applications
C105	PVL1176	ANALOG INTEGRATED CIRCUIT DESIGN	C105.1	Design single stage amplifier circuits using MOS transistors with different loads and CMOS sub-circuits
			C105.2	Understand the concept of Differential Amplifier and analyse its frequency response.
			C105.3	Understand the characteristics of one stage and two stage operational amplifiers
			C105.4	Develop an ability to parse operational amplifier circuits and analyze the circuits as a whole, including for noise, mismatch, and linearity.
			C105.5	Understand and analyse the high frequency response and noise characteristics of single stage amplifiers.
C106	PVL1177	DIGITAL CMOS VLSI DESIGN	C106.1	Design basic digital circuits in transistor level
			C106.2	Analyze and choose suitable logical styles for a given problem
			C106.3	Analyze and optimize the transistor level circuits
			C106.4	Measure the delay, analyze and find the optimized delay.
C107	PAE1111	ELECTRONIC SYSTEM DESIGN LABORATORY - I	C107.1	Create various logic modules in FPGA using VHDL and Verilog
			C107.2	Analyse the module with FPGA design flow
			C107.3	Understand and demonstrate complete design flow of basic VLSI circuits
C108	PAE1115	TECHNICAL SEMINAR	C108.1	Reflect on the purpose of communication, and on the ways of making effective presentations
			C108.2	Explain the role language skill, reading and listening play in effective communication
			C108.3	Make improved presentation on a topic from within their specialty
C109	PAE1276	EMBEDDED SYSTEM DESIGN FOR IoT	C109.1	Understand the fundamental concepts of IoT.
			C109.2	Identify the correct microcontrollers for IoT sensors.
			C109.3	Develop IoT Architecture for a particular application scenario and Identify the correct protocol for a specific application.
			C109.4	Design a portable IoT using Raspberry Pi.
			C109.5	Deploy an IoT application for real time scenario and connect to the cloud.
C110	PAE1277	VLSI SYSTEM DESIGN	C110.1	Understand the complete ASIC design flow
			C110.2	Understand the steps involved in synthesis, simulation and testing of systems
			C110.3	Apply different high performance algorithms in ASICs
			C110.4	Evaluate the design issues of SOC

Code	Course Code	Course Name	CO Code	Course Outcomes
C111	PAE1278	MEMS AND NEMS	C111.1	Understand the basics of micro/nano electromechanical structures, devices and systems including their theoretical foundations, applications and advantages
			C111.2	Understand the use of materials in micro/nano fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA
			C111.3	Analyze the key performance aspects of micro/nano electromechanical transducers including sensors and actuators
			C111.4	Understand the characterization requirements of MEMS/NEMS
C112a	PAE1279	NANO ELECTRONICS AND TECHNOLOGY	C112a.1	Understand the basics and the theoretical foundations of Nano-electronics.
			C112a.2	Understand the use of synthesis methods and describe the properties of Nanomaterials.
			C112a.3	Analyze the key performance aspects of Nano-electronic devices and its characterization
			C112a.4	Understand the applications of nanotechnology.
C112b	PAE1281	DSP PROCESSOR ARCHITECTURE AND PROGRAMMING	C112b.1	Understand various DSP architecture and its programming
			C112b.2	To create and analyse a simple DSP based System
C112c	PAE1221	RF TEST AND MEASUREMENT	C112c.1	Understand the basics of RF measurement and related parameters associated with measurements
			C112c.2	Understand the instrumentation of measuring devices
			C112c.3	Evaluate the performance of samples such as Antennas and RF components
			C112c.4	Understand the management of various test processes for EMI/EMC
			C112c.5	Understand and identify the correct measurement technique and procedure for RF testing
C112d	PAE1282	ADVANCED DIGITAL IMAGE PROCESSING	C112d.1	Analyze and extract image features and apply it for various image processing tasks
			C112d.2	Evaluate the methodologies for image enhancement, segmentation, restoration etc.,
			C112d.3	Apply and analyze image processing techniques and algorithms
			C112d.4	Apply image processing algorithms to practical applications
C113a	PCN1276	PATTERN RECOGNITION AND MACHINE LEARNING	C113a.1	Classify the data and identify the patterns
			C113a.2	Apply dimensionality reduction techniques
			C113a.3	Choose an appropriate pattern recognition system for the given data
			C113a.4	Solve linearly non-separable pattern recognition problems using SVMs
			C113a.5	Apply neural networks for suitable pattern recognition problems
C113b	PAE1222	RECONFIGURABLE VLSI ARCHITECTURES	C113b.1	Understand and identify the need for reconfigurable architectures
			C113b.2	Understand and discuss the various architecture of reconfigurable computing systems
			C113b.3	Design and Develop applications using Hardware Description Languages and appropriate tools

Code	Course Code	Course Name	CO Code	Course Outcomes
C113c	PVL1276	DATA CONVERTERS	C113b.4	Design and develop Reconfigurable Systems-On-Chip
			C113c.1	Create and analyze sample and hold circuits.
			C113c.2	Create and analyze analog to digital and digital to analog converters.
			C113c.3	Analyze ADC and DAC architectures and its performance.
			C113c.4	Understand calibration techniques.
C113d	PVL1278	MICROWAVE INTEGRATED CIRCUITS	C113d.1	Create and analyze impedance matching circuits using LC components and stubs
			C113d.2	Create and analyze microwave components such as power dividers, couplers, filters
			C113d.3	Create and analyze amplifiers and oscillators at microwave frequencies and perform stability analysis
C114a	PAE1223	ROBOTICS FOR ENGINEERS	C114a.1	Understand and explain the concepts of industrial robots along with the need and application of robots & automation
			C114a.2	Examine different sensors and actuators for applications like maze solving and self-driving cars
			C114a.3	Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots
			C114a.4	Understand and explain navigation and path planning techniques along with the control architectures adopted for robot motion planning
			C114a.5	Understand and describe the impact and progress in AI and other research trends in the field of robotics
C114b	PCN1277	MULTIMEDIA COMPRESSION TECHNIQUES	C114b.1	Understand text, audio and 3D compression algorithms and compare their efficiencies
			C114b.2	Apply knowledge for identifying a suitable strategy for compression of text, image, audio and video
			C114b.3	Analyze different compression techniques and standards for image and video
			C114b.4	Apply the compression concepts in multimedia communication
C114c	PVL1277	SIGNAL INTEGRITY FOR HIGH SPEED DESIGN	C114c.1	Apply the fundamental concepts of signal integrity in high speed PCBs
			C114c.2	Analyze and resolve cross talk
			C114c.3	Model the channels, I/O circuits and be able to perform budgeting
C114d	PCN1279	CRYPTOGRAPHY AND NETWORK SECURITY	C114d.1	Understand different types of classical and public key cryptographic algorithms
			C114d.2	Remember and apply block ciphers for software and hardware applications
			C114d.3	Evaluate the authentication algorithms
			C114d.4	Understand various attacks existing in different networks and learn to mitigate the attacks

Code	Course Code	Course Name	CO Code	Course Outcomes
C115	PAE1211	ELECTRONIC SYSTEM DESIGN LABORATORY - II	C115.1	Understand the embedded processor with special features and invoking RTOS features
			C115.2	Create and analyze the real time signal processing system using embedded processor
C116	PAE1215	TECHNICAL WRITING	C116.1	Understand and conduct effective literature review on any chosen topic
			C116.2	Understand the structure of professional communication such as emails, cover letters, manuscripts and reports and be able to write them
			C116.3	Create a technical paper and a report
C201a	PAE1376	WAVELET TRANSFORMS AND ITS APPLICATIONS	C201a.1	Apprehend the detailed knowledge about the Wavelet transforms
			C201a.2	Design wavelet filter bank for various signal processing applications
C201b	PAE1321	SATELLITE COMMUNICATION AND NAVIGATION SYSTEMS	C201b.1	Understand the fundamentals of satellite communication and various subsystems of satellite
			C201b.2	Analyze satellite communication with broadcast and Access Techniques
			C201b.3	Study about various applications of modern satellite systems in day today life
			C201b.4	Demonstrate a clear understanding GPS signal, codes and discuss the practical applications of GPS and the implications of its modernization
C201c	PVL1378	SIGNAL PROCESSING FOR VLSI	C201c.1	Understand the design of FIR filters with pipelining and parallel processing techniques
			C201c.2	Use various optimization techniques for the improved realization of FIR based DSP structures
			C201c.3	Use of different optimization techniques for the improved realization of IIR based DSP structures
			C201c.4	Ability to design optimized bit level arithmetic structures
			C201c.5	Comprehend various numerical strength reduction techniques and clocking strategies of DSP architectures
C201d	PAE1377	ADVANCED COMPUTER ORGANIZATION AND ARCHITECTURE	C201d.1	Describe computer architecture concepts and mechanisms related to the design of modern processors, memories, and networks and explain how these concepts and mechanisms interact
			C201d.2	Apply this understanding to new computer architecture design problems within the context of balancing application requirements against technology constraints
			C201d.3	Evaluate various design alternatives
			C201d.4	Demonstrate the ability to implement and verify designs of varying complexity at the register-transfer-level
			C201d.5	Create new designs at the register-transfer-level and the associated effective testing strategies

Code	Course Code	Course Name	CO Code	Course Outcomes
C202a	PAE1378	SPEECH PROCESSING	C202a.1	Model speech production system and describe the fundamentals of speech
			C202a.2	Extract and compare different speech features
			C202a.3	Choose an appropriate statistical speech model for a given application
			C202a.4	Design and implement a speech and speaker recognition system
			C202a.5	Build speech synthesis systems
C202b	PCN1176	ADVANCED WIRELESS NETWORKS	C202b.1	Understand the latest 4G networks and LTE
			C202b.2	Compare the wireless IP architecture and LTE network architecture
			C202b.3	Understand the Link and Network layer protocols of wireless networks
			C202b.4	Analyze the mobility management in IP and 3GPP
			C202b.5	Address the QoS challenges in wireless Networks
C202c	PAE1322	ADVANCED EMBEDDED COMPUTING	C202c.1	Understand the Embedded System Design Concepts and design Embedded Systems for Applications
			C202c.2	Familiarize the Instruction set and execute programs using ARM and TI C55x Processors
			C202c.3	Analyze CPU performance and understand memory system mechanisms
			C202c.4	Optimize, analyze programs and validate performance
			C202c.5	Understand and analyze the concepts of Real time Operating System
C202d	PVL1376	RF IC DESIGN	C202d.1	Understand the fundamentals of RF IC design
			C202d.2	Design circuit level design of building blocks of RF transceivers using CMOS technology
			C202d.3	Analyze various performance parameters of RF transceivers
C203a	PAE1379	SOFT COMPUTING & OPTIMIZATION TECHNIQUES	C203a.1	Comprehend the fundamentals of artificial neural network, fuzzy systems and optimization techniques
			C203a.2	Analyze various optimization algorithms applied to engineering problems
			C203a.3	Develop ANN-based models
			C203a.4	Choose appropriate optimization techniques for engineering applications
C203b	PCN1376	WIRELESS SENSOR NETWORK	C203b.1	Describe the node architecture, protocol architecture and network architecture
			C203b.2	Analyse the Physical layer protocols and MAC protocols
			C203b.3	Apply the suitable routing algorithm based on the network and user requirement
			C203b.4	Compare the different OS used in Wireless sensor Networks and build basic modules using NesC
			C203b.5	Implement a basic network model using WSN
C203c	PVL1377	LOW POWER VLSI	C203c.1	To analyze and understand the basic principles of low power design

Code	Course Code	Course Name	CO Code	Course Outcomes
		DESIGN	C203c.2	To understand the hierarchy, sources of power consumption and the principles of power dissipation
			C203c.3	To understand the power optimization at different levels and apply the circuit techniques to reduce power consumption
			C203c.4	To study and understand the various power estimation techniques
			C203c.5	To study the low power synthesis techniques and understand the software design methodologies
C203d	PCN1377	FUNDAMENTALS OF BIG DATA ANALYTICS	C203d.1	Understand how to leverage the insights from big data analytics
			C203d.2	Solve applications using statistical and data analytic methods
			C203d.3	Develop applications using Hadoop related tools
			C203d.4	Use database frameworks like MongoDB, Hive and Hbase for data analysis
C204	PAE1318	PROJECT WORK PHASE - I	C204.1	Extract information through literature survey, apply appropriate methodologies, conduct experiments, analyze and interpret data individually for enhancement of knowledge in electronic system design
			C204.2	Demonstrate an ability to visualize and contribute to multidisciplinary research, as an individual.
			C204.3	Apply the engineering and management principles for efficient project management.
			C204.4	Comprehend and communicate confidently and effectively in both verbal and written form.
			C204.5	Demonstrates an ability to observe and examine the outcomes of one's actions and take independent corrective measures.
C205	PAE1418	PROJECT WORK PHASE II	C205.1	Extract information through literature survey, apply appropriate methodologies, conduct experiments, analyze and interpret data individually for enhancement of knowledge in electronic system design
			C205.2	Demonstrate an ability to visualize and contribute to multidisciplinary research, as an individual.
			C205.3	Apply the engineering and management principles for efficient project management.
			C205.4	Comprehend and communicate confidently and effectively in both verbal and written form.
			C205.5	Demonstrates an ability to observe and examine the outcomes of one's actions and take independent corrective measures

Program Educational Objectives (PEOs)

PEO01 Professional development: Graduates will have a successful career in electronic system design or associated industries or research and higher education, or as entrepreneurs.

PEO02 Attitude towards lifelong-learning: Graduates will have the ability and attitude to adapt to evolving technological challenges.

Program Outcomes (POs)

- PO1** An ability to independently carry out research/investigation and development work to solve practical problems.
- PO2** An ability to write and present a substantial technical report/document.
- PO3** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirement in the appropriate bachelor program.
- PO4** Design and develop solutions for problems in electronic systems.
- PO5** Execute independently the projects involving simulations and / or measurements in electronics and allied fields.

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Electronics and Communication Engineering
M.E. Applied Electronics

List of Course Outcomes (R2022)

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	PMA2153	APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS	C101.1	Comprehend the fundamental concepts of fuzzy sets, fuzzy logic, fuzzy propositions and fuzzy quantifiers
			C101.2	Understand the basics of linear space and linear transformation to solve the problems
			C101.3	Apply various methods in matrix theory to solve decomposition problems
			C101.4	Understand the concepts of random process and its properties to solve problems
			C101.5	Understand and solve problems using the principle of optimality
C102	PAE2161	AUTOMOTIVE ELECTRONICS	C102.1	Understand the significance of emission standards in automobiles
			C102.2	Implement electronic fuel injection/ignition components and their function
			C102.3	Choose and use appropriate sensors and equipment for measuring mechanical quantities, temperature, and appropriate actuators
			C102.4	Diagnose electronic engine control systems problems with appropriate diagnostic tools
			C102.5	Analyse the chassis and vehicle safety system
C103	PAE2101	ADVANCED DIGITAL SYSTEM	C103.1	Analyze and design synchronous sequential circuits
			C103.2	Analyze and design asynchronous sequential circuits
			C103.3	Understand fault diagnosis, fault tolerance and apply techniques to identify faults in digital circuits
			C103.4	Understand the faults in PLA and apply DFT techniques
			C103.5	Design and analyze digital circuits using Verilog HDL
C104	PAE2102	SENSORS, ACTUATORS, AND SYSTEM INTERFACE	C104.1	Analyse the characteristic parameters to evaluate the sensor performance
			C104.2	Utilize the sensors for measuring various physical parameters
			C104.3	Analyse the various self-generating sensors
			C104.4	Apply actuators for various real time engineering applications
			C104.5	Interface sensors for real time applications

Code	Course Code	Course Name	CO Code	Course Outcomes
C105	PAE2103	EMBEDDED SYSTEM DESIGN	C105.1	Understand the principles of embedded real-time systems
			C105.2	Apply optimization techniques in an embedded system design
			C105.3	Define processes with constraints and dependencies for an embedded system
			C105.4	Apply and analyze scheduling policies for an embedded real-time system
			C105.5	Customize the features of RTOS
C106	PGE2176	RESEARCH METHODOLOGY AND IPR	C106.1	Ability to formulate research problem
			C106.2	Ability to carry out research analysis
			C106.3	Ability to follow research ethics
			C106.4	Ability to understand that today's world is controlled by Computer, Information technology, but tomorrow world will be ruled by ideas, concept, and creativity
			C106.5	Ability to understand about IPR and filling patents in R &D
C107	PAE2111	DIGITAL DESIGN LAB	C107.1	Understand and Design various digital logic modules in FPGA using Verilog
			C107.2	Create and import logic modules into FPGA, synthesize and analyze the module with FPGA design flow
			C107.3	Develop the exhaustive list of possible faults for the given design and able to prepare the necessary test set for them
C108	PAE2112	EMBEDDED SYSTEM DESIGN LAB	C108.1	Interface various peripherals with ARM Processors
			C108.2	Understand the programming construct of RTOS
			C108.3	Formulate a system design using embedded processors
C109	PAE2201	CMOS VLSI DESIGN	C109.1	Understand the construction and operation of MOS Transistor and CMOS Inverter
			C109.2	Design and Analyse CMOS Inverter
			C109.3	Design and Analyse CMOS Combinational and Sequential Logic Circuits
			C109.4	Understand the construction and operation of CMOS analog IC components
			C109.5	Design and Analyse CMOS Amplifiers
C110	PAE2202	ROBOTICS AND AUTOMATION	C110.1	Explain the concepts of industrial robots on classification, specification, future prospects and application relating to the need of robot & automation
			C110.2	Examine different sensors and actuators for standard industrial applications
			C110.3	Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots
			C110.4	Explain robot motion planning using simulation tools and ROS
			C110.5	Explain AI implications and the design of simple automations using microcontroller
C111a	PAE2241	NANO	C111a.1	Discover the basics and the theoretical foundations of Nano electronics

Code	Course Code	Course Name	CO Code	Course Outcomes
		ELECTRONICS AND TECHNOLOGY	C111a.2	Realize the use of synthesis methods and describe the properties of Nanomaterial
			C111a.3	Analyze the key performance aspects of Nano electronic devices
			C111a.4	Identify the use of Nano characterization methods
			C111a.5	Apply the principles of Nano biosensors
C111b	PAE2242	IOT AND EDGE ANALYTICS	C111b.1	Understand the concepts of IoT system and various enabling technologies
			C111b.2	Differentiate various connective technologies
			C111b.3	Design a portable IoT system using IoT Physical device and connect to the cloud
			C111b.4	Understand the concept of edge computing in IoT
			C111b.5	Perform IoT data analytics in both cloud and edge
C111c	PCN2243	SOFT COMPUTING TECHNIQUES	C111c.1	Comprehend the fundamentals of artificial neural network, fuzzy systems and optimization techniques
			C111c.2	Apply basic operations in fuzzy and implement fuzzy models
			C111c.3	Apply genetic algorithm for optimization problems
			C111c.4	Recognize the importance of hybrid soft computing techniques and apply foreengineering problems
			C111c.5	Analyse the various optimization algorithms and choose an appropriate techniquefor engineering application
C111d	PAE2244	ADVANCED COMPUTER ORGANIZATION AND ARCHITECTURE	C111d.1	Gain knowledge of the principles of computer architecture and instruction-level parallelism and challenges
			C111d.2	Analyze the architecture of vector processor, SIMD, and GPU architecture andenhanche techniques of parallelism
			C111d.3	Analyze the characteristics of multithreading multiprocessors, and various issues in shared memory architecture
			C111d.4	Design and evaluate the performance optimization of the memory system andmemory hierarchy
			C111d.5	Analyze the warehouse-scale computer programming model Domain-Specific architectures
C111e	PAE2245	ARM BASED DEVELOPMENT	C111e.1	Understand ARM7TDMI assembly instructions and their formats and usage
			C111e.2	Write ARM7 based assembly level programs
			C111e.3	Ability to understand how various coprocessors are interfaced in an SoC
			C111e.4	Understand cache design, virtual memory and memory protection concepts and their implementation details in a typical SoC designs
			C111e.5	Understanding on AMBA bus architecture, various HW peripherals in SoCs and

Code	Course Code	Course Name	CO Code	Course Outcomes
				processor SW tools chain for embedded software solution development
C112a	PAE2246	MEMS AND NEMS	C112a.1	Recognize the basics of materials and fabrication of micro electromechanical systems
			C112a.2	Devise the fabrication techniques of nano electromechanical systems
			C112a.3	Analyze the key performance aspects of micro electromechanical transducers
			C112a.4	Analyze the key performance aspects of nano electromechanical transducers
			C112a.5	Identify the characterization requirements of MEMS/NEMS
C112b	PVL2242	DATA CONVERTERS	C112b.1	Understand the sample and hold architectures and performance metrics used for assessing both DACs and ADCs
			C112b.2	Understand the working principles of comparator in the sample and hold circuit and use switched capacitors to precisely hold the sampled voltage before conversion
			C112b.3	Understand the architectures and challenges and design digital to analog converters
			C112b.4	Understand the architectures and challenges and design analog to digital converters
			C112b.5	Understand the principles of sigma delta modulators and design continuous time sigma delta modulators
C112c	PCN2244	PATTERN RECOGNITION AND MACHINE LEARNING	C112c.1	Understand Classification of data and identify the patterns in it
			C112c.2	Analyse parametric and linear models for classification
			C112c.3	Develop unsupervised learning and clustering techniques for the given data
			C112c.4	Construct Neural network models for recognizing patterns
			C112c.5	Implement, train, and finetune the deep learning model parameters
C112d	PCN2241	SIGNAL INTEGRITY FOR HIGH-SPEED DESIGN	C112d.1	Apply the fundamental concepts of signal integrity in high-speed PCBs
			C112d.2	Develop dielectric and conductor models to account for frequency-dependent properties
			C112d.3	Analyse and mitigate cross talk
			C112d.4	Model the channels and I/O circuits
			C112d.5	Interpret jitter and noise and perform budgeting
C112e	PAE2247	EMBEDDED SYSTEM PROGRAMMING	C112e.1	Understanding of C programming and its salient features for embedded systems
			C112e.2	Analyze the compatibility of various programming languages/software to embedded process development with improved design & programming skills
			C112e.3	Develop C programs in Linux environment
			C112e.4	Able to write python programming for Embedded applications
			C112e.5	Gain knowledge on the recent trends in embedded programming skills
C113a	PVL2241	SIGNAL PROCESSING FOR	C113a.1	Understand various commonly used DSP algorithms and their representation
			C113a.2	Apply the pipelining and parallel processing techniques in the design of FIR filter

Code	Course Code	Course Name	CO Code	Course Outcomes
		VLSI	C113a.3	Implement pipelining and parallel processing techniques in the design of IIR and adaptive filters
			C113a.4	Annotate various algorithmic strength reduction techniques
			C113a.5	Apply the algorithmic strength reduction techniques in filters and transforms
C113b	PAE2248	SYSTEM-ON-CHIP DESIGN	C113b.1	Identify & formulate a given problem in framework of SoC based design approaches
			C113b.2	Design SoC based logic cores for engineering applications
			C113b.3	Design SoC based memory and analog cores for engineering applications
			C113b.4	Understand SoC design validation and design examples
			C113b.5	Understand SoC testing
C113c	PAE2243	HARDWARE SOFTWARE CO-DESIGN	C113c.1	Create design specification and model co-design systems
			C113c.2	Apply and analyze partitioning techniques
			C113c.3	Analyze hardware / software co-synthesis techniques
			C113c.4	Analyze prototyping and emulation techniques
			C113c.5	Implement hardware-software co-design concepts with the Zynq processor
C113d	PAE2221	EMBEDDED SYSTEM DEVELOPMENT	C113d.1	Gain knowledge on the basics of embedded real-time systems
			C113d.2	Apply the programming concepts to an embedded system
			C113d.3	Apply the concepts of data structures in embedded programming
			C113d.4	Gain knowledge on the CAN protocol
			C113d.5	Understand the multi-board architecture of embedded systems
C113e	PCN2242	SPEECH PROCESSING	C113e.1	Understand the fundamentals of speech production and apply the same in building spoken language systems
			C113e.2	Apply time and frequency domain properties in speech-based applications
			C113e.3	Analyze parametric and non-parametric spectrum estimation techniques
			C113e.4	Apply linear prediction in extracting speech features
			C113e.5	Apply signal processing techniques for building robust speech-enabled systems
C114	PAE2211	CMOS VLSI DESIGN LAB	C114.1	Design digital and analog integrated circuits and sub-systems for the target specifications
			C114.2	Analyse the performance of digital and analog integrated circuits using pre-layout and post-layout simulations
C115	PAE2212	DESIGN OF AUTOMATION LAB	C115.1	Design and layout multiple actuator systems with start shop and emergency modules
			C115.2	Acquire the skill of interfacing different sensors like LVDT, ultrasonic, and touch sensors
			C115.3	Develop a control system for stepper motors

Code	Course Code	Course Name	CO Code	Course Outcomes
C201a	PVL2341	MOS DEVICE MODELLING	C115.4	Develop and implement the required logic for electro-pneumatic actuator systems
			C201a.1	Comprehend the basic concepts involved in physics of solid-state devices
			C201a.2	Describe the relationship between electron transport properties and operation of semiconductor devices like PN junction diode
			C201a.3	Investigate MOS capacitor operation under different bias configurations and conditions
			C201a.4	Analyse the MOSFET operation taking into consideration of different bias parameters and understand basic MOSFET modelling
			C201a.5	Understand advanced MOSFET modelling including second order effects and high frequency modelling of MOSFET
C201b	PCN2341	MACHINE VISION	C201b.1	Implement fundamental image formation techniques required for machine vision
			C201b.2	Apply feature detectors and feature matching techniques
			C201b.3	Apply 3D vision techniques
			C201b.4	Implement motion-related techniques
			C201b.5	Understand holographic image processing
C201c	PAE2321	EMBEDDED SYSTEM FOR HEALTHCARE	C201c.1	Summarize the hardware and software for ARM processor
			C201c.2	Illustrate the measurement of various bio-potential and non-electrical parameters
			C201c.3	Demonstrate the various data acquisition subsystems for acquiring bio-signals
			C201c.4	Utilize the ARM core in the design of medical embedded system
C201d	PVL2343	CMOS FABRICATION TECHNOLOGY	C201d.1	Analyze issues related to epitaxial growth and oxidation
			C201d.2	Examine the lithography and etching techniques for IC fabrication
			C201d.3	Devise the doping techniques using diffusion and ion implantation
			C201d.4	Associate IC fabrication process steps to deposition and metallization
			C201d.5	Appreciate the non - linearities associated with CMOS process technologies
C201e	PAE2341	NETWORK-ON-CHIP	C201e.1	Comprehend the basic concepts involved in network on chip design
			C201e.2	Analyse different architectures in NoC
			C201e.3	Investigate different routing algorithms for NoC design
			C201e.4	Analyse the fault tolerance techniques of NoC
			C201e.5	Understand three dimensional integration issues in NoC
C202a	PVL2342	LOW POWER VLSI DESIGN	C202a.1	Understand the hierarchy, sources of power consumption and the principles of power dissipation
			C202a.2	Apply various power estimation techniques at circuit level, logic level and architecture level

Code	Course Code	Course Name	CO Code	Course Outcomes
C202b	PVL2344	RECONFIGURABLE VLSI ARCHITECTURES	C202a.3	Analyze the power optimization techniques at circuit level, logic level and architecture level
			C202a.4	Design low power memories, clocks, interconnects, and layout
			C202a.5	Apply low power synthesis techniques and software design methodologies
			C202b.1	Relate the fundamentals of reconfigurable computing systems
			C202b.2	Articulate the design issues involved in reconfigurable programming systems
			C202b.3	Analyse the performance trade-offs by mapping the design methodologies with a reconfigurable platform
			C202b.4	Discuss the implementation of reconfigurable architectures with FPGA
C202c	PAE2322	MICROCONTROLLERS AND INTERFACING	C202b.5	Analyse different FPGA applications as case studies
			C202c.1	Gain understanding between RISC and CISC processors, and work with STM microcontroller
			C202c.2	Gain knowledge on the PIC microcontrollers based PIC18xx architectures
			C202c.3	Design systems using MSP430 family of Microcontrollers
			C202c.4	Design and develop microcontroller based smart electronic system and home appliances
C202d	PAE2342	RF ENERGY HARVESTING	C202c.5	Design real time systems using the appropriate Interfacing peripherals and standards
			C202d.1	Recognize RF energy harvesting sources and methods
			C202d.2	Identify the antennas and rectifiers for RF energy harvesting
			C202d.3	Examine the wireless power transfer schemes for RF energy harvesting
			C202d.4	Model matching circuits for RF energy harvesting
C202e	PCN2342	DEEP LEARNING TECHNIQUES	C202d.5	Analyse the single band and dual band wireless RF energy harvesting
			C202e.1	Understand the fundamental framework of deep learning
			C202e.2	Comprehend the nuances of deep neural network models.
			C202e.3	Select suitable deep learning architecture for an application
			C202e.4	Implement, train, and tune the deep learning model parameters
C203	PAE2316	INTERNSHIP WITH SEMINAR	C202e.5	Apply deep learning models to solve real-world problems
			C203.1	Reflect on the purpose of communication, and on the ways of making effective presentations
			C203.2	Explain the role language skill, reading and listening play in effective communication
C204	PAE2318	PROJECT PHASE I	C203.3	Make improved presentation on a topic from within their specialty
			C204.1	Develop aptitude for research and independent learning
			C204.2	Demonstrate the ability to carry out literature survey and select unresolved problems in

Code	Course Code	Course Name	CO Code	Course Outcomes
				the domain of the selected project topic
			C204.3	Gain the expertise to use new tools and techniques for the design and development
			C204.4	Acquire the knowledge and awareness to carry out cost-effective and environment friendly designs
			C204.5	Develop the ability to write good technical report, to make oral presentation of the work, and to publish the work in refereed conferences/journals
C205	PAE2418	PROJECT PHASE II	C205.1	Develop aptitude for research and independent learning
			C205.2	Demonstrate the ability to carry out literature survey and select unresolved problems in the domain of the selected project topic
			C205.3	Gain the expertise to use new tools and techniques for the design and development
			C205.4	Acquire the knowledge and awareness to carry out cost-effective and environment friendly designs
			C205.5	Develop the ability to write good technical report, to make oral presentation of the work, and to publish the work in refereed conferences/journals

Program Educational Objectives (PEOs)

PEO01 Professional development: Graduates will have a successful career in electronic system design or associated industries or research and higher education, or as entrepreneurs.

PEO02 Attitude towards lifelong-learning: Graduates will have the ability and attitude to adapt to evolving technological challenges.

Program Outcomes (POs)

- PO1** An ability to independently carry out research/investigation and development work to solve practical problems.
- PO2** An ability to write and present a substantial technical report/document.
- PO3** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirement in the appropriate bachelor program.
- PO4** Design and develop solutions for problems in electronic systems.
- PO5** Execute independently the projects involving simulations and / or measurements in electronics and allied fields.

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Electronics and Communication Engineering
M.E. Communication Systems

List of Course Outcomes (R2018)

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	PMA1151	APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS	C101.1	Understand the concepts on vector spaces, linear transformation, inner product spaces, eigen values and generalized eigen vectors. Apply various methods in linear algebra to solve system of linear equations.
			C101.2	Develop a fundamental understanding of linear programming models and apply the simplex method for solving linear programming problems.
			C101.3	Solve numerical solution of differential equations by single and multistep methods.
			C101.4	Understand two dimensional random variables, correlations and regression.
			C101.5	Understand the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.
C102	PCN1101	ADVANCED ANTENNA ENGINEERING	C102.1	Explain antenna terms and characteristics, in general, and in respect of wire, aperture, printed and array antennas, in particular
			C102.2	Demonstrate a deeper understanding of the fundamental principles underlying radiation and antenna operations
			C102.3	Analyze, and design, wire, aperture and array antennas using theory and simulation
			C102.4	Demonstrate an understanding of antenna measurement techniques, and an appreciation of the meaning and importance of uncertainty in measurements
			C102.5	Understand the basic ideas of a computational electromagnetic method for antenna problems
C103	PCN1102	SIGNAL PROCESSING & BASEBAND TECHNIQUES	C103.1	analyze discrete time signals, systems and random processes using power spectral density representation
			C103.2	analyze various parametric and non-parametric spectral estimation methods
			C103.3	apply linear estimation and prediction techniques to discrete random signals for signal separation, detection and estimation

Code	Course Code	Course Name	CO Code	Course Outcomes
C104	PCN1103	ADVANCED MODULATION & CODING TECHNIQUES	C103.4	develop the ability to understand the concepts of signal detection and estimation
			C103.5	understand various synchronization techniques
			C104.1	Demonstrate an understanding of the trade-offs involved in the design of basic and advanced coding and modulation techniques
			C104.2	Analyze modulation techniques and its practical considerations
			C104.3	Theoretically quantify the factors that determine the performance
			C104.4	Design alternate modulation schemes for OFDM
C105	PCN1104	ADVANCED WIRELESS COMMUNICATION	C104.5	Define the importance and rationale of error correcting coding and its application to modern communication systems
			C105.1	Analyze various MIMO systems
			C105.2	Understand the concepts of Large MIMO systems
C106	PCN1176	ADVANCED WIRELESS NETWORKS	C105.3	Analyze various precoding techniques in Large MIMO systems
			C106.1	Understand the latest 4G networks and LTE
			C106.2	Compare the wireless IP architecture and LTE network architecture
			C106.3	Understand the Link and Network layer protocols of wireless networks
			C106.4	Analyze the mobility management in IP and 3GPP
C107	PCN1111	COMMUNICATION SYSTEMS LABORATORY - I	C106.5	Address the QoS challenges in wireless Networks
			C107.1	Design and conduct experiments to demonstrate the trade-offs involved in the design of basic and advanced coding and modulation techniques and the advanced baseband signal conditioning methods.
			C107.2	Apply communication engineering principles and design tools for the design of modern communication system
C108	PCN1115	TECHNICAL SEMINAR	C107.3	Analyze and interpret the experimental measurement data and produce meaningful conclusions.
			C108.1	Reflect on the purpose of communication, and on the ways of making effective presentations
			C108.2	Explain the role language skill, reading and listening play in effective communication
C109	PCN1201	RF SYSTEM DESIGN	C108.3	Make improved presentation on a topic from within their specialty
			C109.1	Design RF circuits
			C109.2	Analyze the performance of RF circuits
			C109.3	Apply knowledge to identify a suitable architecture and systematically design an RF system
			C109.4	Comprehensively record and report the measured data, and would be capable of

Code	Course Code	Course Name	CO Code	Course Outcomes
				analyzing, interpreting the experimentally measured data and produce the meaningful conclusions
C110	PCN1202	MILLIMETER WAVE COMMUNICATION	C110.1	Understand Millimeter devices and circuits
			C110.2	Design antenna for Millimeter wave frequencies
			C110.3	Gain Knowledge of Millimeter wave technology
C111	PAE1276	EMBEDDED SYSTEM DESIGN FOR IoT	C111.1	Understand the fundamental concepts of IoT.
			C111.2	Identify the correct microcontrollers for IoT sensors.
			C111.3	Develop IoT Architecture for a particular application scenario and Identify the correct protocol for a specific application.
			C111.4	Design a portable IoT using Raspberry Pi.
			C111.5	Deploy an IoT application for real time scenario and connect to the cloud.
C112a	PCN1221	COOPERATIVE COMMUNICATION	C112a.1	Analyze the performance of various relaying protocols
			C112a.2	Gain knowledge about base station cooperation and network MIMO
			C112a.3	Understand how cooperative communications improve LTE performance
C112b	PCN1222	COGNITIVE RADIO NETWORKS	C112b.1	Understand fundamental concepts and challenges of cognitive radio
			C112b.2	Describe the spectrum regulation and standardization activities of cognitive radio
			C112b.3	Apply detection techniques for cognitive radio spectrum sensing
			C112b.4	Implement MAC and Network layer protocols for dynamic spectrum access in cognitive radio
			C112b.5	Understand the applicability of cognitive radio for Public safety, Spectrum Markets Internet of Things
C112c	PAE1278	MEMS AND NEMS	C112c.1	Understand the basics of micro/nano electromechanical structures, devices and systems including their theoretical foundations, applications and advantages
			C112c.2	Understand the use of materials in micro/nano fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA
			C112c.3	Analyze the key performance aspects of micro/nano electromechanical transducers including sensors and actuators
			C112c.4	Understand the characterization requirements of MEMS/NEMS
C112d	PAE1282	ADVANCED DIGITAL IMAGE PROCESSING	C112d.1	Analyze and extract image features and apply it for various image processing tasks
			C112d.2	Evaluate the methodologies for image enhancement, segmentation, restoration etc.,
			C112d.3	Apply and analyze image processing techniques and algorithms
			C112d.4	Apply image processing algorithms to practical applications

Code	Course Code	Course Name	CO Code	Course Outcomes
C113a	PCN1277	MULTIMEDIA COMPRESSION TECHNIQUES	C113a.1	Understand text, audio and 3D compression algorithms and compare their efficiencies
			C113a.2	Apply knowledge for identifying a suitable strategy for compression of text, image, audio and video
			C113a.3	Analyze different compression techniques and standards for image and video
			C113a.4	Apply the compression concepts in multimedia communication
C113b	PCN1278	SOFTWARE DEFINED RADIO	C113b.1	Make system-level decisions for software-defined radio technology and products
			C113b.2	Obtain understanding of analog RF components
			C113b.3	Possess understanding of ADC and DAC technology
			C113b.4	Implement and evaluate smart antenna algorithms
			C113b.5	Aware of current industry trends and the importance of SDR in future communication systems
C113c	PCN1279	CRYPTOGRAPHY AND NETWORK SECURITY	C113c.1	Understand different types of classical and public key cryptographic algorithms
			C113c.2	Remember and apply block ciphers for software and hardware applications
			C113c.3	Evaluate the authentication algorithms
			C113c.4	Understand various attacks existing in different networks and learn to mitigate the attacks
C113d	PVL1278	MICROWAVE INTEGRATED CIRCUITS	C113d.1	Create and analyze impedance matching circuits using LC components and stubs
			C113d.2	Create and analyze microwave components such as power dividers, couplers, filters
			C113d.3	Create and analyze amplifiers and oscillators at microwave frequencies and perform stability analysis
C114a	PCN1223	DETECTION AND ESTIMATION THEORY	C114a.1	Apply the statistical framework in signal detection and parameter estimation
			C114a.2	Design and analyze optimum detection schemes
			C114a.3	Analyse hypothesis tests for signal detection and estimation schemes
			C114a.4	Gain an understanding of detection and estimation of signals in presence of white and non-white Gaussian noise
C114b	PCN1224	CYBER PHYSICAL SYSTEMS	C114b.1	Understand the fundamental concepts of CPS
			C114b.2	Identify an appropriate control system for a particular application scenario
			C114b.3	Design the methodology for CPS
			C114b.4	Analyse the need for security
			C114b.5	Apply CPS in real time scenario
C114c	PCN1276	PATTERN RECOGNITION	C114c.1	Classify the data and identify the patterns
			C114c.2	Apply dimensionality reduction techniques

Code	Course Code	Course Name	CO Code	Course Outcomes
		AND MACHINE LEARNING	C114c.3	Choose an appropriate pattern recognition system for the given data
			C114c.4	Solve linearly non-separable pattern recognition problems using SVMs
			C114c.5	Apply neural networks for suitable pattern recognition problems
C114d	PVL1277	SIGNAL INTEGRITY FOR HIGH SPEED DESIGN	C114d.1	Apply the fundamental concepts of signal integrity in high speed PCBs
			C114d.2	Analyze and resolve cross talk
			C114d.3	Model the channels, I/O circuits and be able to perform budgeting
C115	PCN1211	COMMUNICATION SYSTEMS LABORATORY - II	C115.1	Design and conduct experiments to demonstrate the physical layer concepts practically.
			C115.2	Apply communication engineering principles and design tools and will be well practiced in design skills.
			C115.3	Record and report the measured data.
			C115.4	Analyze and interpret the experimental measurement data and produce meaningful conclusions.
C116	PCN1215	TECHNICAL WRITING	C116.1	Understand and conduct effective literature review on any chosen topic presentations
			C116.2	Understand the structure of professional communication such as emails, cover letters, manuscripts and reports and be able to write them
			C116.3	Create a technical paper and a report
C201a	PCN1321	V2X COMMUNICATION	C201a.1	Understand the VANET architecture and its standards
			C201a.2	Understand the connectivity in cars
			C201a.3	Learn the security issues and its challenges
			C201a.4	Learn the routing protocols in VANETs
			C201a.5	Understand the real time application scenarios in VANETs
C201b	PCN1322	NETWORK ROUTING ALGORITHMS	C201b.1	Identify a suitable routing algorithm
			C201b.2	Implement and analyse the performance of routing algorithm
			C201b.3	Design an algorithm to satisfy the evolving demands in the network
C201c	PAE1378	SPEECH PROCESSING	C201c.1	Model speech production system and describe the fundamentals of speech
			C201c.2	Extract and compare different speech features
			C201c.3	Choose an appropriate statistical speech model for a given application
			C201c.4	Design and implement a speech and speaker recognition system
			C201c.5	Build speech synthesis systems
C201d	PAE1177	SENSORS, ACTUATORS AND	C201d.1	Compare different types of sensors and actuators
			C201d.2	Evaluate digital sensors and semiconductor device sensors

Code	Course Code	Course Name	CO Code	Course Outcomes
C202a	PCN1323	SYSTEM INTERFACE	C201d.3	Analyse the various self-generating sensors
			C201d.4	Interface sensors for various applications
		OPTIMIZATION TECHNIQUES IN WIRELESS COMMUNICATIONS	C202a.1	Apply the basic concepts of vector and matrix algebra, including linear dependence / independence, basis and dimension of a subspace, rank and nullity, for the analysis of wireless systems
			C202a.2	Recognise problems in wireless systems that can be formulated as convex optimization
			C202a.3	Explain the role of convex optimization in MIMO and cooperative communications
			C202a.4	Develop a research project in the area of wireless communications
C202b	PCN1324	COMPRESSIVE SENSING	C202a.5	Explain the optimal power allocation for cooperative communication
			C202b.1	Gain the fundamental concepts of CS
			C202b.2	Identify the suitable sensing matrix and reconstruction algorithm for a specific application
			C202b.3	Design an algorithm for different applications in wireless sensor network
C202c	PCN1376	WIRELESS SENSOR NETWORK	C202b.4	Apply compressed sensing technique in real time applications
			C202c.1	Describe the node architecture, protocol architecture and network architecture
			C202c.2	Analyse the Physical layer protocols and MAC protocols
			C202c.3	Apply the suitable routing algorithm based on the network and user requirement
			C202c.4	Compare the different OS used in Wireless sensor Networks and build basic modules using NesC
C202d	PCN1377	FUNDAMENTALS OF BIG DATA ANALYTICS	C202c.5	Implement a basic network model using WSN
			C202d.1	Understand how to leverage the insights from big data analytics
			C202d.2	Solve applications using statistical and data analytic methods
			C202d.3	Develop applications using Hadoop related tools
			C202d.4	Use database frameworks like MongoDB, Hive and Hbase for data analysis
C203a	PCN1325	RADAR AND SATELLITE COMMUNICATION	C202d.5	Understand how to leverage the insights from big data analytics
			C203a.1	Gain the fundamentals of radar communication
			C203a.2	Design the structure of radar transmitters and receivers
			C203a.3	Understand the satellite communication and its broad applications
			C203a.4	Analyze the various segments in satellite communication
C203b	PCN1326	OPTICAL COMMUNICATION	C203a.5	Compare the different broadcast and access techniques
			C203b.1	Summarize the working of optical components
			C203b.2	Develop knowledge about the backbone infrastructure, architectures and the protocol

Code	Course Code	Course Name	CO Code	Course Outcomes
		AND NETWORKING		stack of optical network
			C203b.3	Design an optical network and employ wavelength routing algorithms
			C203b.4	Apply the advances in optical packet switching and analyze various optical access networks
			C203b.5	Identify suitable techniques to manage the optical networks
C203c	PAE1376	WAVELET TRANSFORMS AND ITS APPLICATIONS	C203c.1	Apprehend the detailed knowledge about the Wavelet transforms
			C203c.2	Design wavelet filter bank for various signal processing applications
C203d	PAE1379	SOFT COMPUTING & OPTIMIZATION TECHNIQUES	C203d.1	Comprehend the fundamentals of artificial neural network, fuzzy systems and optimization techniques
			C203d.2	Analyze various optimization algorithms applied to engineering problems
			C203d.3	Develop ANN-based models
			C203d.4	Choose appropriate optimization techniques for engineering applications
C204	PCN1318	PROJECT WORK PHASE - I	C204.1	Extract information through literature survey, apply appropriate methodologies, conduct experiments, analyze and interpret data individually for enhancement of knowledge in Communication Systems.
			C204.2	Demonstrate an ability to visualize and contribute to multidisciplinary research, as an individual.
			C204.3	Apply the engineering and management principles for efficient project management.
			C204.4	Comprehend and communicate confidently and effectively in both verbal and written form.
			C204.5	Demonstrates an ability to observe and examine the outcomes of one's actions and take independent corrective measures.
C205	PCN1418	PROJECT WORK PHASE II	C205.1	Extract information through literature survey, apply appropriate methodologies, conduct experiments, analyze and interpret data individually for enhancement of knowledge in Communication Systems.
			C205.2	Demonstrate an ability to visualize and contribute to multidisciplinary research, as an individual.
			C205.3	Apply the engineering and management principles for efficient project management.
			C205.4	Comprehend and communicate confidently and effectively in both verbal and written form.
			C205.5	Demonstrates an ability to observe and examine the outcomes of one's actions and take independent corrective measures.

Program Educational Objectives (PEOs)

PEO1 Professional development: Graduates will have a successful career in communication system design or associated industries or research and higher education, or as entrepreneurs.

PEO2 Attitude towards lifelong-learning: Graduates will have the ability and attitude to adapt the evolving technological challenges.

Program Outcomes (POs)

- PO1** An ability to independently carry out research/investigation and development work to solve practical problems.
- PO2** An ability to write and present a substantial technical report/document.
- PO3** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirement in the appropriate bachelor program.
- PO4** Design and develop solutions for problems in communication systems.
- PO5** Execute independent projects involving simulations and/or measurements in communication and allied fields.

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Electronics and Communication Engineering
M.E. Communication Systems

List of Course Outcomes (R2022)

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	PMA2154	MATHEMATICAL FOUNDATIONS FOR COMMUNICATION ENGINEERS	C101.1	Acquire knowledge of linear spaces and solve problems
			C101.2	Understand linear transformation and Gram-Schmidt's Orthogonalization process
			C101.3	Apply various methods in matrix theory to solve decomposition problems
			C101.4	Understand and evaluate the problems in random processes and its classification
			C101.5	Formulate and solve Linear programming problems using simplex method
C102	PCN2161	MACHINE LEARNING ALGORITHMS	C102.1	Demonstrate a basic understanding of machine learning types, preliminaries and issues
			C102.2	Analyse linear models for classification.
			C102.3	Develop unsupervised learning and clustering techniques for the given data.
			C102.4	Apply graphical models to encode complex joint multivariate probability distributions using Graphs.
			C102.5	Apply neural networks and deep learning for a given dataset.
C103	PCN2101	ADVANCED WIRELESS COMMUNICATION	C103.1	Understand and analyze various wireless channel models.
			C103.2	Examine the benefits of multiple antennas and space-time communications.
			C103.3	Analyze and choose appropriate multiple access schemes.
			C103.4	Comprehend the concepts of WCDMA and WLAN.
			C103.5	Elucidate the concepts underlying the standardized wireless systems.
C104	PCN2102	RADIATING SYSTEMS	C104.1	Explain the various antenna terms and concepts.
			C104.2	Analyze, and design, wire, aperture and array antennas.
			C104.3	Demonstrate an understanding of antenna synthesis and measurement techniques.
			C104.4	Exhibit an understanding of modern antennas and their applications.

Code	Course Code	Course Name	CO Code	Course Outcomes
C105	PCN2103	COMMUNICATION SYSTEM NETWORKS	C105.1	Understand the evolution of various generations of wireless networks.
			C105.2	Compare the network architecture of wireless IP and LTE.
			C105.3	Explore the mobility Management schemes in IP and 3G.
			C105.4	Analyse the QoS challenges in IP and 3GPP.
			C105.5	Understand the advanced features of 4G.
C106	PGE2176	RESEARCH METHODOLOGY AND IPR	C106.1	Ability to formulate research problem.
			C106.2	Ability to carry out research analysis.
			C106.3	Ability to follow research ethics.
			C106.4	Ability to understand that today's world is controlled by Computer, Information technology, but tomorrow world will be ruled by ideas, concept, and creativity.
			C106.5	Ability to understand about IPR and filling patents in R &D.
C107	PCN2111	COMMUNICATION LAB	C107.1	Demonstrate physical layer functionalities for advanced wireless communication.
			C107.2	Apply digital modulation and coding schemes for wireless communication.
			C107.3	Implement digital modulation schemes using SDR.
			C107.4	Demonstrate wireless concepts for advanced wireless system design.
C108	PCN2112	RADIATING SYSTEMS LAB	C108.1	Analyze and design antenna elements and arrays.
			C108.2	Synthesize antennas
			C108.3	Demonstrate an understanding of antenna measurements
C109	PCN2201	RF AND MICROWAVE CIRCUIT DESIGN	C109.1	Illustrate the fundamentals of high-frequency integrated circuits
			C109.2	Analyze the amplifier and oscillator circuits with appropriate stability considerations
			C109.3	Discuss the design concepts of mixers, phase shifters, and integrated antennas
			C109.4	Explain the various building blocks and the related performance parameters of the transceiver system
C110	PCN2202	STATISTICAL SIGNAL PROCESSING	C110.1	Understand multirate signal processing and demonstrate its applications
			C110.2	Understand the power spectral density and apply to discrete random signals and systems
			C110.3	Apply linear prediction and filtering techniques to discrete random signals for signal separation, detection and estimation
			C110.4	Analyze adaptive filtering problems and demonstrate the application of adaptive

Code	Course Code	Course Name	CO Code	Course Outcomes
				filter components
			C110.5	Understand multi resolution analysis and evaluate their time-frequency resolution properties using FT and wavelets.
C111a	PCN2221	COOPERATIVE COMMUNICATION	C111a.1	Understand the concepts of relaying technology.
			C111a.2	Analyze the performance of various relaying protocols.
			C111a.3	Examine the performance of cooperative transmission schemes with multiple relays.
			C111a.4	Analyze and gain knowledge about base station cooperation and network MIMO.
			C111a.5	Elucidate how cooperative communications improve LTE performance.
C111b	PCN2222	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	C111b.1	Define and explain various terms, ideas, issues and methods in the field of EMI/EMC.
			C111b.2	Analyse electromagnetic field coupling through apertures.
			C111b.3	Interpret various interference control techniques.
			C111b.4	Examine the need for standards and why limits prescribed by different standards could be widely different.
			C111b.5	Evaluate the impact of EMI on wireless and broadband technologies.
C111c	PAE2242	IOT AND EDGE ANALYTICS	C111c.1	Understand the concepts of IoT system and various enabling technologies
			C111c.2	Differentiate various connective technologies.
			C111c.3	Design a portable IoT system using IoT Physical device and connect to the cloud.
			C111c.4	Understand the concept of edge computing in IoT
			C111c.5	Perform IoT data analytics in both cloud and edge.
C111d	PCN2243	SOFT COMPUTING TECHNIQUES	C111d.1	Comprehend the fundamentals of artificial neural network, fuzzy systems and optimization techniques.
			C111d.2	Apply basic operations in fuzzy and implement fuzzy models.
			C111d.3	Apply genetic algorithm for optimization problems.
			C111d.4	Recognize the importance of hybrid soft computing techniques and apply for engineering problems.
			C111d.5	Analyse the various optimization algorithms and choose an appropriate technique for engineering application
C111e	PAE2247	EMBEDDED	C111e.1	Understanding of C programming and its salient features for embedded systems

Code	Course Code	Course Name	CO Code	Course Outcomes
		SYSTEM PROGRAMMING	C111e.2	Analyze the compatibility of various programming languages/software to embedded process development with improved design & programming skills.
			C111e.3	Develop C programs in Linux environment.
			C111e.4	Able to write python programming for Embedded applications.
			C111e.5	Gain knowledge on the recent trends in embedded programming skills.
C112a	PCN2223	SPACE-TIME WIRELESS COMMUNICATIONS	C112a.1	Understand the concepts of space time wireless communications.
			C112a.2	Analyze MIMO systems in the context of diversity and multiplexing.
			C112a.3	Examine the performance of multi-user and multi-carrier MIMO systems.
			C112a.4	Understand the concepts of Large MIMO systems.
			C112a.5	Analyze various precoding techniques in Large MIMO systems.
C112b	PCN2224	SATELLITE COMMUNICATION	C112b.1	Examine the dynamics of satellite communication and impairments during radio wave propagation.
			C112b.2	Articulate and illustrate the various multiple access techniques used in satellite communication.
			C112b.3	Examine the design of satellite links and appropriate antenna designs.
			C112b.4	Present the various systems in earth and space segments of satellite communication.
			C112b.5	Determine the use of satellites in networks and other applications.
C112c	PCN2225	FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGIES	C112c.1	Apply the fundamentals of cryptography in cryptocurrency.
			C112c.2	Gain knowledge about various operations associated with blockchain and cryptocurrency.
			C112c.3	Interpret the methods for verification and validation of bitcoin transactions.
			C112c.4	Analyze the principles, practices and policies associated with bitcoin business.
			C112c.5	Demonstrate the ecosystem of Cryptocurrency.
C112d	PCN2242	SPEECH PROCESSING	C112d.1	Understand the fundamentals of speech production and apply the same in building spoken language systems.
			C112d.2	Apply time and frequency domain properties in speech-based applications.
			C112d.3	Analyze parametric and non-parametric spectrum estimation techniques.
			C112d.4	Apply linear prediction in extracting speech features.
			C112d.5	Apply signal processing techniques for building robust speech-enabled systems

Code	Course Code	Course Name	CO Code	Course Outcomes
C112e	PAE2202	ROBOTICS AND AUTOMATION	C112e.1	Explain the concepts of industrial robots on classification, specification, future prospects and application relating to the need of robot & automation
			C112e.2	Examine different sensors and actuators for standard industrial applications
			C112e.3	Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots
			C112e.4	Explain robot motion planning using simulation tools and ROS
			C112e.5	Explain AI implications and the design of simple automations using microcontroller
C113a	PCN2226	FIBER OPTIC COMMUNICATION TECHNOLOGY	C113a.1	Analyze light wave propagation in optical fibers
			C113a.2	Examine and select appropriate transmitter and receiver for light wave systems
			C113a.3	Analyze optical channels and the degradation of light during transmission
			C113a.4	Design light weight systems for low loss and minimum dispersion
			C113a.5	Comprehend the working of multichannel optical communication systems and its associated high speed digital signal processing
C113b	PCN2241	SIGNAL INTEGRITY FOR HIGH-SPEED DESIGN	C113b.1	Apply the fundamental concepts of signal integrity in high-speed PCBs
			C113b.2	Develop dielectric and conductor models to account for frequency-dependent Properties
			C113b.3	Analyse and mitigate cross talk
			C113b.4	Model the channels and I/O circuits
			C113b.5	Interpret jitter and noise and perform budgeting
C113c	PCN2227	WIRELESS SENSOR NETWORKS	C113c.1	Analyze the node architecture, protocol architecture and network architecture
			C113c.2	Interpret the various existing Physical layer and MAC Protocols
			C113c.3	Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
			C113c.4	Choose appropriate OS for WSN and build basic modules using TinyOS & NesC
			C113c.5	Analyze possible application scenarios
C113d	PCN2228	MULTIMEDIA COMPRESSION TECHNIQUES	C113d.1	Understand text and audio compression algorithms and compare their efficiencies.
			C113d.2	Analyze different compression techniques and standards for image.
			C113d.3	Analyze different compression techniques and standards for video.

Code	Course Code	Course Name	CO Code	Course Outcomes
C113e	PCN2229	ADVANCED MODULATION AND CODING	C113d.4	Apply a suitable strategy for the compression of text, image, audio, and video.
			C113d.5	Comprehend sparse representation model in dictionary learning.
			C113e.1	Demonstrate an understanding of the trade-offs involved in the design of advanced coding and modulation techniques
			C113e.2	Analyze modulation techniques and their practical considerations.
			C113e.3	Comprehend and analyze multi-carrier systems
			C113e.4	Define the importance and rationale of error correcting coding and its application to modern communication systems
C114	PCN2211	RF AND MICROWAVE CIRCUIT DESIGN LAB	C113e.5	Identify and apply suitable error control coding techniques for various application scenarios.
			C114.1	Explain the transmission line parameters
			C114.2	Design and analyze RF circuits such as LNA, Mixer, and VCO
			C114.3	Synthesize filters
			C114.4	Demonstrate the ability to work with Vector Network Analyzer to characterize microwave components.
C115	PCN2212	SIGNAL PROCESSING LAB	C115.1	Demonstrate an understanding of multirate signal processing concepts
			C115.2	Apply spectrum estimation techniques to random signals.
			C115.3	Apply signal processing concepts for the design of linear filters and adaptive filters.
			C115.4	Apply multiresolution signal analysis using wavelets.
C201a	PCN2321	5G COMMUNICATION TECHNOLOGIES	C201a.1	Elucidate the 5G concept and its use cases.
			C201a.2	Comprehend the concepts of the most important topics influencing architecture design of 5G.
			C201a.3	Examine the 5G radio-access technologies
			C201a.4	Comprehend the concepts of machine-type and device-to-device communications
			C201a.5	Analyze massive MIMO and CoMP performance in 5G.
C201b	PCN2322	RADAR COMMUNICATION	C201b.1	Demonstrate an understanding of the basic principles of radar design.
			C201b.2	Understand radar types and model radar echoes from clutters.
			C201b.3	Interpret the techniques used to track radar signals.
			C201b.4	Understand the detection capability of radar receivers.

Code	Course Code	Course Name	CO Code	Course Outcomes
C201c	PCN2323	COMPRESSIVE SENSING	C201b.5	Differentiate the functionalities of various radar transmitters and receivers.
			C201c.1	Understand the fundamental concepts of compressive sensing
			C201c.2	Represent the signals in sparse form.
			C201c.3	Identify the suitable sensing matrix for the signal of interest.
			C201c.4	Recognize an appropriate reconstruction algorithm for a specific application.
C201d	PCN2342	DEEP LEARNING TECHNIQUES	C201c.5	Appreciate the need for compressive sensing in real time applications.
			C201d.1	Understand the fundamental framework of deep learning.
			C201d.2	Comprehend the nuances of deep neural network models.
			C201d.3	Select suitable deep learning architecture for an application.
			C201d.4	Implement, train, and tune the deep learning model parameters.
C201e	PCN2324	ESTIMATION AND DETECTION THEORY	C201d.5	Apply deep learning models to solve real-world problems
			C201e.1	Demonstrate an understanding of Estimation theory.
			C201e.2	Apply various estimation techniques for parameter estimation.
			C201e.3	Comprehend the fundamentals of detection theory.
			C201e.4	Apply principles of detection theory in detecting signals in presence of noise.
C202a	PCN2325	REMOTE SENSING	C201e.5	Analyse the concepts in detection and estimation of signals by the application to real world scenarios.
			C202a.1	Acquire knowledge about concepts of remote sensing, sensors, and their characteristics.
			C202a.2	Understand the principles and properties of MS, thermal and Hyperspectral Sensing
			C202a.3	Understand the various earth resource satellites and their general Characteristics.
			C202a.4	Acquire Fundamentals of microwave and LIDAR sensing in active domain.
C202b	PCN2326	ARRAY SIGNAL PROCESSING	C202a.5	Interpret the sensed data for various applications.
			C202b.1	Understand the principle of spatial sampling and spatial aliasing.
			C202b.2	Design sensor array-based signal acquisition systems.
			C202b.3	Analyze the sensor array signals in the spatial domain.
			C202b.4	Select a suitable array and effectively compute direction of arrival estimation.
			C202b.5	Apply concepts of array signal processing in different domains such as RADAR, Sonar and Seismic etc.

Code	Course Code	Course Name	CO Code	Course Outcomes
C202c	PCN2327	V2X COMMUNICATIO N	C202c.1	Describe the VANET architecture and its standards.
			C202c.2	Analyze and learn the mobility models in VANETs.
			C202c.3	Apply the routing protocols in VANETs.
			C202c.4	Examine and build the real time application scenarios in VANETs.
			C202c.5	Acquire knowledge on automated connectivity in vehicles and its use cases.
C202d	PCN2341	MACHINE VISION	C202d.1	Implement fundamental image formation techniques required for machine vision.
			C202d.2	Apply feature detectors and feature matching techniques.
			C202d.3	Apply 3D vision techniques.
			C202d.4	Implement motion-related techniques.
			C202d.5	Understand holographic image processing.
C202e	PCN2328	INFORMATION THEORY	C202e.1	Determine the entropy and mutual Information for a given communication system.
			C202e.2	Examine the features of source coding techniques.
			C202e.3	Implement various source coding techniques
			C202e.4	Evaluate the information capacity of discrete memoryless channels
			C202e.5	Analyse the different quantization techniques.
C203	PCN2316	INTERNSHIP WITH SEMINAR	C203.1	Reflect on the purpose of communication, and on the ways of making effective presentations.
			C203.2	Explain the role language skill, reading and listening play in effective communication.
			C203.3	Make improved presentation on a topic from within their specialty.
C204	PCN2318	PROJECT PHASE I	C204.1	Develop aptitude for research and independent learning.
			C204.2	Demonstrate the ability to carry out literature survey and select unresolved problems in the domain of the selected project topic.
			C204.3	Gain the expertise to use new tools and techniques for the design and development.
			C204.4	Acquire the knowledge and awareness to carry out cost-effective and environment friendly designs.
			C204.5	Develop the ability to write good technical report, to make oral presentation of the work, and to publish the work in refereed conferences/journals

Code	Course Code	Course Name	CO Code	Course Outcomes
C205	PCN2418	PROJECT PHASE II	C205.1	Develop aptitude for research and independent learning.
			C205.2	Demonstrate the ability to carry out literature survey and select unresolved problems in the domain of the selected project topic.
			C205.3	Gain the expertise to use new tools and techniques for the design and development.
			C205.4	Acquire the knowledge and awareness to carry out cost-effective and environment friendly designs.
			C205.5	Develop the ability to write good technical report, to make oral presentation of the work, and to publish the work in refereed conferences/journals

Program Educational Objectives (PEOs)

PEO1 Professional development: Graduates will have a successful career in communication system design or associated industries or research and higher education, or as entrepreneurs.

PEO2 Attitude towards lifelong-learning: Graduates will have the ability and attitude to adapt the evolving technological challenges.

Program Outcomes (POs)

- PO1** An ability to independently carry out research/investigation and development work to solve practical problems.
- PO2** An ability to write and present a substantial technical report/document.
- PO3** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirement in the appropriate bachelor program.
- PO4** Design and develop solutions for problems in communication systems.
- PO5** Execute independent projects involving simulations and/or measurements in communication and allied fields.

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Electronics and Communication Engineering
M.E. VLSI Design

List of Course Outcomes (R2018)

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	PMA1176	ADVANCED APPLIED MATHEMATICS	C101.1	Understand the concepts on vector spaces, linear transformation, inner product spaces, eigen values and generalized eigen vectors. Apply various methods in linear algebra to solve system of linear equations.
			C101.2	Develop a fundamental understanding of linear programming models and apply the simplex method for solving linear programming problems.
			C101.3	Solve numerical solution of differential equations by single and multistep methods.
			C101.4	Understand two dimensional random variables, correlations and regression.
			C101.5	Understand the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.
C102	PVL1101	SOLID STATE DEVICES AND INTEGRATED CIRCUITS - I	C102.1	Understand the basic concepts involved in physics of solid state devices
			C102.2	"Understand the operation and analyse basic semiconductor devices like PN junction diode
			C102.3	and BJT"
			C102.4	"Understand the physics of MOS capacitor operation and analyse the MOS capacitor under
			C102.5	different process conditions"
C103	PAE1176	ADVANCED DIGITAL SYSTEM DESIGN	C103.1	Design and analyze synchronous and asynchronous sequential circuits.
			C103.2	Design asynchronous hazard free sequential circuits.
			C103.3	Apply appropriate testing algorithms to detect the fault.
			C103.4	Analyze combinational, sequential circuits using Verilog.
			C103.5	Design and Analyze sequential circuits in high end FPGAs with SoC architecture.
C104	PVL1176	ANALOG INTEGRATED	C104.1	Design single stage amplifier circuits using MOS transistors with different loads and CMOS sub-circuits

Code	Course Code	Course Name	CO Code	Course Outcomes
		CIRCUIT DESIGN	C104.2	Understand the concept of Differential Amplifier and analyse its frequency response.
			C104.3	Understand the characteristics of one stage and two stage operational amplifiers
			C104.4	Develop an ability to parse operational amplifier circuits and analyze the circuits as a whole, including for noise, mismatch, and linearity.
			C104.5	Understand and analyse the high frequency response and noise characteristics of single stage amplifiers.
C105	PVL1102	DSP INTEGRATED CIRCUITS	C105.1	Design and analyze Digital FIR and IIR filters
			C105.2	Analyze the effects of finite word length in digital filters.
			C105.3	Understand DSP processor architectures and perform synthesis of processing elements
C106	PVL1177	DIGITAL CMOS VLSI DESIGN	C106.1	Design basic digital circuits in transistor level
			C106.2	Analyze and choose suitable logical styles for a given problem
			C106.3	Analyze and optimize the transistor level circuits
			C106.4	Measure the delay, analyze and find the optimized delay.
C107	PVL1111	INTEGRATED CIRCUITS LABORATORY	C107.1	Create and analyze digital CMOS circuits and sub-systems for the target specifications.
			C107.2	Create and analyze analog CMOS circuits and sub-systems for the target specifications.
C108	PVL1115	TECHNICAL SEMINAR	C108.1	Reflect on the purpose of communication, and on the ways of making effective presentations
			C108.2	Explain the role language skill, reading and listening play in effective communication
			C108.3	Make improved presentation on a topic from within their specialty
C109	PVL1201	HARDWARE SOFTWARE CO-DESIGN	C109.1	Create design specification and model co-design systems
			C109.2	Apply and analyze hardware software partitioning techniques
			C109.3	Analyze hardware / software co-synthesis techniques
			C109.4	Analyze prototyping and emulation techniques
			C109.5	Create and Analyze hardware-software co-design concepts with the Zynq processor
C110	PVL1202	VLSI PHYSICAL DESIGN AND ALGORITHMS	C110.1	Understand the fundamentals of VLSI physical design automation.
			C110.2	Understand and apply data structures and algorithms involved in the physical design.
			C110.3	Analyze various algorithms used for partitioning, floor planning and pin-assignment, placement, routing and compaction processes.
C111	PVL1203	DESIGN FOR TESTABILITY	C111.1	Understand the basics of testing and analyze the fault models in the circuits
			C111.2	Understand and Apply test vector generation methods for combinational and sequential circuit
			C111.3	Apply and Design logic circuits with improved observability and controllability for

Code	Course Code	Course Name	CO Code	Course Outcomes
				testing
			C111.4	Understand and Apply Built-in self-test architectures in designing combinational logic circuits and memory design
			C111.5	Understand circuit level fault diagnosis and apply self-checking design
C112a	PAE1277	VLSI SYSTEM DESIGN	C112a.1	Understand the complete ASIC design flow
			C112a.2	Understand the steps involved in synthesis, simulation and testing of systems
			C112a.3	Apply different high-performance algorithms in ASICs
			C112a.4	Evaluate the design issues of SOC
C112b	PVL1276	DATA CONVERTERS	C112a.1	Create and analyze sample and hold circuits.
			C112a.2	Create and analyze analog to digital and digital to analog converters.
			C112a.3	Analyze ADC and DAC architectures and its performance.
			C112a.4	Understand calibration techniques.
C112c	PVL1277	SIGNAL INTEGRITY FOR HIGH SPEED DESIGN	C112a.1	Apply the fundamental concepts of signal integrity in high speed PCBs
			C112a.2	Analyze and resolve cross talk
			C112a.3	Model the channels, I/O circuits and be able to perform budgeting
C112d	PVL1278	MICROWAVE INTEGRATED CIRCUITS	C112a.1	Create and analyze impedance matching circuits using LC components and stubs
			C112a.2	Create and analyze microwave components such as power dividers, couplers, filters
			C112a.3	Create and analyze amplifiers and oscillators at microwave frequencies and perform
C113a	PAE1276	EMBEDDED SYSTEM DESIGN FOR IoT	C113a.1	Understand the fundamental concepts of IoT
			C113a.2	Identify the correct microcontrollers for IoT sensors.
			C113a.3	Develop IoT Architecture for a particular application scenario and Identify the correct protocol for a specific application.
			C113a.4	Design a portable IoT using Raspberry Pi.
			C113a.5	Deploy an IoT application for real time scenario and connect to the cloud.
C113b	PCN1277	MULTIMEDIA COMPRESSION TECHNIQUES	C113b.1	Understand text, audio and 3D compression algorithms and compare their efficiencies
			C113b.2	Apply knowledge for identifying a suitable strategy for compression of text, image, audio and video
			C113b.3	Analyze different compression techniques and standards for image and video
			C113b.4	Apply the compression concepts in multimedia communication
C113c	PCN1278	SOFTWARE DEFINED RADIO	C113c.1	Make system-level decisions for software-defined radio technology and products
			C113c.2	Obtain understanding of analog RF components
			C113c.3	Possess understanding of ADC and DAC technology

Code	Course Code	Course Name	CO Code	Course Outcomes
			C113c.4	Implement and evaluate smart antenna algorithms
			C113c.5	Aware of current industry trends and the importance of SDR in future communication systems
C113d	PCN1279	CRYPTOGRAPHY AND NETWORK SECURITY	C113d.1	Understand different types of classical and public key cryptographic algorithms
			C113d.2	Remember and apply block ciphers for software and hardware applications
			C113d.3	Evaluate the authentication algorithms
			C113d.4	Understand various attacks existing in different networks and learn to mitigate the attacks
C114a	PAE1278	MEMS & NEMS	C114a.1	Understand the basics of micro/nano electromechanical structures, devices and systems including their theoretical foundations, applications and advantages.
			C114a.2	Understand the use of materials in micro/nano fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
			C114a.3	Analyze the key performance aspects of micro/nano electromechanical transducers including sensors and actuators.
			C114a.4	Understand the characterization requirements of MEMS/NEMS.
C114b	PAE1279	NANO ELECTRONICS AND TECHNOLOGY	C114b.1	Understand the basics and the theoretical foundations of Nanoelectronics.
			C114b.2	Understand the use of synthesis methods and describe the properties of Nanomaterials.
			C114b.3	Analyze the key performance aspects of Nanoelectronic devices and its characterization.
			C114b.4	Understand the applications of nanotechnology.
C114c	PAE1281	DSP PROCESSOR ARCHITECTURE AND PROGRAMMING	C114c.1	Understand various DSP architecture and its programming
			C114c.2	To create and analyse a simple DSP based System
C114d	PAE1282	ADVANCED DIGITAL IMAGE PROCESSING	C114d.1	Analyze and extract image features and apply it for various image processing tasks
			C114d.2	Evaluate the methodologies for image enhancement, segmentation, restoration etc.,
			C114d.3	Apply and analyze image processing techniques and algorithms
			C114d.4	Apply image processing algorithms to practical applications
C115	PVL1211	VLSI SYSTEM DESIGN LABORATORY	C115.1	Understand and Design various logic modules in FPGA using VHDL and Verilog.
			C115.2	Create and import logic modules into FPGA, synthesize and analysis the module with FPGA design flow.
C116	PVL1215	TECHNICAL WRITING	C116.1	Understand and conduct effective literature review on any chosen topic
			C116.2	Understand the structure of professional communication such as emails, cover letters, manuscripts and reports and be able to write them
			C116.3	Create a technical paper and a report

Code	Course Code	Course Name	CO Code	Course Outcomes
C201a	PAE1377	ADVANCED COMPUTER ORGANIZATION AND ARCHITECTURE	C201a.1	Describe computer architecture concepts and mechanisms related to the design of modern processors, memories, and networks and explain how these concepts and mechanisms interact
			C201a.2	Apply this understanding to new computer architecture design problems within the context of balancing application requirements against technology constraints
			C201a.3	Evaluate various design alternatives
			C201a.4	Demonstrate the ability to implement and verify designs of varying complexity at the register-transfer-level
			C201a.5	Create new designs at the register-transfer-level and the associated effective testing strategies
C201b	PVL1321	CAD FOR VLSI DESIGN	C201b.1	Understand various synthesis tools
			C201b.2	Comprehend various levels of static and dynamic analysis
			C201b.3	Apply constraints for multi-level Logic Synthesis for Hierarchical VLSI Design
C201c	PVL1376	RF IC DESIGN	C201c.1	Understand the fundamentals of RF IC design
			C201c.2	Design circuit level design of building blocks of RF transceivers using CMOS technology
			C201c.3	Analyze various performance parameters of RF transceivers
C201d	PVL1377	LOW POWER VLSI DESIGN	C201d.1	To analyse and understand the basic principles of low power design
			C201d.2	To understand the hierarchy, sources of power consumption and the principles of power dissipation
			C201d.3	To understand the power optimization at different levels and apply the circuit techniques to reduce power consumption
			C201d.4	To study and understand the various power estimation techniques
			C201d.5	To study the low power synthesis techniques and understand the software design methodologies
C202a	PVL1322	SCRIPTING LANGUAGES FOR VLSI	C202a.1	Explain advanced TCL
			C202a.2	Discuss TK and Java script
C202b	PVL1323	VLSI TECHNOLOGY	C202b.1	Associate IC fabrication process steps to the different layers of diffusion, passivation, contacts and metallization that are part of a CMOS IC
			C202b.2	Appreciate the non - linearities associated with CMOS process technologies and its impact on the performance of post fabricated CMOS devices
C202c	PVL1324	NANO SCALE TRANSISTORS	C202c.1	To design circuits using nano scaled MOS transistors with the physical insight of their functional characteristics

Code	Course Code	Course Name	CO Code	Course Outcomes
C202d	PAE1177	SENSROS, ACTUATORS AND SYSTEM INTERFACE	C202d.1	Compare different types of sensors and actuators
			C202d.2	Evaluate digital sensors and semiconductor device sensors
			C202d.3	Analyse the various self-generating sensors
			C202d.4	Interface sensors for various applications
C203a	PVL1325	ARTIFICIAL INTELLIGENCE	C203a.1	Identify problems that are amenable to solution by AI methods
			C203a.2	Identify appropriate AI methods to solve a given problem
			C203a.3	Formalise a given problem in the language/framework of different AI methods
			C203a.4	Implement basic AI algorithms
			C203a.5	Design and carry out an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports
C203b	PVL1326	QUANTUM COMPUTING AND QUANTUM INFORMATION	C203b.1	Understand quantum kinematics, dynamics and quantum entanglement
			C203b.2	Understand the applications of quantum algorithms
			C203b.3	Apply error correction techniques using quantum cryptography
C203c	PVL1327	SOLID STATE DEVICES AND INTEGRATED CIRCUITS - II	C203c.1	Understand the concepts of basic MOS device physics for different levels of modelling, noise modelling of MOSFET, influence of process variation for modelling device mismatch
			C203c.2	Understand the fundamentals of circuit analysis equations and circuit modelling through different techniques to solution of network equations
			C203c.3	Analyze the adaptation of different multistep methods to the solution of electrical networks
			C203c.4	Understand different mathematical techniques for device simulations
			C203c.5	Apply the mathematical techniques for the simulation of characteristics of simple devices like p-n junction diode, MOS capacitor and MOSFET
C203d	PVL1378	SIGNAL PROCESSING FOR VLSI	C203d.1	Understand the design of FIR filters with pipelining and parallel processing techniques
			C203d.2	Use various optimization techniques for the improved realization of FIR based DSP structures
			C203d.3	Use of different optimization techniques for the improved realization of IIR based DSP structures
			C203d.4	Design optimized bit level arithmetic structures
			C203d.5	Comprehend various numerical strength reduction techniques and clocking strategies of DSP architectures

Code	Course Code	Course Name	CO Code	Course Outcomes
C204	PVL1318	PROJECT WORK PHASE - I	C204.1	Develop aptitude for research and independent learning.
			C204.2	Demonstrate the ability to carry out literature survey and select unresolved problems in the domain of the selected project topic.
			C204.3	Gain the expertise to use new tools and techniques for the design and development.
			C204.4	Acquire the knowledge and awareness to carry out cost-effective and environment friendly designs.
			C204.5	Develop the ability to write good technical report, to make oral presentation of the work, and to publish the work in refereed conferences/journals.
C205	PVL1418	PROJECT WORK PHASE II	C205.1	Develop aptitude for research and independent learning.
			C205.2	Demonstrate the ability to carry out literature survey and select unresolved problems in the domain of the selected project topic.
			C205.3	Gain the expertise to use new tools and techniques for the design and development.
			C205.4	Acquire the knowledge and awareness to carry out cost-effective and environment friendly designs.
			C205.5	Develop the ability to write good technical report, to make oral presentation of the work, and to publish the work in refereed conferences/journals.

Program Educational Objectives (PEOs)

PEO1 Professional development: Graduates will have a successful career in electronic system design or associated industries or research and higher education, or as entrepreneurs.

PEO2 Attitude towards lifelong-learning: Graduates will have the ability and attitude to adapt to evolving technological challenges.

Program Outcomes (POs)

- PO1** An ability to independently carry out research/investigation and development work to solve practical problems.
- PO2** An ability to write and present a substantial technical report/document.
- PO3** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirement in the appropriate bachelor program.
- PO4** Design and develop solutions for problems in digital and analog electronic system through VLSI Integrated Circuits.
- PO5** Execute independently the projects involving simulations and / or measurements in digital and analog electronic circuits and system design.

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Electronics and Communication Engineering
M.E. VLSI Design

List of Course Outcomes (R2022)

Code	Course Code	Course Name	CO Code	Course Outcomes
C101	PMA2155	APPLIED MATHEMATICS FOR VLSI DESIGN	C101.1	Comprehend the fundamental concepts of fuzzy sets, fuzzy logic, fuzzy propositions and fuzzy quantifiers
			C101.2	Understand the basics of linear space and linear transformation to solve the problems
			C101.3	Apply various methods in matrix theory to solve decomposition problems
			C101.4	Understand the concepts of random process and its properties to solve problems
			C101.5	Acquire knowledge of graphs and cut-sets and apply in network flow problems
C102	PVL2161	DIGITAL ASIC DESIGN	C102.1	Design and verify Boolean expression and simple logic cells using dataflow and behavioral Verilog models
			C102.2	Design, synthesize and verify arithmetic and selection logic circuits using Verilog models
			C102.3	Design, synthesize and verify sequential arithmetic logic, shift registers and counters using Verilog models
			C102.4	Design, synthesize and verify synchronous finite state machine and sequence detectors using Verilog behavioural models
			C102.5	Design layered testbench for Verilog design using system Verilog
C103	PVL2101	CMOS ANALOG INTEGRATED CIRCUIT DESIGN	C103.1	Realize and design various CMOS sub-circuits and single stage CMOS amplifier circuits
			C103.2	Configure Biasing circuits for the single stage amplifiers and Differential Amplifier with Active loads
			C103.3	Know the characteristics of differential amplifiers and design OP Amps
			C103.4	Analyse the Feedback, stability, and Noise of the single stage CMOS amplifiers
			C103.5	Develop an CMOS amplifier circuits and applications of differential amplifier as operational amplifier and comparator
C104	PVL2102		C104.1	Analyse the operation of MOS Transistor and CMOS Inverter

Code	Course Code	Course Name	CO Code	Course Outcomes
		CMOS DIGITAL VLSI DESIGN	C104.2	Design and Analyse CMOS Inverter
			C104.3	Design and Analyse CMOS Combinational Logic Circuits
			C104.4	Design and Analyse CMOS Sequential Logic Circuits
			C104.5	Design and Analyse CMOS sub-systems
C105	PVL2103	VLSI PHYSICAL DESIGN AND ALGORITHMS	C105.1	Apply graph theory and data structures to implement algorithms involved in the physical Design
			C105.2	Derive objectives and constraints for partitioning, floor planning and pin-assignment, placement, routing and compaction processes
			C105.3	Solve the partitioning, floor planning and pin-assignment, placement problems using Data Structures and Graph Algorithms
			C105.4	Solve the routing and compaction problems using Data Structures and Graph Algorithms
			C105.5	Apply sign-off validation process to complete the Physical Design
C106	PGE2176	RESEARCH METHODOLOGY & IPR	C106.1	Ability to formulate research problem
			C106.2	Ability to carry out research analysis
			C106.3	Ability to follow research ethics
			C106.4	Ability to understand that today's world is controlled by Computer, Information technology, but tomorrow world will be ruled by ideas, concept, and creativity
			C106.5	Ability to understand about IPR and filling patents in R &D
C107	PVL2111	CMOS ANALOG IC DESIGN LABORATORY	C107.1	Design analog CMOS circuits and sub-systems for the target specifications
			C107.2	Analyse analog CMOS circuits and sub-systems for the target specifications
C108	PVL2112	CMOS DIGITAL VLSI DESIGN LABORATORY	C108.1	Design digital integrated circuits and sub-systems for the target specifications
			C108.2	Analyse the performance of digital integrated circuits and sub-systems using pre-layout and post-layout simulations
C109	PVL2201	RF IC DESIGN	C109.1	Analysis of RF microelectronics parameters through S-parameter analysis
			C109.2	Design and characterize LNA with impedance matching
			C109.3	Design of up/down conversion mixers and Voltage controlled oscillators
			C109.4	Design Phase lock loops and Integer-N & Fractional-N frequency synthesizers
			C109.5	Design of Power amplifier with impedance matching
C110	PVL2202	DESIGN FOR TESTABILITY	C110.1	Understand the basics of testing and analyse the fault models in the circuits
			C110.2	Understand and Apply test vector generation methods for combinational and sequential circuit

Code	Course Code	Course Name	CO Code	Course Outcomes
			C110.3	Apply and Design logic circuits with improved observability and controllability for testing
			C110.4	Understand and Apply Built-in self-test architectures in designing combinational logic circuits and memory design
			C110.5	Understand circuit level fault diagnosis and apply self-checking design
C111a	PAE2246	MEMS AND NEMS	C111a.1	Recognize the basics of materials and fabrication of micro electromechanical systems
			C111a.2	Devise the fabrication techniques of nano electromechanical systems
			C111a.3	Analyze the key performance aspects of micro electromechanical transducers
			C111a.4	Analyze the key performance aspects of nano electromechanical transducers
			C111a.5	Identify the characterization requirements of MEMS/NEMS
C111b	PAE2241	NANO ELECTRONICS AND TECHNOLOGY	C111b.1	Discover the basics and the theoretical foundations of Nano electronics
			C111b.2	Realize the use of synthesis methods and describe the properties of Nanomaterial
			C111b.3	Analyze the key performance aspects of Nano electronic devices
			C111b.4	Identify the use of Nano characterization methods
			C111b.5	Apply the principles of Nano biosensors
C111c	PVL2221	NANOSCALE TRANSISTORS	C111c.1	Analyze the engineering aspects of Gate/Source and Drain in SOI MOSFETS
			C111c.2	Recognise the physics of SOI MOSFETS and Quantum effects
			C111c.3	Illustrate the synthesis and construction of nanoscale FET & SET
			C111c.4	Examine the radiation effects in multi-gate MOSFETs
			C111c.5	Model circuits using nanoscale MOSFET devices
C111d	PCN2244	PATTERN RECOGNITION AND MACHINE LEARNING	C111d.1	Understand Classification of data and identify the patterns in it
			C111d.2	Analyse parametric and linear models for classification
			C111d.3	Develop unsupervised learning and clustering techniques for the given data
			C111d.4	Construct Neural network models for recognizing patterns
			C111d.5	Implement, train, and fine tune the deep learning model parameters
C111e	PAE2247	EMBEDDED SYSTEM PROGRAMMING	C111e.1	Understanding of C programming and its salient features for embedded systems
			C111e.2	Analyze the compatibility of various programming languages/software to embedded process development with improved design & programming skills
			C111e.3	Develop C programs in Linux environment
			C111e.4	Able to write python programming for Embedded applications
			C111e.5	Gain knowledge on the recent trends in embedded programming skills
C112a	PVL2242	DATA	C112a.1	Understand the sample and hold architectures and performance metrics used for

Code	Course Code	Course Name	CO Code	Course Outcomes
		CONVERTERS		assessing both DACs and ADCs
			C112a.2	Understand the working principles of comparator in the sample and hold circuit and use switched capacitors to precisely hold the sampled voltage before conversion
			C112a.3	Understand the architectures and challenges and design digital to analog converters
			C112a.4	Understand the architectures and challenges and design analog to digital converters
			C112a.5	Understand the principles of sigma delta modulators and design continuous time Sigma delta modulators
C112b	PCN2241	SIGNAL INTEGRITY FOR HIGH- SPEED DESIGN	C112b.1	Apply the fundamental concepts of signal integrity in high-speed PCBs
			C112b.2	Develop dielectric and conductor models to account for frequency-dependent properties
			C112b.3	Analyse and mitigate cross talk
			C112b.4	Model the channels and I/O circuits
			C112b.5	Interpret jitter and noise and perform budgeting
C112c	PCN2201	RF AND MICROWAVE CIRCUIT DESIGN	C112c.1	Illustrate the fundamentals of high-frequency circuit design
			C112c.2	Analyze the amplifier and oscillator circuits with appropriate stability considerations
			C112c.3	Discuss the design concepts of mixers, phase shifters, and integrated antennas
			C112c.4	Explain the various building blocks and the related performance parameters of the transceiver system
C112d	PAE2202	ROBOTICS AND AUTOMATION	C112d.1	Explain the concepts of industrial robots on classification, specification, future prospects and application relating to the need of robot & automation
			C112d.2	Examine different sensors and actuators for standard industrial applications
			C112d.3	Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots
			C112d.4	Explain robot motion planning using simulation tools and ROS
			C112d.5	Explain AI implications and the design of simple automations using microcontroller
C112e	PAE2245	ARM BASED DEVELOPMENT	C112e.1	Understand ARM7TDMI assembly instructions and their formats and usage
			C112e.2	Write ARM7 based assembly level programs
			C112e.3	Ability to understand how various coprocessors are interfaced in an SoC
			C112e.4	Understand cache design, virtual memory and memory protection concepts and their implementation details in a typical SoC designs
			C112e.5	Understanding on AMBA bus architecture, various HW peripherals in SoCs and processor SW tools chain for embedded software solution development
C113a	PAE2243	HARDWARE	C113a.1	Create design specification and model co-design systems
			C113a.2	Apply and, analyze partitioning techniques

Code	Course Code	Course Name	CO Code	Course Outcomes
		SOFTWARE CO-DESIGN	C113a.3	Analyze hardware / software co-synthesis techniques
			C113a.4	Analyze prototyping and emulation techniques
			C113a.5	Implement hardware-software co-design concepts with the Zynq processor
C113b	PVL2241	SIGNAL PROCESSING FOR VLSI	C113b.1	Understand various commonly used DSP algorithms and their representation
			C113b.2	Apply the pipelining and parallel processing techniques in the design of FIR filter
			C113b.3	Implement pipelining and parallel processing techniques in the design of IIR and Adaptive filters
			C113b.4	Annotate various algorithmic strength reduction techniques
			C113b.5	Apply the algorithmic strength reduction techniques in filters and transforms
C113c	PAE2244	ADVANCED COMPUTER ORGANIZATION AND ARCHITECTURE	C113c.1	Gain knowledge of the principles of computer architecture and instruction-level parallelism and challenges
			C113c.2	Analyze the architecture of vector processor, SIMD, and GPU architecture and enhance techniques of parallelism
			C113c.3	Analyze the characteristics of multithreading multiprocessors, and various issues in shared memory architecture
			C113c.4	Design and evaluate the performance optimization of the memory system and memory hierarchy
			C113c.5	Analyze the warehouse-scale computer programming model Domain-Specific architectures
C113d	PAE2248	SYSTEM-ON-CHIP DESIGN	C113d.1	Identify & formulate a given problem in framework of SoC based design approaches
			C113d.2	Design SoC based logic cores for engineering applications
			C113d.3	Design SoC based memory and analog cores for engineering applications
			C113d.4	Understand SoC design validation and design examples
			C113d.5	Understand SoC testing
C113e	PVL2222	MULTI-CORE ARCHITECTURE AND PROGRAMMING	C113e.1	Comprehend multicore architectures and identify their characteristics and challenges
			C113e.2	Identify the issues in programming Parallel Processors
			C113e.3	Develop programs using OpenMP and MPI
			C113e.4	Design parallel programming solutions to common problems
			C113e.5	Analyse the programming for serial processors and programming for parallel processors
C114	PVL2211	RF IC DESIGN LABORATORY	C114.1	Design RF CMOS circuits and sub-systems for the target specifications
			C114.2	Analyse RF CMOS circuits and sub-systems for the target specifications
C115	PVL2212		C115.1	Develop verification architecture for the given design and verify it with effective use of simulators

Code	Course Code	Course Name	CO Code	Course Outcomes
		DESIGN VERIFICATION AND TESTING LABORATORY	C115.2	Develop exhaustive list of possible faults for the given design and also be able to prepare necessary test set
C201a	PVL2342	LOW POWER VLSI DESIGN	C201a.1	Understand the hierarchy, sources of power consumption and the principles of power dissipation
			C201a.2	Apply various power estimation techniques at circuit level, logic level and architecture level
			C201a.3	Analyze the power optimization techniques at circuit level, logic level and architecture level
			C201a.4	Design low power memories, clocks, interconnects and layout
			C201a.5	Apply low power synthesis techniques and software design methodologies
C201b	PVL2341	MOS DEVICE MODELLING	C201b.1	Comprehend the basic concepts involved in physics of solid state devices
			C201b.2	Describe the relationship between electron transport properties and operation of semiconductor devices like PN junction diode
			C201b.3	Investigate MOS capacitor operation under different bias configurations and conditions
			C201b.4	Analyse the MOSFET operation taking into consideration of different bias parameters and understand basic MOSFET modelling
			C201b.5	Understand advanced MOSFET Modelling including second order effects and high frequency modelling of MOSFET
C201c	PAE2343	CMOS FABRICATION TECHNOLOGY	C201c.1	Analyze issues related to epitaxial growth and oxidation
			C201c.2	Examine the lithography and etching techniques for IC fabrication
			C201c.3	Devise the doping techniques using diffusion and ion implantation
			C201c.4	Associate IC fabrication process steps to deposition and metallization
			C201c.5	Appreciate the non - linearities associated with CMOS process technologies
C201d	PAE2103	EMBEDDED SYSTEM DESIGN	C201d.1	Understand the principles of embedded real-time systems
			C201d.2	Apply optimization techniques in an embedded system design
			C201d.3	Define processes with constraints and dependencies for an embedded system
			C201d.4	Apply and analyze scheduling policies for an embedded real-time system
			C201d.5	Understand the features of RTOS
C201e	PAE2342	RF ENERGY	C201e.1	Recognize RF energy harvesting sources and methods

Code	Course Code	Course Name	CO Code	Course Outcomes
		HARVESTING	C201e.2	Identify the antennas and rectifiers for RF energy harvesting
			C201e.3	Examine the wireless power transfer schemes for RF energy harvesting
			C201e.4	Model matching circuits for RF energy harvesting
			C201e.5	Analyse the single band and dual band wireless RF energy harvesting
C202a	PVL2344	RECONFIGURABLE VLSI ARCHITECTURES	C202a.1	Relate the fundamentals of reconfigurable computing systems
			C202a.2	Articulate the design issues involved in reconfigurable programming systems
			C202a.3	Analyse the performance trade-offs by mapping the design methodologies with a reconfigurable platform
			C202a.4	Discuss the implementation of reconfigurable architectures with FPGA
			C202a.5	Analyse different FPGA applications as case studies
C202b	PCN2342	DEEP LEARNING TECHNIQUES	C202b.1	Understand the fundamental framework of deep learning
			C202b.2	Comprehend the nuances of deep neural network models
			C202b.3	Select suitable deep learning architecture for an application
			C202b.4	Implement, train, and tune the deep learning model parameters
			C202b.5	Apply deep learning models to solve real-world problems
C202c	PCN2341	MACHINE VISION	C202c.1	Implement fundamental image formation techniques required for machine vision
			C202c.2	Apply feature detectors and feature matching techniques
			C202c.3	Apply 3D vision techniques
			C202c.4	Implement motion-related techniques
			C202c.5	Understand holographic image processing
C202d	PAE2102	SENSORS, ACTUATORS AND SYSTEM INTERFACE	C202d.1	Analyse the characteristic parameters to evaluate the sensor performance
			C202d.2	Utilize the sensors for measuring various physical parameters
			C202d.3	Analyse the various self-generating sensors
			C202d.4	Apply actuators for various real time engineering applications
			C202d.5	Interface sensors for real time applications
C202e	PAE2341	NETWORK-ON-CHIP	C202e.1	Comprehend the basic concepts involved in network on chip design
			C202e.2	Analyse different architectures in NoC
			C202e.3	Investigate different routing algorithms for NoC design
			C202e.4	Analyse the fault tolerance techniques of NoC
			C202e.5	Understand three dimensional integration issues in NoC
C203	PVL2316	INTERNSHIP WITH SEMINAR	C203.1	Reflect on the purpose of communication, and on the ways of making effective presentations

Code	Course Code	Course Name	CO Code	Course Outcomes
C204	PVL2318	PROJECT PHASE I	C203.2	Explain the role language skill, reading and listening play in effective communication
			C203.3	Make improved presentation on a topic from within their specialty
			C204.1	Develop aptitude for research and independent learning
			C204.2	Demonstrate the ability to carry out literature survey and select unresolved problems in the domain of the selected project topic
			C204.3	Gain the expertise to use new tools and techniques for the design and development
			C204.4	Acquire the knowledge and awareness to carry out cost-effective and environment friendly designs
			C204.5	Develop the ability to write good technical report, to make oral presentation of the work, and to publish the work in refereed conferences/journals
C205	PVL2418	PROJECT PHASE II	C205.1	Develop aptitude for research and independent learning
			C205.2	Demonstrate the ability to carry out literature survey and select unresolved problems in the domain of the selected project topic
			C205.3	Gain the expertise to use new tools and techniques for the design and development
			C205.4	Acquire the knowledge and awareness to carry out cost-effective and environment friendly designs
			C205.5	Develop the ability to write good technical report, to make oral presentation of the work, and to publish the work in refereed conferences/journals

Program Educational Objectives (PEOs)

PEO1 Professional development: Graduates will have a successful career in electronic system design or associated industries or research and higher education, or as entrepreneurs.

PEO2 Attitude towards lifelong-learning: Graduates will have the ability and attitude to adapt to evolving technological challenges.

Program Outcomes (POs)

- PO1** An ability to independently carry out research/investigation and development work to solve practical problems.
- PO2** An ability to write and present a substantial technical report/document.
- PO3** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirement in the appropriate bachelor program.
- PO4** Design and develop solutions for problems in digital and analog electronic system through VLSI Integrated Circuits.
- PO5** Execute independently the projects involving simulations and / or measurements in digital and analog electronic circuits and system design.

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

1	C101	PMA2152	APPLIED MATHEMATICS FOR POWER ELECTRONICS ENGINEERS	C101.1	Familiarize the concepts of vector spaces and subspaces and solve the problems.
				C101.2	Apply various methods in matrix theory to solve decomposition problems.
				C101.3	Introduce the concept of Generalized Fourier series and solve problems.
				C101.4	Solve problems in power spectral density, by gaining the knowledge of random process and its properties.
				C101.5	Obtain the extremum of the functionals and solve problems using various methods in Calculus of variations.
2	C102	PPE2101	MODELING AND ANALYSIS OF ELECTRICAL MACHINES	C102.1	To describe the relationship among various magnetic circuit parameters in mathematical form and use the concepts in electromechanical energy conversion process.
				C102.2	To analyze model with voltage torque equations, and time domain block diagram with state equations and, analyze steady state and dynamic performance of various DC machines.
				C102.3	To demonstrate different types of reference frame theories and to determine the transformations among various co-ordinate frame.
				C102.4	To compare the induction machine modeling using arbitrary reference frame and machine frame variables with voltage and torque equations.
				C102.5	To compare the synchronous machine modeling using arbitrary reference frame, rotor reference frame and machine frame variables. Also, to study the modeling of Permanent magnet synchronous machine.

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

3	C103	PPE2102	ADVANCED POWER SEMICONDUCTOR DEVICES	C103.1	Explain the desired power devices attributes and identify appropriate device for a specified power circuit.
				C103.2	Describe the physical operation and characteristics of current controlled power semiconductor devices.
				C103.3	Describe the physical operation and characteristics of voltage-controlled power semiconductor devices.
				C103.4	Explain the principle of advanced power devices and new materials for device fabrication.
				C103.5	Design the triggering and protection circuits for various power devices
4	C104	PPE2103	ANALYSIS AND DESIGN OF POWER CONVERTERS	C104.1	Analyze various single phase and three phase ac-dc power converters.
				C104.2	Analyze dc-dc converter topologies for a wide range of switched mode power supply applications.
				C104.3	Outline the design of inductor and capacitor components for different power converters.
				C104.4	Describe the working of voltage source and current source inverters.
				C104.5	Describe the working of ac-ac converters for variable voltage and frequency applications.
				C104.6	Design power converters for industrial applications.

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

5	C105	PPE2104	SYSTEM DESIGN USING MICROCONTROLLER	C105.1	Describe the architectural features and programming aspects of 8051 microcontroller
				C105.2	Illustrate the interfacing of peripherals with 8051 microcontrollers
				C105.3	Explain the functional block diagram and features of STM32 microcontroller
				C105.4	Illustrate the interfacing of peripherals with STM32 microcontroller
				C105.5	Demonstrate the applications of microcontroller and FPGA for power electronics and drives.
6	C106	PGE2176	RESEARCH METHODOLOGY AND IPR	C106.1	Formulate research problem
				C106.2	Carry out research analysis
				C106.3	Follow research ethics
				C106.4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity Explain IPR on digital products and law.
				C106.5	Understand about IPR and filing patents in R & D.

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

7	C107	PPE2111	POWER CONVERTERS SIMULATION LABORATORY	C107.1	Analyse the performance of single phase and three phase rectifiers through simulation
				C107.2	Analyse the performance of DC-DC converters and DC-AC inverters through simulation
				C107.3	Analyse the performance of single phase and three phase AC-AC converters.
8	C108	PPE2112	DIGITAL CONTROLLERS FOR POWER ELECTRONIC CONVERTERS LABORATORY	C108.1	Develop programs in microcontroller to generate switching pulses for power electronic circuits
				C108.2	Demonstrate the interfacing I/O devices and sensors with microcontroller using suitable program
				C108.3	Develop programs in FPGA for power electronic circuits
9	C109	PPE2201	SOLID STATE DRIVES	C109.1	Analyze the performance of phase-controlled converter fed DC drives
				C109.2	Illustrate the operation of chopper fed DC drives.
				C109.3	Analyze the performance of induction motor drive with various control methods
				C109.4	Explain the vector control of induction motor drive
				C109.5	Demonstrate the control strategies for synchronous motor drive

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes					
				C109.6	Select suitable drive and develop its control strategies for industrial applications

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

10	C110	PPE2202	ELECTRIC AND HYBRID VEHICLES	C110.1	Summarise the basics of electric vehicle and vehicle mechanics.
				C110.2	Explain the basics of internal combustion engines and design of HEV.
				C110.3	Discuss the concepts of HEV motor and its controls.
				C110.4	Demonstrate the use of battery and alternate energy storage systems.
				C110.5	Explain the power train technology and management systems of the EV.
11	C111	PPE2211	ELECTRIC DRIVES LAB	C111.1	Apply experimentation methods to analyze speed control of conventional and special electric machines fed with power electronic converters.
				C111.2	Evaluate power quality parameters of VSI fed drive using Power quality analyzer.
				C111.3	Apply simulation methods to implement speed control of special electric machines.

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

12	C112	PPE2212	POWER ELECTRONIC SYSTEM DESIGN LABORATORY	C112.1	Design of components for power electronic converters.
				C112.2	Development of DC-DC chopper and DC-AC PWM inverter.
				C112.3	Analyze the characteristics of PV & EV battery and perform study of fuel cell.
13	C113	PPE2216	INTERNSHIP WITH SEMINAR	C113.1	Understand specific functional areas.
				C113.2	Gain practical insights of selected topics in the specialization area.
				C113.3	Explore career opportunities in the specialization areas.

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

14	C114	PPE2318	PROJECT PHASE I	C114.1	Analyze literature, recent industrial developments to formulate a research problem in the area of power electronics and drives and understand the need for continuing professional development
				C114.2	Develop and devise methodologies to arrive at feasible solutions by applying fundamentals of science, mathematics and electrical engineering.
				C114.3	Demonstrate the modelling and simulation aspects of power electronic and drive systems employed in applications like renewable energy, smart grid and electric vehicle.
				C114.4	Demonstrate the solutions through organized technical reports and oral presentations highlighting the societal relevance and economic feasibility.
15	C115	PPE2418	PROJECT PHASE II	C115.1	Analyze literature, recent industrial developments to formulate a research problem in the area of power electronics and drives and understand the need for continuing professional development.
				C115.2	Develop and devise methodologies to arrive at feasible solutions by applying fundamentals of science, mathematics and electrical engineering.
				C115.3	Demonstrate the modelling and simulation aspects of power electronic and drive systems employed in applications like renewable energy, smart grid and electric vehicle.
				C115.4	Illustrate the feasibility of solutions through appropriate hardware technology.
				C115.5	Demonstrate the solutions through organized technical reports and oral presentations highlighting the societal relevance and economic feasibility

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

16	C116	UEE1211	Electric Circuits Laboratory	C116.1	Apply simulation and experimentation methods to verify Kirchoff's laws and network theorems
				C116.2	Apply simulation and experimentation methods to validate transient response, frequency response and resonance in electrical circuits
				C116.3	Apply simulation and experimentation methods to analyze various types of three phase balanced and unbalanced circuits
17	C117	PPE2223	DESIGN OF SOLAR PHOTOVOLTAIC SYSTEMS	C117.1	Explain the photovoltaic principles and techniques of solar energy conversion.
				C117.2	Illustrate the design of standalone PV system.
				C117.3	Describe the design of grid connected PV system.
				C117.4	Describe the safety aspects and standards involved in the installation of solar PV systems.
				C117.5	Design PV system for real world applications.

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

18	C118	PPE2229	POWER QUALITY	C118.1	Explain causes of power quality issue along with terminologies, definitions, and standards.
				C118.2	Explain conventional load compensation methods.
				C118.3	Apply principles and operation of DSTATCOM for load compensation.
				C118.4	Illustrate various series compensation techniques for power distribution system.
				C118.5	Describe power quality issue in distributed generation and grid integration.
19	C119	PPE2236	Electromagnetic Theory	C119.1	Explain the concepts of IoT.
				C119.2	Analyze various protocols for IoT.
				C119.3	Design an IoT system using Raspberry Pi, Arduino, STM32
				C119.4	Apply data analytics and use cloud offerings related to IoT.
				C119.5	Apply IoT for real time systems.

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

20	C120	PPE2323	POWER ELECTRONICS FOR SOLAR AND WIND ENERGY CONVERSION SYSTEMS	C120.1	Examine the various renewable energy sources and its impact on the environment.
				C120.2	Explain the operating principle of electrical machines used in wind energy conversion system.
				C120.3	Analyse the power electronic converters utilized for wind energy systems.
				C120.4	Analyse the Multistage amplifiers and differential amplifiers
				C120.5	Apply the feedback amplifier concepts and analyze the oscillator circuits
21	C121	PPE2326	PULSE WIDTH MODULATION FOR POWER ELECTRONIC CONVERTERS	C121.1	Explain the effects of Harmonics in Power Electronics and Drives.
				C121.2	Demonstrate the need and methods of PWM.
				C121.3	Analyse the Space Vector based PWM Techniques.
				C121.4	Analyse the performance parameters for various PWM strategies and Design the PWM techniques for over-modulation.

R2022 M.E. Power Electronics and Drives Subjects Course Outcomes

22	C122	PGE2942	INDUSTRIAL SAFETY	C122.1	Ability to summarize basics of industrial safety.
				C122.2	Ability to describe fundamentals of maintenance engineering.
				C122.3	Ability to explain wear and corrosion.
				C122.4	Ability to illustrate fault tracing.
				C122.5	Ability to identify preventive and periodic maintenance.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
1	C101	UEN1176	Communicative English	C101.1	Apply reading strategies to comprehend articles of a general kind in magazines and newspapers.
				C101.2	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
				C101.3	Comprehend conversations and short talks delivered in English in both formal and informal contexts.
				C101.4	Write short essays of a general kind and personal letters and emails in English.
2	C102	UMA1176	Algebra and Calculus	C102.1	Obtain the expansion of trigonometric functions using De-Moivre's theorem.
				C102.2	Determine the Eigen values and Eigen vectors and diagonalize the given matrix.
				C102.3	Evaluate the circle of curvature, evolute and envelope of a given curve.
				C102.4	Find Taylor's expansion for functions of two variables, solve problems using Jacobians and find the extreme points of a function of two variables.
				C102.5	Solve problems using beta and gamma functions and evaluate problems in double integral and triple integral.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
3	C103	UPH1176	Engineering Physics	C103.1	Analyze crystal structures and the influence of imperfections on their properties.
				C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.
				C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
				C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
				C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.
4	C104	UCY1176	Engineering Chemistry	C104.1	Apply the principles of chemistry to determine the impurities present in water and their removal
				C104.2	Classify polymers based on synthesis, properties and applications and explain the adverse effect of polymers on environment
				C104.3	Construct phase diagram with the help of thermal analysis and apply electrochemical principles to control corrosion of metals and alloys.
				C104.4	Explain the characteristics of different types of fuels and apply the knowledge on combustion to improve the efficiency of fossil fuel.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
5	C105	UGE1176	Problem Solving and Programming in Python	C105.1	Think logically to solve programming problems and write solutions in pseudo code.
				C105.2	Understand and develop simple Python programs using conditionals and loops.
				C105.3	Decompose a program into functions.
				C105.4	Represent compound data using Python lists, tuples, dictionaries.
				C105.5	Perform input/output with files.
6	C106	UGE1177	Engineering Graphics	C106.1	Familiarize with the fundamentals and standards of Engineering graphics
				C106.2	Perform freehand sketching of basic geometrical constructions and multiple views of objects.
				C106.3	Project orthographic projections of lines and plane surfaces.
				C106.4	Draw projections and solids and development of surfaces.
				C106.5	Visualize and to project isometric and perspective sections of simple solids.
				C106.6	Read a building drawing.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
7	C107	UGE1197	Programming in Python Laboratory	C107.1	To write, test, and debug simple Python programs.
				C107.2	To implement Python programs with conditionals and loops.
				C107.3	Use functions for structuring Python programs.
				C107.4	Represent compound data using Python lists, tuples, and dictionaries.
				C107.5	Read and write data from/to files in Python.
8	C108	UGS1197	Physics & Chemistry Laboratory	C108.1	The physical properties of materials like elasticity, compressibility, and viscosity.
9	C109	UEN1276	Technical English	C109.1	Apply reading strategies to comprehend technical texts and write area- specific texts effortlessly.
				C109.2	Listen and comprehend lectures and talks in science and technology.
				C109.3	Speak appropriately and effectively in varied formal and informal contexts.
				C109.4	Write technical documents like reports, emails, resume and winning job applications.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
10	C110	UMA1276	Complex functions and Laplace transforms	C110.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations.
				C110.2	Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function.
				C110.3	Obtain the Laplace Transforms of standard functions.
				C110.4	Solve Differential Equations of Second order and Simultaneous linear equations with constant coefficients of first order using Laplace Transform.
				C110.5	Solve problems using divergence and curl and evaluate line, Surface and Volume integrals.
11	C111	UPH1277	Physics for Electronics Engineering	C111.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures
				C111.2	Acquire knowledge on basics of semiconductor physics and its application to simple devices like PN junction devices
				C111.3	Relate the magnetic and superconducting phenomena to their applications
				C111.4	Demonstrate an understanding of dielectric materials, their operational limits and applications
				C111.5	Understand the structure-property relationship of various nano and optoelectronic materials and their realization in various domains.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
12	C112	UCY1276	Environmental Science	C112.1	To understand the fundamentals of ecosystems and the importance of biodiversity.
				C112.2	To understand the importance of natural resources and the social issues arising due the overexploitation of natural resources and the growing human population.
				C112.3	To understand the causes, effects and control measures of various types of environmental pollution.
				C112.4	To know the role of Government machineries and individual in preventing environmental degradation as well as in disaster management and the role of information technology as a tool for environmental management and sustainability.
13	C113	UGE1276	Basic Civil and Mechanical Engineering	C113.1	Appreciate the Civil and Mechanical Engineering components
				C113.2	Explain the usage of construction material and proper selection of construction materials.
				C113.3	Measure distances and area by surveying
				C113.4	Identify the components used in power plant cycle.
				C113.5	Demonstrate working principles of petrol and diesel engine.
				C113.6	Elaborate the components of refrigeration and Air conditioning cycle

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
14	C114	UEE1201	Electric circuit analysis	C114.1	Explain the basic concepts of DC and AC circuits.
				C114.2	Illustrate and solve the electric circuits using theorems.
				C114.3	Demonstrate the concepts of series and parallel resonance and their parameters.
				C114.4	Identify the circuit transients and infer the impact of it on circuit performance.
				C114.5	Illustrate the concepts of three phase AC circuits.
15	C115	UG1297	Design Thinking and Engineering Practices Laboratory	C115.1	Apply basic knowledge about civil and mechanical works in practice
				C115.2	Apply knowledge of basic electrical into household electrical practices
				C115.3	Apply knowledge about basic electronics in household electronics practices

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
16	C116	UEE1211	Electric Circuits Laboratory	C116.1	Apply simulation and experimentation methods to verify Kirchoff's laws and network theorems
				C116.2	Apply simulation and experimentation methods to validate transient response, frequency response and resonance in electrical circuits
				C116.3	Apply simulation and experimentation methods to analyze various types of three phase balanced and unbalanced circuits
17	C201	UMA1376	Transform Techniques and Partial Differential Equations	C201.1	Solve engineering problems using Fourier series.
				C201.2	Understand and solve partial differential equations of first and higher order.
				C201.3	Use Fourier series techniques to solve partial differential equations .
				C201.4	Apply Fourier transform techniques to solve some of the physical problems of engineering.
				C201.5	Apply Z - transform techniques to solve some of the physical problems of engineering.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
18	C202	UEE1301	Electrical Machines I	C202.1	Illustrate the principles of electromechanical energy conversion in singly and multiply excited systems.
				C202.2	Describe the construction, working principle and characteristics of the DC generator.
				C202.3	Explain the speed control methods, starters and tests of DC motor
				C202.4	Analyse the performance of single-phase and three-phase transformers
				C202.5	Demonstrate the three phase transformer connections and principles of instrument transformers
19	C203	UEE 1302	Electromagnetic Theory	C203.1	Describe and solve problems in the vector analysis in orthogonal coordinate systems
				C203.2	Explain the concepts of static electric fields
				C203.3	Describe the concepts of static magnetic fields
				C203.4	Analyze an electromagnetic device by applying Maxwell's equations
				C203.5	Illustrate the electromagnetic wave propagation and corresponding parameters

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
20	C204	UEE1303	Electronic Devices and Circuits	C204.1	Describe the operation, characteristics and applications of electronic devices
				C204.2	Explain the biasing methods for amplifiers
				C204.3	Analyze the frequency response of amplifiers
				C204.4	Analyse the Multistage amplifiers and differential amplifiers
				C204.5	Apply the feedback amplifier concepts and analyze the oscillator circuits
21	C205	UEE1304	Object Oriented Programming	C205.1	Explain the concepts of object oriented programming
				C205.2	Apply the concepts of polymorphism in object oriented programming with C++
				C205.3	Illustrate the concepts of file handling and IO streams in C++
				C205.4	Differentiate JAVA from C++ and discuss the basics of JAVA
				C205.5	Illustrate the concepts of threads, error handling and IO streams in JAVA

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
22	C206	UEE1305	Modern Power Plant Engineering	C206.1	Explain the layout, construction and working of thermal power plant.
				C206.2	Illustrate the construction and working of Diesel, Gas and Combined cycle power plants
				C206.3	Describe the layout, construction and working of nuclear power plant
				C206.4	Describe the methods of power generation and conversion methods from Renewable energy sources
				C206.5	Analyse the economics of power generation
23	C207	UEE1311	Electrical Machines Laboratory-I	C207.1	Measure, interpret and explain the characteristics of DC shunt, series and compound generators
				C207.2	Measure, analyse and examine the performance of DC shunt, series and compound motors
				C207.3	Examine the regulation and performance characteristics of transformers
				C207.4	Experiment the predetermination test on DC motor and transformer

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
24	C208	UEE1312	Object Oriented Programming Laboratory	C208.1	Gain the basic knowledge on Object Oriented concepts.
				C208.2	Develop applications using Object Oriented Programming Concepts.
				C208.3	Implement features of Object-Oriented Programming to solve real world problems.
25	C209	UMA1452	Numerical Methods	C209.1	Understand the basic concepts and techniques of solving algebraic and transcendental equations.
				C209.2	Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
				C209.3	Apply the numerical techniques of differentiation and integration for engineering problems.
				C209.4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
				C209.5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
26	C210	UEE1401	Electrical Machines II	C210.1	Explain the fundamentals of AC machines and the basic principles of emf, mmf generation in the machine windings.
				C210.2	Acquire knowledge on the constructional features, working and performance evaluation methods of synchronous machines.
				C210.3	Describe the construction, principle and analyze performance characteristics of three phase induction motors.
				C210.4	Explain the constructional features of single phase induction motors and other fractional KW motors.
				C210.5	Evaluate the performance of synchronous and induction machines to assess suitability for domestic and industrial applications.
27	C211	UEE1402	Transmission and Distribution	C211.1	Explain the transmission line parameters for various geometrical configurations of single phase and three phase systems
				C211.2	Apply the transmission line models and evaluate its performance parameters.
				C211.3	Analyze the various types of insulators, cables and their construction
				C211.4	Examine the mechanical and electrical components of the power system
				C211.5	Classify the DC and AC distribution systems

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
28	C212	UEE1403	Control Systems	C212.1	Describe the different types of control system, mathematical modelling of the system with differential equations, block diagram reduction technique and signal flow graph method.
				C212.2	Analyze the time response of given control system and the effects of P, PI, PID controllers.
				C212.3	Analyze the frequency response and stability of the given control system.
				C212.4	Analyze the different types of compensator to ascertain the desired response of the system.
				C212.5	Test the controllability and observability of a given system using the state variable model.
29	C213	UEE1404	Digital Logic System Design	C213.1	Apply fundamental digital principles to model combinational logic circuits.
				C213.2	Demonstrate the use of various combinational logic circuits
				C213.3	Analyse and design synchronous sequential logic circuit for counters and FSM realization.
				C213.4	Analyse and design asynchronous sequential logic circuits and PLDs.
				C213.5	Illustrate the use of VHDL in synthesizing various digital logic circuits.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
30	C214	UEE1405	Analog Electronic Circuits	C214.1	Explain the IC fabrication steps and their integrated sequence to fabricate Silicon devices and ICs.
				C214.2	Describe the Characteristics of Op-amp ICs.
				C214.3	Analyze the Op-amp circuits for basic applications with feedback using passive components and diodes.
				C214.4	Analyze the Op-amp circuits for reasonably complex applications such as multivibrators, filters and oscillators.
				C214.5	Illustrate the internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs
31	C215	UEE1411	Electrical Machines Laboratory-II	C215.1	Formulate and practice the experimental procedures and measurement involved in the determination of regulation of alternators
				C215.2	Measure, analyze, interpret and describe the characteristics of synchronous motor.
				C215.3	Measure, analyze, interpret and describe the characteristics of induction motors.
				C215.4	Evaluate and analyze the characteristics of induction motors used in industrial applications.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
32	C216	UEE1412	Analog and Digital Electronic Circuits Laboratory	C216.1	Experimentally verify the characteristics of operational amplifiers and timer circuits
				C216.2	Experimentally obtain the characteristics of diode and BJT
				C216.3	Design Digital circuits using gates and digital ICs
				C216.4	Use software simulators for analysis of analog ICs.
				C216.5	Apply VHDL programming to synthesize digital circuits.
33	C301	UEE1501	Power System Analysis	C301.1	Explain the mathematical model of a power system under steady state operating condition.
				C301.2	Solve steady state power flow analysis of power system networks using iterative methods.
				C301.3	Analyze symmetrical faults in power system networks.
				C301.4	Analyze unsymmetrical faults in power system networks.
				C301.5	Explain the concept of steady state and transient stability.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
34	C302	UEE1502	Discrete Time Signals and Systems	C302.1	Describe the mathematical representation of various types of standard signals and systems.
				C302.2	Analyze the discrete time signals
				C302.3	Analyze of discrete time systems
				C302.4	Apply the transformation techniques to discrete time signals and systems.
				C302.5	Outline the Filters design procedure for DT systems
35	C303	UEE1503	Microprocessor and Microcontroller-Theory and Applications	C303.1	Explain the architectural building blocks of 8085 processor
				C303.2	Apply the programming concepts of 8085 processor
				C303.3	Describe the architectural features of 8051microcontroller.
				C303.4	Illustrate the interfacing of peripheral devices with 8085 and 8051.
				C303.5	Apply the programming concepts of 8051 microcontroller
				C303.6	Develop real time applications using microcontroller

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
36	C304	UEE1504	Power Electronics	C304.1	Describe the characteristics of power semiconductor devices
				C304.2	Analyse the operation and performance of phase-controlled rectifiers
				C304.3	Examine the operation and control of DC – DC converters
				C304.4	Discuss the operation and switching strategies of DC – AC and AC – AC converters
				C304.5	Select an appropriate power converter and illustrate its characteristics for specific applications
37	C305	UEE1505	Electrical Measurements and Instrumentation Systems	C305.1	Explain the basic functional elements of any instrument
				C305.2	Explain the fundamental concept of electrical and electronic instruments
				C305.3	Compare various principles and techniques involved in measurement
				C305.4	Illustrate the concept of different storage and display devices
				C305.5	Demonstrate the knowledge about various transducers and data acquisition systems
				C305.6	Identify an appropriate instrument for a particular application

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
38	C306A	UEE1521	Principles of Management	C306A.1	Describe the theories, functions, current trends and challenges of business management for different types of organization.
				C306A.2	Illustrate the planning, strategies and decision making process.
				C306A.3	Describe the concept of organization structures and human resource management.
				C306A.4	Describe the qualities leaders along with communication process.
				C306A.5	Analyze business issues to formulate best control strategies.
39	C306B	UGE1476	Total Quality Management	C306B.1	Describe basic concepts of total quality management (TQM) and contributions to TQM.
				C306B.2	Describe the Strategic quality planning and Continuous process improvement like PDCA cycle, 5S and Raizen.
				C306B.3	Illustrate traditional and new management tools for bench marking process
				C306B.4	Explain the concepts of six sigma, quality function development and total productive maintenance
				C306B.5	Describe the process for TQM Implementations.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
40	C306C	UGE1576	Professional Ethics	C306C.1	Explain the human values and work ethics
				C306C.2	Explain the moral issues and ethical theories
				C306C.3	Describe the codes of ethics and infer the ethical issues from the case studies
				C306C.4	Illustrate the safety and risks of a product/service in industries
				C306C.5	Summarize the globalization issues and corporate social responsibility
41	C307	UEE1511	Control and Instrumentation Laboratory	C307.1	Apply the control system concept to electrical engineering problems
				C307.2	Illustrate the characteristics of different converters, compensators and other instruments
				C307.3	Design a signal conditioning circuit
				C307.4	Build a specific bridge network for a particular application
				C307.5	Demonstrate the transducer concept to a particular engineering problem

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
42	C308	UEE1512	Microprocessors and Microcontroller Laboratory	C308.1	Use the programming aspects of 8085 processor
				C308.2	Develop programs in assembly language for 8051 micro controllers
				C308.3	Apply A/D , D/A and serial communication knowledge to interface microprocessor with A/D and D/A
				C308.4	Develop programs in microprocessor and microcontroller for the interfacing with DC and AC motors.
				C308.5	Analyze capabilities of the simulation environment of different software
43	C309	UEE1601	Solid State Drives	C309.1	Describe the steady state operation and transient dynamics of a motor load system
				C309.2	Examine the operation of the converter/chopper fed dc drive
				C309.3	Analyse the operation and performance of AC motor drives
				C309.4	Outline current and speed controllers for a closed loop motor drive
				C309.5	Select a suitable electrical drive for specific application in the industry

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
44	C310	UEE1602	Communication Engineering	C310.1	Apply analog and digital communication techniques
				C310.2	Use data and pulse communication techniques
				C310.3	Analyze Source and Error control coding.
				C310.4	Analyze Spread Spectrum and Multiple Access Techniques.
45	C311	UEE1603	Protection and Switchgear	C311.1	Discuss the theory behind the operation of circuitbreakers and select fuses for a given situation.
				C311.2	Analyse and compare different types of circuitbreakers and select the type of circuit breaker for a given application.
				C311.3	Analyze the functioning of various protective relays and to explain their characteristics.
				C311.4	Apply proper protective schemes for power apparatus and design the protective system for the given power system components.
				C311.5	Analyse various methods of power system earthing.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
46	C312	UEE1604	Power System Operation and Control	C312.1	Explain the system load variations and estimate the load demand using forecasting techniques.
				C312.2	Analyze the load frequency dynamics in power system.
				C312.3	Illustrate the model of automatic voltage regulator and various conventional methods of reactive power compensation.
				C312.4	Apply optimization techniques to solve economic dispatch and unit commitment problems.
				C312.5	Select optimal set points for secure power system operation through contingency analysis.
				C312.6	Design a power-frequency controller and/or reactive power compensator for a given power system.
47	C313A	UEE1622	Embedded System Design	C313A.1	Explain the basic modules of embedded system
				C313A.2	Describe the fundamentals and standards of communication framework
				C313A.3	Illustrate the selection of suitable processor for the given design
				C313A.4	Illustrate the salient features in designing a real time system using RTOS
				C313A.5	Analyse various case studies towards system development

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
48	C313B	UEE1623	Biomedical Instrumentation	C313B.1	Describe the origin of bio potentials and Select appropriate transducers for measurement of physical phenomenon.
				C313B.2	Illustrate the various nonelectrical parameters measurements and diagnostic procedures.
				C313B.3	Analyse various electrical parameters and its characteristics.
				C313B.4	Outline the working principles of various imaging techniques
				C313B.5	Demonstrate the working of life assisting and therapeutic instruments.
49	C313C	UEE1625	Microcontroller Based System Design	C313C.1	Explain the architectural features and instruction set of PIC microcontroller
				C313C.2	Describe the programming concepts of interrupt and timer module in PIC microcontroller
				C313C.3	Illustrate the interfacing of peripheral devices with PIC microcontroller for data communication
				C313C.4	Explain the significant features and architectural support of ARM processor
				C313C.5	Illustrate the organization and applications of ARM processor

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
50	C313D	UEE1626	IOT in Power System Engineering	C313D.1	Explain the concept of IoT.
				C313D.2	Analyse various protocols for IoT.
				C313D.3	Design a PoC of an IoT system using Raspberry Pi/Arduino
				C313D.4	Apply data analytics and use cloud offerings related to IoT.
				C313D.5	Analyse applications of IoT in real time scenario in Electric Power Distribution Network
51	C314	UEE1611	Power electronics and Drives Laboratory	C314.1	Examine the characteristics of various power devices by conducting a suitable experiment.
				C314.2	Construct and test-controlled converters and AC voltage controller circuits
				C314.3	Design and analyze chopper and inverter circuits by conducting a suitable experiment.
				C314.4	Design pulse generation circuits for power electronic converters
				C314.5	Evaluate the performance of various power electronic circuits by simulation studies

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
52	C315	UEE1612	Power System Simulation Laboratory	C315.1	Apply simulation tool to perform load flow analysis and fault analysis.
				C315.2	Analyze the load frequency dynamics and economic schedule of the given power system.
53	C401	UEE1701	Electrical Machine Design	C401.1	Describe the design considerations of electrical apparatus
				C401.2	Illustrate the design of single and three phase transformer
				C401.3	Illustrate the design of DC machines.
				C401.4	Demonstrate the design of induction motor
				C401.5	Demonstrate the design of synchronous machines
				C401.6	Design, analyze and evaluate the performance of electric motors for industrial applications

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
54	C402	UEE1702	High Voltage Engineering	C402.1	Determine the causes of over voltages in power system and protection methods.
				C402.2	Understand the nature of breakdown mechanism in solid, liquid and gaseous dielectrics and apply for the selection of an appropriate one for the application.
				C402.3	Analyse the various methods for generation of different types of over voltages
				C402.4	Use the various methods for measurement of different types of over voltages
				C402.5	Illustrate the testing methods of various power apparatus and insulation coordination.
55	C403	UEE1703	Special Electrical Machines	C403.1	Describe the construction, principle of operation and performance characteristics of synchronous reluctance motors
				C403.2	Describe the construction , principle of operation ,performance characteristics and control aspects of stepper motors
				C403.3	Illustrate the construction , principle of operation, control aspects and applications of switched reluctance motors
				C403.4	Illustrate the construction , principle of operation, control aspects and performance characteristics of permanent magnet brushless D.C motors and permanent magnet synchronous motors
				C403.5	Evaluate the characteristics of reluctance and permanent magnet motor drives for variable speed applications.

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
56	C404A	UEE1724	Digital Control Systems	C404A.1	Solve discrete control systems using z-transforms
				C404A.2	Determine the time response and steady state error of the multi input multi output (MIMO) system
				C404A.3	Determine the stability of discrete control systems
				C404A.4	Analyze the different types of digital compensator to ascertain the desired response of the system.
				C404A.5	Test the controllability and observability of a given system using the discrete-time state equations.
57	C405A	UEE1725	Energy Management and Auditing	C405A.1	Understand the concept of electricity billing, power factor improvements and demand side management
				C405A.2	Understand the effect of unbalanced voltage on performance of motors
				C405A.3	Examine the energy performance of lighting system
				C405A.4	Understand the energy conservation building code
				C405A.5	understand the energy audit process and energy management information system
				C405A.6	Apply the concept of energy management and auditing to various loads

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
58	C406	UEE1711	Advanced Electrical Engineering Laboratory	C406.1	Demonstrate knowledge on the use of high voltage test equipment and illustrate the characteristics of breaking voltages in various insulators.
				C406.2	Examine the characteristics of solar modules by conducting a suitable experiment and model the suitable photovoltaic power electronic converters.
				C406.3	Conduct a suitable experiment to analyse and select the most appropriate energy storage technology based on the application.
				C406.4	Illustrate the operation of partially shaded photovoltaic arrays and select a simple maximum power point tracking algorithm to track the Maximum Power Point (MPP) using MATLAB/Simulink.
59	C407	UEE1718	Project Work Phase 1	C407.1	Review literature and identify relevant solutions that is suitable to the broader scope of the project
				C407.2	Develop a design flow considering the methodology and financial aspects.
				C407.3	Design and analyse the proposed work using modern tools and techniques.
				C407.4	Function ethically and effectively as an individual, and as a member of a team.
				C407.5	Communicate effectively the outcomes of the project through organized technical reports and oral presentations

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
60	C408A	UEE1729	Energy Resources and Utilization	C408A.1	Summarize the energy needs of economy with respect to Indian and Global energy scenario to understand the importance of energy conservation.
				C408A.2	Explain the operation of conventional power plants.
				C408A.3	Describe the working principle of different renewable power plants
				C408A.4	Illustrate the lightning schemes and electric heating in various industrial application.
				C408A.5	Explain the electric traction system along with control strategies
61	C409A	UEE1831	Power System Planning and Reliability	C409A.1	Understand the concepts of load forecasting and system planning
				C409A.2	Understand the fundamentals of power system reliability
				C409A.3	Analyse the concepts of generation expansion planning and reliability evaluation
				C409A.4	Understand the concept of operating reserve and security approach
				C409A.5	Understand distribution planning and reliability

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
62	C409B	UEE1823	Solar and Energy Storage Systems	C409B.1	Explain the photovoltaic principle and techniques of solar energy conversion system.
				C409B.2	Illustrate the design of standalone PV system.
				C409B.3	Describe the design of grid connected PV system.
				C409B.4	Describe the techno-economic and safety aspects involved in the design of solar PV systems
				C409B.5	Analyze the various energy storage system and its applications
63	C409C	UEE1826	Power Electronics for Renewable Energy Systems	C409C.1	Learn about the electrical machines and modern power converters for renewable energy power harnessing.
				C409C.2	Analyse and comprehend the various operating modes of wind electrical generators and solar photovoltaic systems
				C409C.3	Equip with required skills to derive the criteria for the design of power converters for Renewable energy applications.
				C409C.4	Develop maximum power point tracking algorithms

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
64	C410	UEE1818	Project Work Phase 2	C410.1	Review literature and identify relevant solutions that is suitable to the broader scope of the project
				C410.2	Develop a design flow considering the methodology and financial aspects.
				C410.3	Design and analyse the proposed work using modern tools and techniques.
				C410.4	Function ethically and effectively as an individual, and as a member of a team.
				C410.5	Communicate effectively the outcomes of the project through organized technical reports and oral presentations

Programme Outcomes (POs):

Students graduating with a degree in Electrical and Electronics Engineering have:

1. Ability to apply knowledge of mathematics, science, and engineering.
2. Ability to design and conduct experiments as well as analyze and interpret data.
3. Ability to design a system, component, or process to meet desired needs.
4. Ability to function on multidisciplinary teams.
5. Ability to identify, formulate, and solve engineering problems.
6. Ability to use modern engineering and IT tools appropriately.
7. Understanding of professional and ethical responsibility.
8. Ability to communicate effectively.
9. A broad education necessary to understand impact of engineering solutions in global/societal context.
10. A knowledge of contemporary issues and the need for sustainable development.
11. Ability to use techniques, financial & management skills necessary for engineering practice.
12. A recognition of need for and ability to engage in lifelong learning.

Program Specific Outcome:

1. PSO1 To apply advanced science and engineering knowledge to analyse and design complex electrical and electronic devices, software and systems containing hardware and software components.
2. PSO2 To design and analyze systems used in advanced power applications, renewable energy, electrical drives for the transportation, manufacturing industries and in allied technical fields.

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
1	C101	UEN2176	Technical English	C101.1	To read and comprehend texts (technical) effectively.
				C101.2	To write proposals, reports, emails, letters, SOPs meeting professional expectations.
				C101.3	To Improve Vocabulary (use of right collocations, idioms and phrases etc).
				C101.4	To enhance their grammatical competency for writing and speaking.
				C101.5	To improve their ability to listen and comprehend at deeper levels
2	C102	UMA2176	Matrices and Calculus	C102.1	Reduce quadratic form to canonical form by orthogonal transformation and identify the nature of the quadratic form
				C102.2	Analyse the convergence of a given infinite series
				C102.3	Find evolute of a given curve and envelope of family of curves
				C102.4	Find the extrema of function of two variables
				C102.5	Evaluate the double and triple integrals
				C102.6	Application of extreme points of functions and multiple integrals in engineering Problems
3	C103	UPH2176	Engineering Physics	C103.1	Analyze crystal structures and the influence of imperfections on their properties.
				C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.
				C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
				C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
4	C104	UCY2176	Engineering Chemistry	C104.1	Apply the Principles of Electrochemistry for Qualitative Analysis
				C104.2	Detect/Identify various types of corrosion under severe to normal corrosive environments and provide appropriate solution.
				C104.3	Construct phase diagram of one and two component system and analyse its properties for application purposes.
				C104.4	Explain the synthesis, properties and applications of industrially important engineering materials

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
5	C105	UGE2176	Problem Solving and Programming in Python	C105.1	Solve programming problems and express solutions in pseudo code.
				C105.2	Develop simple programs using basic constructs.
				C105.3	Construct programs using conditions and iterations decompose a problem into functions.
				C105.4	Make use of strings, lists, tuples and dictionaries data structures.
				C105.5	Perform Input/Output Operations using files.
6	C106	UGE2177	Engineering Graphics	C106.1	Draw Plane curves and perform Free hand sketching of three - dimensional objects
				C106.2	Draw the Orthographic projections of points, lines and plane surfaces.
				C106.3	Draw the Projections of solids.
				C106.4	Draw the Projections of sectioned solids and Development of surfaces.
				C106.5	Draw the Isometric and Perspective projections of solids.
7	C107	UGE2197	Programming in Python Lab	C107.1	Write, test, and debug simple Python programs
				C107.2	Build Python programs with conditionals and loops
				C107.3	Solve a problem using functions in python programming
				C107.4	Construct python programs using compound data like lists, tuples, and dictionaries
				C107.5	Build a simple application in teams using files and appropriate datatypes by applying the best programming practices
8	C108	UGS2197	Physics and Chemistry Lab	C108.1	Apply principles of elasticity, optics, viscosity, thermal and band gap determination for engineering applications
				C108.2	To understand the principles and procedures of pHmetry, potentiometry and conductometry

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
9	C109	UMA2276	Complex Functions and Laplace Transforms	C109.1	Solve problems in Analytic functions and construction of analytic functions using CR equations.
				C109.2	Solve problems using integration techniques, find Taylor's and Laurent's Series expansions.
				C109.3	Obtain the Laplace Transforms and inverse transforms of standard functions.
				C109.4	Solve Differential Equations using different techniques.
				C109.5	Evaluate Line, Surface and Volume integrals.
				C109.6	Application of Complex integration, Laplace transforms, Ordinary differential equations, and vector calculus in engineering problems
10	C110	UEE2276	Basic Electrical and Electronics Engineering	C110.1	Analyze DC and AC circuits.
				C110.2	Explain the operating principle of AC and DC machines.
				C110.3	Describe the utilization of electric power.
				C110.4	Describe the working principle of electronic devices and its applications
				C110.5	Describe the working principle of sensors and transducers.
11	C111	UEE2201	Electrical Circuits and Systems - Fundamentals and practices	C111.1	Understand the concepts of circuit analysis, network reduction methods and network theorems.
				C111.2	Demonstrate the application of series, parallel resonance and coupled circuits.
				C111.3	Analyze the transient response of electric circuit and characteristics of two port networks.
				C111.4	Analyze three phase circuits and various methods of power measurement.
				C111.5	Use modern simulation tools for electric circuit analysis.
				C111.6	Design and develop electric circuits for practical applications.
12	C112	ACY2276	Environmental Science	C112.1	The structure and functions of the ecosystems and diversity among life forms within ecosystem
				C112.2	The importance of various natural resources and its sustainable use
				C112.3	The various environmental issues such as pollution, population explosion etc and suggest remedial measures.
				C112.4	The role of engineering techniques to minimize environmental stress
				C112.5	The role of various environmental machineries and to ensure proper environmental regulation

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
13	C113	UHS2243	Film Appreciation	C113.1	The process of the development of film as an art and entertainment form.
				C113.2	The evolution of the language of cinema as it evolved over a century.
				C113.3	The script writing techniques of a film and appreciate the various nuances
				C113.4	The evolution of film industry from the past to present
				C113.5	How to appreciate all aspects of the film.
14	C114	UMA2276	Engineering Mechanics for Electrical Engineers	C114.1	Illustrate the vectoral and scalar representation of forces and moments (BL: L3)
				C114.2	Analyze the rigid body in equilibrium (BL: L3)
				C114.3	Evaluate the properties of surfaces and solids (BL: L3)
				C114.4	Calculate dynamic forces exerted in rigid body (BL: L3)
				C114.5	Determine the friction and the effects by the laws of friction (BL: L3)
15	C115	UGE2297	Design Thinking and Engineering Practices Lab	C115.1	Draw pipeline plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household woodwork (K2)
				C115.2	Practice machining to make holes on different materials; fabricate sheet metal components (K2)
				C115.3	Dismantle, understand the functional / aesthetic aspects of the product, prepare the functional model of various components (K2)
				C115.4	Construct domestic electrical circuits and verify their output parameters (K3)
				C115.5	Construct electronics circuits and verify their output (K3)
16	C201	UMA2376	Transform Techniques and Partial Differential Equation	C201.1	Obtain Fourier series expansion of periodic functions.
				C201.2	Solve the problems in partial differential equations.
				C201.3	Able to solve initial and boundary value problems using Fourier series techniques.
				C201.4	Obtain Fourier transform of various functions
				C201.5	Evaluate difference equations using Z- transform technique.
				C201.6	Application of Fourier Series, Partial differential equations, Fourier transform, and Z-transforms in engineering problems

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
17	C202	UHS2376	Universal Human Values 2: Understanding Harmony	C202.1	Understand the significance of value education, happiness, and prosperity(K2)
				C202.2	Understand the significance of harmony in self and body (K2)
				C202.3	Understand the value of harmony in human relationships (K2)
				C202.4	Understand the harmony in nature and existence and work out their mutually fulfilling participation in the nature. (K2)
				C202.5	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work (K4)
18	C203	UEC2376	Signals and Systems	C203.1	Analyze the properties of signals & systems.
				C203.2	Apply Fourier series, Laplace transform, Fourier transform, Z-transform and DTFT in signal analysis.
				C203.3	Analyze continuous time LTI systems using Fourier and Laplace Transforms
				C203.4	Analyze discrete time LTI systems using Z-transform and DTFT.
19	C204	UEE2301	Electromagnetic Theory	C204.1	Apply the basic mathematical concepts related to electromagnetic vector fields.
				C204.2	Examine the concepts of electrostatic fields, electrical potential, energy density and their applications.
				C204.3	Infer the concepts of magneto static fields, magnetic flux density, vectorpotential and its applications.
				C204.4	Perform analysis using concepts related to electrostatics, magnetostatics and electrodynamics in obtaining Maxwell's equations.
				C204.5	Understand electromagnetic wave propagation and characterize the parameters.
20	C205	UEE2302	OOPS and Data Structures for Electrical Engineering	C205.1	Understand the fundamental concepts of object-oriented programming.
				C205.2	Apply the concepts of polymorphism, inheritance, exception, and file handling in programming.
				C205.3	Illustrate the concepts of linear data structures using list, stacks, and queues.
				C205.4	Apply the concepts non-linear data structures in programming.
				C205.5	Assess various sorting and searching algorithms for data handling
				C205.6	Formulate solutions to electrical engineering problems using the concept of OOPS and data structures.

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
21	C206	UEE2303	Electronic Devices and Circuits	C206.1	Describe the operation, characteristics and applications of diodes
				C206.2	Describe the operation, characteristics and applications of transistors
				C206.3	Design and analyze BJT and MOSFET amplifiers through frequency response
				C206.4	Design and analyze multistage and differential amplifiers through frequency response
				C206.5	Design feedback circuits for amplifier and describe various oscillators and its stability
22	C207	UEE2311	Electronics Laboratory	C207.1	Characterize PN diode, zener diode, BJT, FET , UJT, photo diode and photo transistor.
				C207.2	Characterize rectifiers, passive filters, CE amplifiers and differential amplifiers.
				C207.3	Characterize oscillators and realize filters.
23	C208	UEE2312	OOPS and Data Structures Laboratory for Electrical Engineering	C208.1	Develop software skills for real time programming using the concept of OOPS.
				C208.2	Understand and apply the concepts of Inheritance, Exception and File handling.
				C208.3	Understand and apply the concepts of Linear Data structures
				C208.4	Understand and apply the concepts Non Linear Data structures
				C208.5	Apply the concepts of oops and data structures to Electrical Engineering.
24	C209	UMA2452	Probability and Statistics for Electrical Engineering	C209.1	Identify standard distributions and apply them.
				C209.2	Solve problems in two dimensional random variables and find the correlation between them.
				C209.3	Identify and apply the suitable testing of hypothesis under normal, t, F and chi square distribution
				C209.4	Solve problems in analysis of variance.
				C209.5	Analyze quality control by applying control chart methods.
				C209.6	Application of Design of Experiments in engineering problems

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
25	C210	AHS2476	Indian Constitution	C210.1	Understand history and philosophy of Indian constitution.
				C210.2	Realize powers and functions of Indian government.
				C210.3	Acquire awareness on structure and functions of local administration.
				C210.4	Enhance knowledge about organization and composition of judiciary.
				C210.5	Explore the distribution of financial powers and emergency provisions.
26	C211	UEE2401	Electrical Machines -I	C211.1	Analyze the principles of electromechanical energy conversion in singly and multiply excited systems.
				C211.2	Describe the construction, working principle and characteristics of DC generator.
				C211.3	Illustrate various speed control methods, necessity of starters and performance assessment of DC motor.
				C211.4	Evaluate the performance of single phase transformers
				C211.5	Describe the various three phase transformer connections and principle of instrument transformers.
				C211.6	Evaluate the suitability of DC machines and transformers for the given application.
27	C212	UEE2402	Analog Electronic Circuits	C212.1	Describe the IC fabrication steps and their integrated sequence to fabricate Silicon devices and ICs.
				C212.2	Describe the Characteristics of Op-amps.
				C212.3	Design the Op-amp circuits for basic applications with feedback using passive components and diodes.
				C212.4	Design the Op-amp circuits for reasonably complex applications such as multivibrators, filters and oscillators.
				C212.5	Illustrate the internal functional blocks and the applications of special ICs like Timers, PLL, Regulator, Analog Multiplier, etc.
28	C213	UEE2476	Control Systems Engineering	C213.1	Derive transfer function for a given physical system (K3)
				C213.2	Analyse a system in both time domain and frequency domain (K3)
				C213.3	Determine the stability of a given system (K3)
				C213.4	Design and analyse a compensator for a given system specification (K4)
				C213.5	Design a controller to improve the stability of a given system (K3)

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
29	C214	UEE2403	Generation, Transmission and Distribution	C214.1	Understand the principles of power generation and various power tariff.
				C214.2	Determine the various transmission line parameters.
				C214.3	Analyze the performance of overhead transmission line.
				C214.4	Compute the voltage distribution, string efficiency, and dielectric stress for OHTL and Cables.
				C214.5	Analyze the performance of DC and AC distribution systems
				C214.6	Evaluate and Summarize the concepts of transmission and distribution for a specific time problem.
30	C215	UEE2411	Electrical Machines -I Laboratory	C215.1	Measure, analyze, interpret and explain the characteristics of DC shunt, series and compound generators
				C215.2	Measure, analyze, interpret and describe the characteristics of DC shunt, series and compound motors
				C215.3	Measure, analyze, interpret and explain the characteristics of single phase and three phase transformers
31	C216	UEE2412	Analog Electronic Circuits Laboratory	C216.1	Characterize IC741 Op-Amp and realize various applications
				C216.2	Realize astable and monostable multivibrators using IC555 timer
				C216.3	Use the software simulators like PSpice for analysis of analog ICs.
32	C301	UEE2501	Power Electronics	C301.1	Describe the characteristics of power semiconductor devices
				C301.2	Analyse the operation and performance of phase-controlled rectifiers
				C301.3	Examine the operation and control of DC – DC converters
				C301.4	Discuss the operation and switching strategies of DC – AC and AC – AC converters
				C301.5	Select an appropriate power converter and illustrate its characteristics for specific applications

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
33	C302	UEE2502	Electrical Machines -II	C302.1	Explain the fundamentals of AC machines and the basic principles of emf, mmf generation in the machine windings.(K3)
				C302.2	Estimate the voltage regulation of and analyze parallel operation of 3 ϕ synchronous generators (K3)
				C302.3	Describe the construction, working principle and analyze the performance characteristics of a 3 ϕ synchronous motor. (K3)
				C302.4	Evaluate the performance of three phase induction motors using both equivalent circuit and Circle diagrams(K3)
				C302.5	Describe the constructional features, working of single phase and fractional kW motors(K2)
34	C303	UEE2503	Electrical Measurements and Instrumentation Systems	C303.1	Explain the basic functional elements of any electrical and electronic instrument
				C303.2	Compare various principles and techniques involved in measurement
				C303.3	Illustrate the concept of different storage and display devices
				C303.4	Demonstrate the knowledge about various transducers and data acquisition systems
				C303.5	Identify an appropriate instrument for a particular application
35	C304	UEE2504	Digital Logic System Design and Practices	C304.1	Understand the digital principles and design of combinational logic circuit using VHDL.
				C304.2	Analysis and design of synchronous sequential logic circuits.
				C304.3	Analysis and design of Asynchronous Sequential Circuits.
				C304.4	Understanding the concept of ASM and Data paths for Synchronous Sequential Circuit design.
				C304.5	Design of customized microprocessor.
36	C305	UBA2541	Principles of Management	C305.1	Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling.
				C305.2	Have same basic knowledge on international aspect of management.
				C305.3	Ability to understand management concept of organizing.
				C305.4	Ability to understand management concept of directing.
				C305.5	Ability to understand management concept of controlling.

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
37	C306	UEE2521	Solar Energy Systems	C306.1	Explain the characteristics, techniques of solar energy conversion system and PV module fabrication.
				C306.2	Describe the design of standalone photovoltaic system.
				C306.3	Describe the design of grid connected photovoltaic system.
				C306.4	Understand the various PV system components and design the PV water pumping system
				C306.5	Analyze the various applications of solar energy systems.
38	C307	UEE2511	Electrical Machines -II Laboratory	C307.1	Formulate and practice the experimental procedures and measurement involved in the determination of regulation of alternators
				C307.2	Measure, analyze, interpret and describe the characteristics of synchronous motor.
				C307.3	Measure, analyze, interpret and describe the characteristics of induction motors.
				C307.4	Evaluate and analyze the characteristics of induction motors used in industrial applications.
39	C308	UEE2512	Control System and Instrumentation Laboratory	C308.1	Implement the control system concept to electrical engineering problems
				C308.2	Illustrate the characteristics of different converters, compensators and other instruments
				C308.3	Design a signal conditioning circuit and implement a bridge network and transducer concept for a particular engineering problem.
40	C309	UEE2601	Microprocessors and Microcontrollers - Fundamentals and Practices	C309.1	Describe the architecture and instruction set of 8085 and 8086 microprocessor
				C309.2	Illustrate the interfacing of peripheral devices with 8086 microprocessor
				C309.3	Explain the architectural features and instruction set of 8051 microcontroller
				C309.4	Illustrate the architectural features and peripherals of STM microcontroller
				C309.5	Apply the concepts of interfacing and programming in microprocessor and microcontroller
				C309.6	Develop real time applications using microcontroller

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
41	C310	UEE2602	Power System Analysis	C310.1	Understand the basics of numerical methods to solve non-linear algebraic equations non-linear ordinary differential equation.
				C310.2	Demonstrate modeling of various power system components, represent them in simple diagrams and construct computational matrices.
				C310.3	Apply numerical solution methods to complex and non-linear power flow problems.
				C310.4	Analyze symmetrical and unsymmetrical short circuit faults in a power system
				C310.5	Apply equal area criterion and concept of numerical solution methods to non-linear ordinary differential equation for transient stability problem.
42	C311	UEE2603	Power System Operation and Control	C311.1	Understand system load variations along with the need for voltage and frequency regulation and estimate the load using forecasting techniques.
				C311.2	Analyze the load frequency dynamics in power system and design power-frequency controller.
				C311.3	Articulate the various conventional methods of reactive power compensation and illustrate the model of automatic voltage regulator.
				C311.4	Compute the optimal dispatch of the generating units in a power system by solving Unit Commitment and economic dispatch problems.
				C311.5	Understand the functions of energy control centre and provide control set-points for secure power system operation using contingency analysis.
43	C312A	UEE2621	Wind Energy Conversion Systems	C312A.1	Acquire knowledge on the basic concepts of wind energy conversion system
				C312A.2	Demonstrate the types of wind turbine and aero dynamics
				C312A.3	Explain the principle of fixed speed system.
				C312A.4	Illustrate the working and design of variable speed system.
				C312A.5	Analyze the grid integration issues and current practices of wind interconnection.
44	C312B	UEE2625	Switched Mode Power Supplies	C312B.1	Outline the fundamentals of isolated and non-isolated converter for SMPS.
				C312B.2	Analyze the feedback controller for regulated output voltage.
				C312B.3	Choose appropriate components for the design of SMPS.
				C312B.4	Analyze and simulate various power electronic converter topologies.
				C312B.5	Assess the thermal performance of SMPS, and design suitable filters and heat sink.

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
45	C313A	UEE2626	Energy Storage Systems	C313A.1	Describe the thermal energy storage systems and their applications.
				C313A.2	Illustrate the operating principles of electrochemical energy storage systems.
				C313A.3	Summarize the principles underpinning the operation of electromagnetic energy storage systems.
				C313A.4	Explain the operation of mechanical energy storage systems.
				C313A.5	Solve the grid integration issues of renewable energy sources by energy storage techniques.
46	C313B	UEE2628	Artificial Intelligence for Power Systems	C313B.1	Understand and comprehend the principles lying behind Expert Systems, Fuzzy Logic Systems and Artificial Neural Network.
				C313B.2	Understand and comprehend the principles lying behind Evolutionary program techniques like PSO, ACO, GA, EP, TS.
				C313B.3	Apply Intelligent system technique and EP based technique to solve complex nonlinear optimal power flow problem.
				C313B.4	Apply Intelligent system technique and EP based technique to voltage and VAR control problems in power system.
				C313B.5	Apply Intelligent system technique and EP based technique to Vulnerability Assessment Control Coordination in power System.
47	C313C	UEE2629	Automotive Electronics	C313C.1	Know the importance of emission standards in automobiles.
				C313C.2	Understand the electronic fuel injection/ignition components and their function
				C313C.3	Choose and use sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.
				C313C.4	Analyses the chassis and vehicle safety system.
				C313C.5	Analyse various methods of power system earthing.
48	C315	UEE2611	Power Electronics and Drives Laboratory	C315.1	Characterize the power devices through DC analysis.
				C315.2	Design and test AC-DC and AC-AC converters
				C315.3	Design and test chopper and inverter circuits
				C315.4	Design pulse generation circuits for power electronic converters
				C315.5	Evaluate the performance of power converters through simulation

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
49	C316	UEE2612	Power System Simulation Laboratory	C316.1	Compute transmission line parameters and model the line for steady state analysis by formulating bus admittance matrix using inspection method and analyze the computational performance via Gauss-Seidel (GS), Newton Raphson (NR) and Fast Decoupled Load Flow (FDLF) methods of solving power flow problem.
				C316.2	Calculate the fault current for various types of faults in the power system and analyze the transient stability by applying different fault clearing time to the circuit breakers, also analyze the switching surge in long transmission line using EMTP, subsequently analyze the power system reliability by performing Contingency Analysis using linear sensitivity factors.
				C316.3	Analyze load frequency control dynamics and design appropriate controllers for single and multiple area power system and compute the optimal dispatch of the generating units in a power system by solving economic dispatch problems and determine the optimal generation schedule of the generating units in a power system by solving unit commitment problems.
50	C401	UEE2701	Solid State Drives	C401.1	Describe the steady state operation and transient dynamics of a motor load system
				C401.2	Examine the operation of the converter/chopper fed dc drive
				C401.3	Analyse the operation and performance of AC motor drives
				C401.4	Outline current and speed controllers for a closed loop motor drive
				C401.5	Select a suitable electrical drive for specific application in the industry
				C401.6	Design power electronic converter fed drives with advanced control techniques
62	C402	UEE2702	Protection and Switchgear	C402.1	Discuss the theory behind the operation of circuit breakers and select fuses for a given situation.
				C402.2	To analyse and compare different types of circuit breakers and select the type of circuit breaker for a given application.
				C402.3	To analyze the functioning of various protective relays and to explain their characteristics.
				C402.4	To apply proper protective schemes for power apparatus and to design the protective system for the given power system components.
				C402.5	Analyse various methods of power system earthing

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
63	C403	UEE2703	High Voltage Engineering	C403.1	Ability to understand the various types of over voltages in power system and protection methods.
				C403.2	Ability to understand the Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
				C403.3	Ability to analyse the various methods for Generation of different types of over voltages
				C403.4	Ability to analyse the various methods for Measurement of different types of over voltages
				C403.5	Ability to analyse the various testing methods of power apparatus and apply the insulation coordination to the power system.
64	C404	UEE2716	Industrial Training / Internship	C404.1	Formulate a real-world problem, identify the requirement and develop the design solutions.
				C404.2	Express the technical ideas, strategies and methodologies.
				C404.3	Test and validate through conformance of the developed prototype and analysis the cost effectiveness. Prepare report and present the oral demonstrations
				C404.4	Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
64	C405	UEE2711	Advanced Electrical and Electronics Design Laboratory	C405.1	Demonstrate knowledge on the use of high voltage test equipment and the characteristics of breakdown voltages in various insulators.
				C405.2	Illustrate the characteristics of photovoltaic modules and model suitable power electronic converters.
				C405.3	Experiment the wind, Wind-PV hybrid and hydel power systems and show their characteristics.
				C405.4	Examine the characteristics of battery and performance parameters of fuel cell.

R2021 B.E Electrical and Electronics Engineering Subjects
Course Outcomes (COs)

Sl No	Code	Course Code	Course Name	CO Code	Course Outcomes
65	C406	UEE2718	Project Phase I	C406.1	Analyze literature & formulate methodology to solve complex problems by applying fundamentals of sciences and electrical engineering
				C406.2	Apply modern techniques and tools to arrive at feasible solutions
				C406.3	Function ethically and effectively as an individual, and as a member or leader in multidisciplinary teams and prepare for independent and lifelong learning.
				C406.4	Discuss and illustrate the effectiveness of solutions through organized technical reports and oral presentations
66	C407	UEE2818	Project Phase II	C407.1	Analyze literature & formulate methodology to solve complex problems by applying fundamentals of sciences and electrical engineering.
				C407.2	Illustrate the feasibility of solutions through the conduct of experiments with effective financial planning and reports with valid conclusions and recommendations.
				C407.3	Develop electrical engineering solutions based on societal, health, safety, legal, cultural and environmental considerations for sustainable development.
				C407.4	Function ethically and effectively as an individual, and as a member or leader in multidisciplinary teams and prepare for independent and lifelong learning.
				C407.5	Discuss and illustrate the effectiveness of solutions through organized technical reports and oral presentations.

PROGRAMME OUTCOMES (POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree programme, the students should be able to:

- PO 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO 4. Conduct investigations of complex problems:** Use research - based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO 12. Life-long learning:** Recognize the need for and have the preparation and ability to engage in self, and lifelong learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree programme, Graduate will have the ability to:

- PSO 1.** To apply advanced science and engineering knowledge to analyse and design complex electrical and electronic devices, software and systems containing hardware and software components.
- PSO 2.** To design and analyze systems used in advanced power applications, renewable energy, electrical drives for the transportation, manufacturing industries and in allied technical fields.

Code	Course Code	Course Name	CO code
C201	UMA1377	Discrete Mathematics	C201.1
			C201.2
			C201.3
			C201.4
			C201.5
C202	UIT1301	Digital Electronics	C202.1
			C202.2
			C202.3
			C202.4
C203	UIT1302	Fundamentals of Data St	C203.1
			C203.2
			C203.3
			C203.4
C204	UIT1303	Principles of Analog and	C204.1
			C204.2
			C204.3
			C204.4
C205	UIT1304	Database Management S	C205.1
			C205.2
			C205.3
			C205.4
			C205.5
C206	UIT1305	Computer Organization	C206.1
			C206.2
			C206.3
			C206.4
			C206.5
C207	UIT1311	Programming and Data S	C207.1
			C207.2
			C207.3
C208	UIT1312	Database Technology La	C208.1
			C208.2
			C208.3
			C208.4
C209	UMA1478	Probability and Statistics	C209.1
			C209.2
			C209.3
			C209.4
			C209.5
C210	UIT1401	Principles of Software En	C210.1
			C210.2
			C210.3
			C210.4
			C210.5
C211	UIT1402	Information Theory and A	C211.1
			C211.2
			C211.3
			C211.4
C212	UIT1403	Microprocessors and M	C212.1
			C212.2
			C212.3
C213	UIT1404	Advanced Data Structure	C213.1

			C213.2
			C213.3
			C213.4
			C213.5
C214	UIT1405	Algorithm Design and An	C214.1
			C214.2
			C214.3
C215	UIT1411	Microprocessors and Mic	C215.1
			C215.2
C216	UIT1412	Programming and Data S	C216.1
			C216.2
			C216.3
C301	UIT1501	Finite Automata Theory	C301.1
			C301.2
			C301.3
			C301.4
			C301.5
			C301.6
C302	UIT1502	Principles of Operating S	C302.1
			C302.2
			C302.3
			C302.4
			C302.5
C303	UIT1503	Computer Network and it	C303.1
			C303.2
			C303.3
			C303.4
C304	UIT1504	Introduction to Digital Sig	C304.1
			C304.2
			C304.3
			C304.4
C305	UIT505	Artificail Intelligence Con	C305.1
			C305.2
			C305.3
C306	UIT1511	Software Design Lab	C306.1
			C306.2
C307	UIT1512	Operating Systems Lab	C307.1
			C307.2
			C307.3
			C307.4
			C307.5
C308	UIT1521	Fundamentals of Digital I	C308.1
			C308.2
			C308.3
			C308.4
C309	UIT1522	Information Distributed C	C309.1
			C309.2
			C309.3
			C309.4
			C309.5
C310	UIT1601	Principles of Compiler De	C310.1
			C310.2
			C310.3
			C310.4
C311	UIT1602	Web Programming	C311.1

			C311.2
			C311.3
C312	UIT1603	Big Data Engineering	C312.1
			C312.2
			C312.3
			C312.4
C313	UIT1604	Machine Learning Funda	C313.1
			C313.2
			C313.3
C314	UIT1611	Web Programming Lab	C314.1
			C314.2
			C314.3
			C314.4
C315	UIT1621	Real Time Embedded Sy	C315.1
			C315.2
			C315.3
			C315.4
			C315.5
C316	UIT1623	Interactive System Desig	C316.1
			C316.2
			C316.3
			C316.4
			C316.5
C317	UIT1625	Analysis and Design of S	C317.1
			C317.2
			C317.3
C318	UEN1497	Interpersonal Skills/ Liste	C318.1
			C318.2
			C318.3
			C318.4
C401	UIT1701	Cloud Computing and Vir	C401.1
			C401.2
			C401.3
			C401.4
			C401.5
C402	UIT1702	Network Security	C402.1
			C402.2
			C402.3
			C402.4
			C402.5
			C402.6
C403	UIT1703	Management Principles a	C403.1
			C403.2
			C403.3
			C403.4
C404	UIT1711	Mobile Application Develo	C404.1
			C404.2
			C404.3
			C404.4
			C404.5
C405	UIT1731	Introduction to Deep Lea	C405.1
			C405.2
C406	UIT1722	Agile Software Developm	C406.1
			C406.2

			C406.3
			C406.4
C407	UIT1723	DevOps	C407.1
			C407.2
			C407.3
C408	UIT1724	Cloud Computing & Virtu	C408.1
			C408.2
			C408.3
			C408.4
			C408.5
C409	UIT1823	Web Design Managemer	C409.1
			C409.2
			C409.3
C410	UIT1826	Social Network Informati	C410.1
			C410.2
			C410.3
C411	UGE1576	Professional Ethics	C411.1
			C411.2
C412	UIT1818	Project Work	C412.1

Course Outcomes
Apply logical identities and implications in deriving the conclusion.
Solve problems using different mathematical techniques.
Have a clear understanding of graph theory.
Exposed to concepts and properties of algebraic structures such as semi groups, monoids and groups.
Solve problems in partial ordering relations, equivalence relations and lattices.
Analyze a problem, Design combinational and sequential circuits.
Simplify Boolean functions using KMap.
Simplify Boolean functions using KMap.
Write HDL code for combinational and Sequential Circuits.
Implement ADTs as Python classes
Design and analyze linear data structures, such as lists, queues, and stacks, according to the needs of different
Design, implement, and analyze efficient tree structures to meet requirements such as searching, indexing, and
Design and analyze sorting, searching, and hashing algorithms
Explain the analog and digital modulation-demodulation techniques
Explain CDMA
Utilize multiuser radio communication
Use the learnt principles to understand the physical layer of a network
Develop database designs using ER and Relational models
Use of SQL for relational databases
Apply concurrency control and recovery mechanisms for practical problems
Design the query processor and transaction processor
Develop a real database application using various concepts of DBMS
Explain processor fundamentals.
Design arithmetic and logic unit.
Evaluate performance of memory systems.
Extend the learning to parallel processing architectures.
Explain interconnection structures.
Write programs using structured programming concepts
Implement any data structure using ADT
Solve the given problem using appropriate data structure
Design and implement a database schema for a given problem-domain.
Design a database and query using SQL DML/DDDL commands.
Create procedures using PL/SQL.
Design and build any GUI application.
Identify standard distributions and apply them.
Solve problems in two dimension random variables and find the correlation between them.
Identify and apply the suitable testing of hypothesis under normal and t and F distribution.
Solve problems in analysis of variance.
Analyze quality control by applying control chart methods.
Identify the key phases in process models.
Compare different process models.
Apply the concepts of requirements engineering and Analysis modelling.
Apply systematic procedure for software design and deployment.
Compare and contrast various testing and maintenance.
Explain and estimate information theory metrics, entropy and cross entropy
Design an application with error control
Apply entropy as a cost function in machine learning algorithms
Make use of MEE in small applications
Write programs to run on 8086 microprocessor based systems.
Design the system using memory chips and peripheral chips for microprocessor and Microcontroller.
Analyse, Specify. Design , write and test assembly language programs.
Design and implement programs using object oriented basic concepts - Encapsulation, Abstraction and Inheritance

Implement generic OOPS programs using STL and Exception handling
Apply appropriate Tree and Graph data structure for a given dataset
Analyze various graph algorithms and apply for applications
Modify and suggest new data structure for a given problem
Design algorithms for various computing problems
Analyze the time and space complexity of algorithms
Analyze different algorithm design techniques to solve a problem efficiently
Make use of Microprocessors for an application
Make use of Microcontrollers for an application
Implement the solution to a problem using object oriented programming concepts
Implement advanced data structures using OOP concepts
Analyze and apply the tree/graph data structures for real world problems
Construct automata, regular expression for any pattern.
Write Context free grammar for any construct.
Design Turing machines for any language.
Propose computation solutions using Turing machines.
Analyze time and space complexity for a given problem.
Examine whether a problem is decidable or not.
Design various scheduling algorithms
Apply the principles of concurrency.
Design deadlock, prevention and avoidance algorithms.
Compare and contrast various memory management schemes.
Design and implement a prototype file systems.
Choose the components required to build different types of networks
Select the required functionality at each layer for given application
Develop a solution for each functionality at each layer.
Explain the flow of information from one node to another node in the network.
Define various types of discrete-time signals and systems, and to perform, given a digital signal, the basic operations
Estimate the frequency content of a given signal using discrete Fourier transform, and to appreciate the time vs frequency
Design simple FIR and IIR filters, and to understand the difference between them.
Design the digital filters and to analyze the issues due to finite-word-length effects.
Explain autonomous agents that efficiently make decisions in fully informed, partiallyObservable and adversarial se
Choose appropriate algorithms for solving given AI problems
Illustrate the working of AI algorithms in Natural Language Processing / ComputerVision / Robotics
Make use of CASE tools to develop software
Analyze and Design software requirements in an efficient manner.
Write shell script, basic commands and system calls.
Make use of deadlock avoidance and virtual memory.
Compare the performance of various CPU Scheduling Algorithms.
Create processes, threads, implement IPC and synchronization.
Analyze the performance of the various memory management, page replacement, disk scheduling algorithms, file al
Explain digital image fundamentals
Apply image enhancement and restoration techniques
Make use of image compression and segmentation Techniques
Determine the features of images
Explain the trends in Distributed Systems.
Apply network virtualization.
Apply remote method invocation and objects.
Design process and resource management systems.
Design and implement a prototype file systems.
Design and implement a prototype compiler.
Apply the various optimization techniques.
Use the different compiler construction tools.
Implement the different Phases of compiler
Design web pages using HTML, CSS, Java Script.

Develop web sites and build web applications.
Build web service APIs.
Apply the statistical analysis methods
Make use of data mining in large data sets and streams.
Model distributed file systems in big data mining
Make use of visualization techniques
Explain machine Learning algorithms and their limitations
Apply common Machine Learning algorithms in practice and implement them for
Make use of the Deep Learning algorithms for unstructured data
Design web pages using HTML/DHTML and style sheets
Build dynamic web pages using client and server side scripting
Design and implement full stack web applications
Develop RESTful web services
Appreciate the usefulness of embedded systems in building different systems specific to their applications.
Understand the importance of system-on-chip and network-on-chip in designing power efficient high performance sy
Know what are relevant characteristics of RTOS useful in building real time embedded systems.
Understand the different energy saving algorithms in embedded systems.
Be able to identify the different techniques used to perform power optimization in embedded systems.
Design effective dialog for HCI.
Design effective HCI for individuals and persons with disabilities.
Assess the importance of user feedback.
Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites
Develop meaningful user interface.
Analyze and Design SOA based applications.
Explain SOA applications using SOAP based Web services and REST services.
Build SOA-based applications for intra-enterprise and inter-enterprise applications.
Speak proficiently and make presentations
Participate in group discussions effectively
Improve general and academic listening skills
Hone their soft skills and take part in team activities
Explain the concepts of Cloud Computing.
Apply the concept of virtualization in the cloud computing.
Compare the architecture, infrastructure, and delivery models of cloud computing.
Illustrate the cloud security mechanisms that can be applied to combat the various cloud security threats.
Illustrate the capabilities of Cloud Tools.
Build basic security algorithms required by any computing system.
Analyze the vulnerabilities in any computing system and hence be able to design a security
Analyze the possible security attacks in complex real time systems and their effective counter
Classify the security issues in the network and resolve it.
Evaluate security mechanisms using rigorous approaches, including theoretical derivation,modeling, and simulations
Formulate research problems in the computer security field.
Explain and discuss the elements of effective management.
Apply the planning, organizing, control and decision making processes
Explain various theories related to the development of leadership skills, motivationtechniques, team work and effecti
Analyze the different control activities of management and forecasting methodologies.
Describe the design and architecture of a mobile application.
Design and implement various mobile applications using Android Studio.
Invent new programming techniques to meet the requirements of a mobile application.
Perceive the challenges that mobile programming has in providing an effective user interface.
Develop applications for hand-held devices.
Explain Deep Learning algorithms and their limitations
Apply Deep Learning algorithms in practice
Compare evolutionary, iterative and adaptive development.
Explain agile software process.

Apply agile methodologies for software design.
Apply agile based testing.
Explain the core concepts / principles of Devops
experiment devops concepts by using various tools
outline the benefits of devops
Explain the concepts of Cloud Computing.
Apply the concept of virtualization in the cloud computing.
Compare the architecture, infrastructure, and delivery models of cloud computing.
Illustrate the cloud security mechanisms that can be applied to combat the various cloud security threats.
Illustrate the capabilities of Cloud Tools.
Design Website using HTML CSS and JS.
Design Responsive Sites.
Manage, Maintain and Support Web Apps.
Explain the graph representation of knowledge
Predict human behavior in social web and related communities.
Visualize social networks
Apply ethics in society.
Explain the ethical issues related to engineering and realize the responsibilities and rights in the society.
On completion of the project work, students will be in a position to take up any challenging practical problems and fir

location and organization methods.

id solution by formulating proper methodology.

Code	Course Code	Course Name	CO code
C101	UEN2176	TECHNICAL ENGLISH	C101.1
			C101.2
			C101.3
			C101.4
			C101.5
C102	UMA2176	MATRICES AND CALCULUS	C102.1
			C102.2
			C102.3
			C102.4
			C102.5
			C102.6
C103	UPH 2176	ENGINEERING PHYSICS	C103.1
			C103.2
			C103.3
			C103.4
			C103.5
C104	UCY 2176	ENGINEERING CHEMISTRY	C104.1
			C104.2
			C104.3
			C104.4
			C104.5
C105	UGE 2176	PROBLEM SOLVING AND PROGRAMMING IN PYTHON	C105.1
			C105.2
			C105.3
			C105.4
			C105.5
C106	UGE 2177	ENGINEERING GRAPHICS	C106.1
			C106.2
			C106.3
			C106.4
			C106.5
C107	UGE 2197	PROGRAMMING IN PYTHON LAB	C107.1
			C107.2
			C107.3
			C107.4
			C107.5
C108	UGS 2197	PHYSICS AND CHEMISTRY LABORATORY	C108.1
			C108.2
			C108.3
C109	UMA2276	COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS	C109.1
			C109.2
			C109.3

			C109.4
			C109.5
			C109.6
C110	UEE2276	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	C110.1
			C110.2
			C110.3
			C110.4
			C110.5
C111	UIT2201	PROGRAMMING AND DATA STRUCTURES	C111.1
			C111.2
			C111.3
			C111.4
			C111.5
			C111.6
			C111.7
C112	ACY2276	ENVIRONMENTAL SCIENCE	C112.1
			C112.2
			C112.3
			C112.4
			C112.5
C113	UPH2251	PHYSICS FOR INFORMATION SCIENCE AND TECHNOLOGY	C113.1
			C113.2
			C113.3
			C113.4
			C113.5
C114	UGE2297	DESIGN THINKING AND ENGINEERING PRACTICES LAB	C114.1
			C114.2
			C114.3
			C114.4
			C114.5
C201	UMA2377	DISCRETE MATHEMATICS	C201.1
			C201.2
			C201.3
			C201.4
			C201.5
			C201.6
C202	UHS2376	Humanities II -UHV: Understanding Harmony	C202.1
			C202.2
			C202.3
			C202.4
			C202.5
C203	UIT2301	PROGRAMMING AND DESIGN PATTERNS	C203.1
			C203.2
			C203.3
			C203.4
C204	UIT2302	DATABASE TECHNOLOGY	C204.1
			C204.2

			C204.3
			C204.4
			C204.5
C205	UIT2304	DIGITAL LOGIC AND COMPUTER ORGANIZATION	C205.1
			C205.2
			C205.3
			C205.4
			C205.5
			C205.6
C206	UIT2305	INTRODUCTION TO DIGITAL COMMUNICATION	C206.1
			C206.2
			C206.3
			C206.4
C207	UIT2311	DATABASE TECHNOLOGY LAB	C207.1
			C207.2
			C207.3
			C207.4
C208	UIT2312	PROGRAMMING AND DESIGN PATTERNSLAB	C208.1
			C208.2
			C208.3
			C208.4
			C208.5
C209	UMA2453	PROBABILITY AND STATISTICS	C209.1
			C209.2
			C209.3
			C209.4
			C209.5
			C209.6
C210	UIT2401	MICROPROCESSOR AND MICROCONTROLLER	C210.1
			C210.2
			C210.3
			C210.4
			C210.5
C211	UIT2402	ADVANCED DATA STRUCTURES AND ALGORITHM ANALYSIS	C211.1
			C211.2
			C211.3
			C211.4
			C211.5
			C211.6
C212	UIT2403	DATA COMMUNICATION AND NETWORKS	C212.1
			C212.2
			C212.3
			C212.4
			C212.5
C213	UIT2404	AUTOMATA THEORY AND COMPILER DESIGN	C213.1
			C213.2
			C213.3

			C213.4
			C213.5
C214	UIT2411	NETWORK PROGRAMMING LAB	C214.1
			C214.2
			C214.3
C215	UIT2412	DIGITAL SYSTEMS AND MICROPROCESSOR LAB	C215.1
			C215.2
			C215.3
			C215.4
			C215.5
			C215.6
C301	UIT2501	PRINCIPLES OF SOFTWARE ENGINEERING AND PRACTI	C301.1
			C301.2
			C301.3
			C301.4
			C301.5
C302	UIT2502	DATA ANALYTICS & VISUALIZATION	C302.1
			C302.2
			C302.3
			C302.4
C303	UIT2503	PRINCIPLES OF OPERATING SYSTEMS	C303.1
			C303.2
			C303.3
			C303.4
			C303.5
			C303.6
C304	UIT2504	ARTIFICIAL INTELLIGENCE	C304.1
			C304.2
			C304.3
C305	UIT2511	SOFTWARE DESIGN LAB	C305.1
			C305.2
			C305.3
			C305.4
			C305.5
C306	UIT2512	OPERATING SYSTEMS PRACTICES LAB	C306.1
			C306.2
			C306.3
			C306.4
			C306.5
C307	UIT2601	PATTERN RECOGNITION AND MACHINE LEARNING	C307.1
			C307.2
			C307.3
			C307.4
C308	UIT2602	WEB PROGRAMMING	C308.1
			C308.2
			C308.3
			C308.4

			C308.5
			C308.6
			C308.7
			C308.8
C309	UIT2603	INTERNET OF THINGS AND C PROGRAMMING	C309.1
			C309.2
			C309.3
			C309.4
			C309.5
C310	UIT2611	MOBILE APPLICATION DEVELOPMENT LAB	C310.1
			C310.2
			C310.3
C401	UIT2701	NETWORK AND COMMUNICATION SECURITY	C401.1
			C401.2
			C401.3
			C401.4
			C401.5
C402	UIT2702	CLOUD AND DISTRIBUTED COMPUTING	C402.1
			C402.2
			C402.3
			C402.4
			C402.5
C403	UIT2716	INDUSTRIAL TRAINING /INTERNSHIP	C403.1
			C403.2
			C403.3
			C403.4
			C403.5
C404	UIT2717	PROJECT WORK-PHASE-I	C404.1
			C404.2
			C404.3
			C404.4
			C404.5
			C404.6
			C404.7
C405	UIT2718	PROJECT WORK-PHASE-II	C405.1
			C405.2
			C405.3
			C405.4
			C405.5
			C405.6
			C405.7
			C405.8

Course Outcomes

CO 1: To read and comprehend texts (technical)effectively.

CO 2: To write proposals, reports, emails, letters, SOPs meeting professional expectations.

CO 3: To Improve Vocabulary (use of right collocations, idioms and phrases etc).

CO 4: To enhance their grammatical competency for writing and speaking.

CO 5: To improve their ability to listen and comprehend at deeper levels.

CO1: Reduce quadratic form to canonical form by orthogonal transformation and identify the nature of the quadratic form

CO2: Analyse the convergence of a given infinite series

CO3: Find evolute of a given curve and envelope of family of curves

CO4: Find the extrema of function of two variables

CO5: Evaluate the double and triple integrals

CO6: Application of extreme points of functions and multiple integrals in engineering problems

CO1: Analyze crystal structures and the influence of imperfections on their properties.

CO2: Demonstrate and explain the general concepts of elastic and thermal properties of materials.

CO3: Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.

CO4: Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.

CO5: Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommur

CO1-The unique properties of nanoparticles and their applications

CO2 -The principles of electrochemistry and its application for quantitative analysis

CO3-The various types of corrosion under normal to severe corrosive environments and their control measures

CO4 -Construction of phase diagram and its application to analyse simple eutectic Systems

CO5 - The synthesis, properties and applications of important industrial polymers

CO 1: Solve programming problems and express solutions in pseudo code.

CO 2: Develop simple programs using basic constructs.

CO 3: Construct programs using conditions and iterations decompose a problem into functions.

CO 4: Make use of strings, lists, tuples and dictionaries data structures.

CO 5: Perform Input/Output Operations using files.

CO1: Draw Plane curves and perform Free hand sketching of three - dimensional objects.(BL: L3)

CO2: Draw the Orthographic projections of points, lines and plane surfaces. (BL: L3)

CO3: Draw the Projections of solids. (BL: L3)

CO4: Draw the Projections of sectioned solids and Development of surfaces. (BL: L3)

CO5: Draw the Isometric and Perspective projections of solids. (BL: L3)

CO 1: Write, test, and debug simple Python programs.

CO 2: Build Python programs with conditionals and loops.

CO 3: Solve a problem using functions in python programming.

CO 4: Construct python programs using compound data like lists, tuples, and dictionaries.

CO 5: Build a simple application in teams using files and appropriate datatypes by applying the best programming practices.

PHYSISCS

CO1: Apply principles of elasticity, optics, viscosity, thermal and band gap determination for engineering applications

CHEMISTRY

CO1 - Analyse ions like Fe^{2+} , Fe^{3+} , H^+ using different instruments

CO2 - Determine the Molecular weight and Degree of Polymerisation using viscometer

CO1: solve problems in Analytic functions and construction of analytic functions using C-R equations

CO2: solve problems using integration techniques, find Taylor's and Laurent's Series expansions

CO3: obtain the Laplace Transforms and inverse transforms of standard functions.

CO4: solve Differential Equations using different techniques

CO5: evaluate Line, Surface and Volume integrals

CO6: application of Complex integration, Laplace transforms, Ordinary differential equations, and vector calculus in engineering problems

CO1: Solve and analyse DC and AC circuits.

CO2: Explain the operating principle of AC and DC machines.

CO3: Know the concepts electrical power utilization.

CO4: Describe the working principle of various electronic devices and its applications

CO5: Describe the working principle of various sensors and transducers.

CO1: Implement ADTs as Python classes

CO2: Design, implement, and analyze linear data structures, such as lists, queues, and stacks, according to the needs of different application:

CO3: Design, implement, and analyze sorting, searching, and indexing techniques

CO4: Design, implement, and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting.

CO5: Model problems as graph problems and implement efficient graph algorithms to solve them.

CO6: Design and develop data structure intensive software systems by applying best practices for IT project management

CO7: Communicate efficiently in team meetings & presentations and prepare documents for data structure intensive software systems

CO1: The structure and functions of the ecosystems and diversity among life forms within an ecosystem

CO2: The importance of various natural resources and its sustainable use

CO3: The various environmental issues such as pollution, population explosion etc and suggest remedial measures.

CO4: The role of engineering techniques to minimize environmental stress

CO5: The role of various environmental machineries and to ensure proper environmental regulation

CO1: Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band

CO2: Acquire knowledge on basics of semiconductor physics and its application to PN junction devices.

CO3: Elucidate the function of magnetic and optical properties of materials in data storage devices.

CO4: Explain the functioning of modern display devices.

CO5: Apply quantum mechanics of nanostructures and their application to Nano devices for optoelectronic switching.

CO1: Draw pipeline plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood m

CO2: Practice machining to make holes on different materials; fabricate sheet metal components (K2)

CO3: Dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model of various components (K2)

CO4: Construct domestic electrical circuits and verify their output parameters (K3)

CO5: Construct electronics circuits and verify their output (K3)

CO1: Write simple proofs using Propositional and First Order Logics

CO2: Solve problems using different counting techniques

CO3: Prove simple graph properties.

CO4: Explain basic concepts in group theory such as semigroups, monoids and groups.

CO5: Solve problems in partial ordering relations, equivalence relations and lattices.

CO6: Application of Graph theory and Boolean algebra in engineering problems

CO1: Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines

CO2: Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co- existence of Self and Body.

CO3: Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human rela

CO4: Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.

CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherev

CO1. Solve problems using objects, classes, interfaces, modules and packages.

CO2. Apply the concepts of inheritance, polymorphism and exceptions in software design

CO3. Employ effective object serialization and data formats to solve problems

CO4. Select and apply design patterns in their design and analysis

CO1. Explain the database development life cycle and apply conceptual modeling

CO2. Apply SQL and programming in SQL to create, manipulate and query the database

CO3. Apply the conceptual-to-relational mapping and normalization to design relational data base

CO4. Determine the serializability of any non-serial schedule using concurrency techniques

CO5. Apply the data model and querying in Object-relational and No-SQL data bases.

CO1. Understand the concept of number systems, logic gates and different binary arithmetic operations.

CO2. Design and analyse the operation of different combinational logic circuits.

CO3. Design and analyse the operation of different sequential logic circuits

CO4. Understand the design and implementation of a digital system.

CO5. Understand the computer functional blocks and execution of instructions.

CO6. Understand the design of different circuits used in ALU, memory hierarchy and different issues in parallelism

CO1. Explain various data communication techniques.

CO2. Explain multiuser radio communication.

CO3. Use information entropy to design source and channel coding.

CO4. Appreciate the importance of digital communication in the physical layer of a network

CO1. Design and implement a database schema for a given problem-domain.

CO2. Design a database and query using SQL DML/DDL commands.

CO3. Create procedures using PL/SQL.

CO4. Design and build any GUI application.

CO1. Design and implement ADTs using Python modules and packages

CO2. Judiciously select and apply object-oriented concepts for software development

CO3. Implement object persistence and serialization techniques

CO4. Develop test cases and perform systematic testing of object-oriented software

CO5. Develop software systems with sub-systems running concurrently communicating and collaborating with each other

CO1: identify standard distributions and apply them.

CO2: solve problems in two dimensional random variables and find the correlation between them.

CO3: identify and apply the suitable testing of hypothesis under normal, t, F and chi square distribution

CO4: solve problems in analysis of variance.

CO5: analyze quality control by applying control chart methods.

CO6: application of Random variables, Design of Experiments and control charts in engineering problems

CO1. Explain the addressing modes, assembly language programming of X86, and ARM.

CO2. Explain architecture of 8086.

CO3. Design and develop assembly language programs.

CO4. Interface different external memory and peripheral devices with microprocessors and microcontroller

CO5. Analyze a problem and formulate appropriate computing solution for microprocessor-based application

CO1. Design and implement algorithms using hierarchical data structures

CO2. Judiciously select and apply algorithm design techniques for efficiently solving problems

CO3. Analyze the time and space complexity of algorithms and their implementations

CO4. Explain intractability and characterization of NP problems

CO5. Apply best practices for IT project management

CO6. Communicate efficiently in team meetings & presentations and prepare documents

CO1. Identify the components required to build different types of networks.

CO2. Choose the required functionality at each layer for given application.

CO3. Identify solution for each functionality at each layer.

CO4. Ability to trace and interpret information flow in the network

CO5. Understand the functionalities of network application services

CO1. Construct automata, regular expression for any pattern.

CO2. Write Context free grammar for any construct.

CO3. Build the different Phases of compiler and apply the various optimization techniques.

CO4. Design Turing machine for a given language

CO5. Explain decidability, semi-decidability, and undecidability

CO1. Ability to study and implement network sockets

CO2. Study and analyze the performance of networking protocols

CO3. Ability to work with network simulation tools

CO1. Write ALP for 8086 processor and ARM Processor

CO2. Develop systems with interfacing peripheral devices with microprocessor & Controller.

CO3. Create ALP to solve simple problems using ARM board

CO4. Develop real time applications using interfacing various peripherals and processor.

CO5. Solve simple problems using Micro python

CO6. Design and develop suitable autonomous applications for the given situation using ARM Board/ARM Embedded Trainer Kit/ Raspberry

CO1. Identify the key phases and compare different process models.

CO2. Apply the concepts of Requirements Engineering and Analysis modelling.

CO3. Apply systematic procedure for software design and deployment.

CO4. Compare and contrast various testing strategies.

CO5. Apply umbrella activities from inception till maintenance.

CO1. Explain end-to-end data analytics pipeline

CO2. Use appropriate tools to describe and visualize data

CO3. Perform various statistical analysis to make statistical inferences

CO4. Build, validate and communicate data analytical models for complex engineering problems

CO1. Explain operating system services and operations.

CO2. Implement various scheduling algorithms.

CO3. Apply the principles of concurrency.

CO4. Compare and contrast various memory management schemes.

CO5. Analyze the various disk scheduling algorithms

CO6. Design and implement prototype file systems.

CO1. Understand the foundations of artificial intelligence (AI) and autonomous agents that make effective decisions in various environment

CO2. Apply basic principles of AI in solutions that require problem solving, inference under certainty and uncertainty, perception, knowledge

CO3. Define complex problems in AI terms, and solve them by analyzing appropriate AI agents.

CO1. Apply systematic approach to software development using enduring principles and best practices

CO2. Design, implement, and evaluate software to meet business requirements of users

CO3. Judiciously select and apply artificial intelligence techniques in their computing solutions

CO4. Apply best practices for IT project management

CO5. Communicate efficiently in team meetings & presentations and prepare documents

CO1. Install and configure operating systems

CO2. Implement operating system services

CO3. Automate routine operating system maintenance tasks

CO4. Develop software using operating system services

CO5. Analyze the performance of the various scheduling, memory management, and storage management algorithms

CO1. Explain and appreciate the underlying mathematics and paradigms of Machine Learning algorithms.

CO2. Select the appropriate machine learning approach and suitable model parameters for a given problem.

CO3. Design machine learning experiments, and implement machine learning solutions for regression, classification and clustering problems

CO4. Implement various machine learning algorithms for real-world applications.

CO1. Explain the basics of web technology and software-as-a-service

CO2. Employ ruby-on-rails platform for web software development

CO3. Develop and test micro-services and restful apis

CO4. Develop client-side code using javascript ecosystem

CO5. Judiciously select and employ design patterns in web programming

CO6. Employ software engineering best practices for web programming

CO7. Apply best practices for IT project management

CO8. Communicate efficiently in team meetings & presentations and prepare documents

CO1. Develop software solutions using C

CO2. Explain the IoT value chain structure (device, data cloud), application areas and technologies involved

CO3. Explain IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules

CO4. Perform market forecast for IoT devices with a focus on sensors

CO5. Develop smart solutions using IoT

CO1. Design and build simple mobile applications supporting multiple platforms.

CO2. Apply various programming techniques and patterns to build mobile applications.

CO3. Build real-time/gaming/multimedia/AI-based mobile applications for society/environment following ethical practices

CO1. Build basic security algorithms required by any computing system.

CO2. Analyze the vulnerabilities in any computing system and hence be able to design a security solution.

CO3. Analyze the possible security attacks in complex real time systems and their effective countermeasures.

CO4. Classify the security issues in the network and resolve it.

CO5. Evaluate security mechanisms using rigorous approaches, including theoretical derivation, modeling, and simulations.

CO1. Understand how distributed system concepts apply inside cloud.

CO2. Apply the distributed algorithms for effective scheduling.

CO3. Analyze the need for virtualization and apply it in a cloud environment.

CO4. Understand the architecture, infrastructure, and delivery models of cloud computing.

CO5. Explore cloud tools and build applications.

CO1. Integrate theory and practice, and identify curriculum gap

CO2. Develop work competencies for a specific profession or occupation.

CO3. Communicate and collaborate effectively and appropriately with different professionals in the work environment through written and

CO4. Exhibit critical thinking and problem solving skills in building real time applications.

CO5. Present a report on work experience and skill sets acquired.

CO1. To propose solution to the problem by applying the acquired knowledge

CO2. To understand and apply the different advancements happened in their selected area

CO3. To understand and apply the different techniques used in project management.

CO4. To apply the different efficient and modern tools for designing their project modules.

CO5. To analyze and categorize the executable project modules after identifying the risks to assess the health, societal, safety and legal issues

CO6. To select the best alternative design techniques used for designing solutions to the complex problems by following ethical principles.

CO7. To integrate different modules together through team work after undergoing efficient testing, elaborate the completed task and comp

CO1. To propose solution to the problem by applying the acquired knowledge

CO2. To understand and apply the different advancements happened in their selected area

CO3. To understand and apply the different techniques used in project management.

CO4. To apply the different efficient and modern tools for designing their project modules.

CO5. To analyze and categorize the executable project modules after identifying the risks to assess the health, societal, safety and legal issues

CO6. To select the best alternative design techniques used for designing solutions to the complex problems by following ethical principles.

CO7. To integrate different modules together through team work after undergoing efficient testing, elaborate the completed task and comp

CO8. To present their project work effectively by using the modern media tools.

3. Content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current s

scenario in the society.

Code	Course Code	Course Name	CO code
C101	PCP1176	ADVANCED DATA STRUCTURES AND ALGORITHMS	C101.1
			C101.2
			C101.3
			C101.4
C102	PIF1101	ADVANCED DATABASES AND SECURITY	C102.1
			C102.2
			C102.3
C103	PIF1176	AGILE SOFTWARE ENGINEERING	C103.1
			C103.2
			C103.3
C104	PIF1102	MACHINE LEARNING ALGORITHMS AND APPLICATIONS	C104.1
			C104.2
			C104.3
C105	PCP1197	ADVANCED DATA STRUCTURES AND ALGORITHMS	C105.1
			C105.2
			C105.3
C106	PIF1111	ADVANCED DATABASES LAB	C106.1
			C106.2
			C106.3
C107	PMA1251	OPERATIONS RESEARCH	C107.1
			C107.2
C108	PIF1201	SMART SENSORS AND INTERNET OF THINGS	C108.1
			C108.2
			C108.3
			C108.4
			C108.5
C109	PIF1202	BIG DATA ANALYTICS AND VISUALIZATION	C109.1
			C109.2
			C109.3
			C109.4
			C109.5
C110	PIF1203	ADVANCED WEB TECHNOLOGIES	C110.1
			C110.2
			C110.3
			C110.4
			C110.5
C111	PIF1211	MACHINE LEARNING WITH PYTHON LAB	C111.1
			C111.2
C112	PIF1212	BIG DATA ANALYTICS LAB	C112.1
			C112.2
			C112.3
			C112.4
			C112.5
C201	PIF1301	CYBER SECURITY	C201.1
			C201.2

			C201.3
			C201.4

Course Outcomes
Design data structures and algorithms to solve computing problems(K3)
Design algorithms using tree and graph data structure(K3)
Apply suitable design strategy for problem solving(K3)
Classify the P and NP type problems(K2)
To develop skills on databases to optimize their performance in practice.
To analyze each type of databases and its necessity.
To design faster algorithms in solving practical database problem.
Explain the importance of interacting with business stakeholders in determining the requirements for a software s
Apply iterative software development process
Apply the impact of social aspects on software development success
Explain Machine Learning algorithms and their limitations.
Apply common Machine Learning algorithms in practice and implement them.
Relate current research papers on Machine Learning and Deep Learning, and understand the issues raised by cur
Build basic data structures and sorting algorithms (K4).
Build algorithms using tree and graph structures (K3).
Design and develop efficient algorithms for problems, using algorithm design techniques (K3).
Design and Implement databases.
Formulate complex queries using SQL.
Design and Implement applications that have GUI and access databases for backend connectivity
Analyze a problem,
Formulate and solve problems in any engineering field using operations research principles
Apply the concepts of sensor for interfacing with the environment.
Evaluate the performance of different types of applications for performance.
Develop new IOT protocols by doing some minor changes.
Apply the different architectural features of Embedded systems for IOT application design.
Apply the concepts for sensors and IOT for health care applications.
Apply the statistical analysis methods.
Compare and contrast various soft computing frameworks.
Design distributed file systems.
Apply Stream data model.
Use Visualisation techniques
Use bootstrap framework to design web pages
Implement Single Page Applications
Use Express framework to develop web applications
Design a web page applying functional programming concept
Analyze web performance
Build simple python codes for Data Science
Build Machine Learning algorithms using datasets available in public repositories
Apply data mining techniques and methods to large data sets.
Experiment big data using Hadoop framework.
Build and apply linear and logistic regression models.
Analyze data with machine learning methods.
Analyze graphical data analysis.
Apply security principles in the application layer.
Explain computer forensics.

Use forensics tools.
Analyze and validate forensics data

system.

ent research.

Code	Course Code	Course Name	CO code
C101	PMA2158	MATHEMATICS FOR AI & ML	C101.1
			C101.2
			C101.3
			C101.4
			C101.5
C102	PIF2101	DESIGN AND ANALYSIS OF CONCURRENT STRUCTURES AND ALGORITHMS	C102.1
			C102.2
			C102.3
			C102.4
C103	PIF2102	ADVANCED ARTIFICIAL INTELLIGENCE	C103.1
			C103.2
			C103.3
			C103.4
C104	PIF2103	MACHINE LEARNING FOR MULTIMODAL	C104.1
			C104.2
			C104.3
			C104.4
C105	PIF2111	PROGRAMMING WITH CONCURRENT STRUCTURES AND ALGORITHMS	C105.1
			C105.2
			C105.3
			C105.4
			C105.5
C106	PIF2112	MULTI-MODAL MACHINE LEARNING LAB	C106.1
			C106.2
			C106.3
			C106.4
C107	PIF2201	DEEP LEARNING FOR COMPUTER VISION	C107.1
			C107.2
			C107.3
C108	PIF2202	DATA ENGINEERING & MANAGEMENT	C108.1
			C108.2
			C108.3
			C108.4
			C108.5
			C108.6
C109	PIF2211	DEEP LEARNING FOR COMPUTER VISION LABORATORY	C109.1
			C109.2
			C109.3
C110	PIF2212	DATA ENGINEERING & MANAGEMENT LABORATORY	C110.1
			C110.2
			C110.3
C111	PIF2216	INTERNSHIP WITH SEMINAR	C111.1
			C111.2
			C111.3
C201	PIF2301	DEEP LEARNING FOR LANGUAGE AND SPEECH TECHNOLOGIES	C201.1

			C201.2
			C201.3
			C201.4
			C201.5
C202	PIF2318	PROJECT -PHASE I	C202.1
			C202.2
			C202.3
C203	PIF2418	PROJECT -PHASE II	C203.1
			C203.2
			C203.3

Course Outcomes
CO1: Identify the standard distributions and apply them in solving problems.
CO2: Acquire knowledge of linear spaces and solve problems.
CO3: Apply various methods in matrix theory to solve decomposition problems.
CO4: Understand the concepts of differential and integral calculus and solve problems.
CO5: Acquire knowledge of graphs and cut-sets and apply in network flow problems.
CO 1: Apply knowledge of computing and mathematics to analyze the problem, requirements and algorithms
CO 2: Solve the complex engineering problems using hierarchical data structures
CO 3: Apply suitable design strategy in a way that demonstrates comprehension of the trade-offs involved in design
CO 4: Classify the type of the problem as P, NP Complete or NP Hard.
CO 1: Identify the role of propositional and first order logic in Artificial Intelligence
CO 2: Demonstrate an understanding of knowledge and reasoning under certainty and uncertainty.
CO 3: Apply principles of AI in solutions that require problem solving, inference, perception
CO 4: Implement algorithms on simple and complex decision making.
CO 1: Demonstrate the image, video and speech and text data acquisition, representation, and storage approaches
CO 2: Analyse Machine Learning algorithms and their limitations
CO3: Apply Machine Learning algorithms on image, video, audio, and text data
CO4: Relate current research papers on Machine Learning and understand the issues raised by current research.
CO1: Analyze the existing algorithms.
CO2: Implement and apply concurrency in linked lists, stacks, queues, heap and hashing.
CO3: Implement advanced search trees and graph algorithms
CO4: Implement approximation, randomized, parallel algorithm, Greedy and Dynamic Algorithms
CO5: Solve real time applications using advanced algorithm concepts.
CO 1: Use Python packages for Machine Learning applications
CO 2: Implement image/video/speech /text processing techniques using tools such as openCV and NTLK
CO3: Build and validate machine learning models using supervised and unsupervised learning methods
CO4: Design and develop Machine Learning based solutions for image, video and speech and text analysis through
CO 1: Explain the fundamentals of computer vision techniques.
CO 2: Describe deep learning architecture models.
CO 3: Apply the deep learning algorithms and solve real-world problems.
CO1: Develop database designs using Relational models.
CO2: Use advanced SQL features for managing relational databases.
CO3: Apply concurrency control and recovery mechanisms for practical problems.
CO4: Store and process big data in a distributed environment.
CO5: Use various concepts of NoSQL databases.
CO6: Design and develop applications on Hadoop/Spark
CO 1: Implement the fundamental computer vision techniques.
CO 2: Design and develop deep learning models through research/investigations
CO 3: Apply the deep learning algorithms to solve real-world problems.
CO 1: Design databases and write advanced SQL queries to perform database retrieval
CO 2: Process and analyze big data using Hadoop and Spark framework
CO 3: Develop real time applications using database frameworks like MongoDB, Hbase, Pig and Hive for data analysis
CO1: Ability to learn and apply new and existing concepts for solving engineering problems
CO2: function effectively on multidisciplinary teams or as an individual
CO3: clearly communicate ideas through preparation of a well-documented internship report, and oral demonstration
CO1: Explain existing and emerging deep learning architectures for text and speech processing

CO2: Apply deep learning techniques for NLP tasks, language modeling and machine translation
CO3: Explain coreference and coherence for text processing
CO4: Build question answering systems, chatbots and dialogue systems
CO5: Apply deep learning models for building speech recognition and text-to-speech systems
CO1: Demonstrate an ability to define a precise problem statement with objectives and scope, and define a comp
CO2: demonstrate the skills for performing literature survey, identify gaps, analyze the technical content, and pre
CO3: Communicate orally, showing knowledge on the subject and sensitivity towards social impact of the disserta
CO1: Apply knowledge to design suitable software/hardware, conduct experiments and utilize modern tools for d
CO2: Demonstrate communication skills through effective oral presentation showing knowledge on the subject, a
CO3: Write a dissertation paper in scientific journal style and publish in refereed journal, or patent.

eveloping working models / process / systems for solving real world engineering problems

Sri Sivasubramaniya Nadar College of Engineering

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Rajiv Gandhi Salai (OMR), Kalavakkam – 603110



**Regulations 2022
Choice Based Credit System (CBCS)**

Curriculum and Syllabi for

**Master of Engineering
in
Manufacturing Engineering**

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110

(An Autonomous Institution, Affiliated to Anna University, Chennai)

REGULATIONS 2022 CHOICE BASED CREDIT SYSTEM

DETAILED SYLLABUS OF M.E., MANUFACTURING ENGINEERING

SEMESTER I

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2101	MICRO MANUFACTURING	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to

CO#	Course Outcome	Level
CO1	To understand the capabilities of mechanical energy-based micro machining processes	R : K1
CO2	Explain the principles of thermal energy-based micro machining processes	U : K2
CO3	Use of the mechanical tool contact-based micro machining processes	U : K2
CO4	Understanding the material removal in various nano finishing processes	R : K1
CO5	Discuss the micro forming technologies and micro parts characterization	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2		3		3	1
CO2	2		3		3	1
CO3	2		3		3	1
CO4	2	1	3		3	1
CO5	2	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2102	ROBOTICS & AUTOMATION	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Explain the concepts of industrial robots on classification, specification, future prospects and application relating to the need of robot & automation	U : K2
CO2	Examine different sensors and actuators for standard industrial applications	Ap : K3
CO3	Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots	An : K4
CO4	Explain robot motion planning using simulation tools and ROS	Ap : K3
CO5	Explain AI implications and the design of simple automations using microcontroller	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3	2	3	1
CO2	1		3		3	2
CO3	2		3		3	2
CO4	2	1	3		3	2
CO5	2	2	3	2	3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2103	ADVANCES IN CASTING AND WELDING	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Discuss the recent trends in casting processes	U : K2
CO2	Acquire knowledge on metallurgy of casting processes and design considerations for various metals and alloys	U : K2
CO3	Explain the recent trends in fusion and solid-state welding techniques	U : K2
CO4	Gain the knowledge on welding metallurgy and mechanical testing of various alloys	U : K2
CO5	Understand various quality control and automation methods in casting and welding-based industries	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	2		3	2	3	1
CO4	2		3		3	1
CO5	2		3	2	3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2104	MECHANICAL BEHAVIOR OF MATERIALS	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Explain basic concepts of stress, strain and mechanical properties of materials and solve problems	Ap : K3
CO2	Describe various types of crystals and their defects, slips and dislocations in crystal structures and solve related problems	Ap : K3
CO3	Explain various strengthening mechanisms of materials	U : K2
CO4	Explain different types of fractures and application of fracture mechanics in real time	U : K2
CO5	Explain fatigue in ceramics, polymers, metals, creep and stress rupture in materials	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2105	MATERIALS TESTING AND CHARACTERIZATION TECHNIQUES	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Summarize the principle, procedures, and applications of hardness, tensile, impact and fracture toughness testing methods	U : K2
CO2	Discuss the principle, procedure, and applications of dynamic mechanical testing methods	U : K2
CO3	Explain the principle and procedures for optical microscopy and able to determine the crystal structures.	U : K2
CO4	Distinguish the different techniques of electronic and atomic structures.	U : K2
CO5	Discuss the various spectrometry techniques and thermal analysis	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2		3		3	1
CO2	2		3		3	1
CO3	2		3		3	1
CO4	2	1	3		3	1
CO5	2	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2176	RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS	2	0	0	2

CO#	Course Outcome	Level
CO1	Understand research problem formulation.	U : K2
CO2	Analyze research related information and follow research ethics	An : K4
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	U : K2
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.	U : K2

CO5	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	3		3		1	3
CO2	3	3	3		1	3
CO3	3		2		1	3
CO4			1		1	1
CO5			1		1	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2111	INDUSTRIAL MODELING AND SIMULATION LAB	0	0	4	2

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Acquire practical knowledge on R programming and use the same to perform manufacturing process analysis by simulation to enable lean in Industries	Ap : K3
CO2	Demonstrate practical knowledge on modelling industrial robots and use the same to simulate manufacturing operations of real-world industrial systems in virtual industrial environment for dynamic conditions	An : K4

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1	2	3		3	1
CO2	1	2	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2112	CASTING AND WELDING LABORATORY	0	0	4	2

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Acquire practical knowledge on the fabrication, testing and characterization of castings and welded joints.	Ap : K3
CO2	Analyze the casting and welding experimental results using statistical tools	An : K4

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2	2	3		3	2
CO2	2	2	3		3	2

SEMESTER II

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2201	COMPUTATIONAL METHODS & OPTIMIZATION TECHNIQUES IN MANUFACTURING	3	1	0	4

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Apply direct and iterative methods to solve linear and non-linear system of equations.	Ap : K3
CO2	Apply linear programming techniques to solve linear problems	Ap : K3
CO3	Apply non-linear programming techniques like Lagrangian method, K-T conditions, quadratic programming, separable programming to solve non-linear problems	Ap : K3
CO4	Apply integer programming techniques, dynamic programming and network techniques.	Ap : K3
CO5	Apply advanced simulation techniques like GA, SA, PSO, ANN and fuzzy.	Ap : K3

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	3		3		3	2
CO2	3		3		3	2
CO3	3		3		3	2
CO4	3	1	3		3	2
CO5	3	1	3		3	2

CODE	COURSE TITLE	L	T	P	C
PMF2202	ADDITIVE MANUFACTURING	3	0	0	3

OUTCOMES: At the **CO/PO & PSO Mapping:**

end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Understand the basic principles, classification and standards of Additive Manufacturing	R : K1
CO2	Understand and apply the principles of design for additive manufacturing	Ap : K3
CO3	Knowledge of various types of AM processes used mainly for non metallic materials and understand the effect of process parameters on quality of AM products	U : K2
CO4	Knowledge of various types of AM processes used mainly for metallic materials and understand the effect of process parameters on quality of AM products	U : K2
CO5	understand the Materials, post processing, Safety and standardization aspects of AM	U : K2

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2	2		3		3	2
CO3	2		3		3	2
CO4	2	1	3		3	2
CO5		1	3	2	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2211	ROBOTICS AND AUTOMATION LABORATORY	0	0	4	2

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Demonstrate the competence to program an industrial/mobile robot for simple applications	Ap : K3
CO2	Design and trouble shoot a microcontroller-based circuit for simple automation applications	E : K5

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	3	2	3		3	2
CO2	3	2	3		3	2

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2212	ADDITIVE MANUFACTURING LABORATORY	0	0	4	2

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Create 3D models of components and make the necessary modifications to suit Additive manufacturing of the component	Ap : K3
CO2	Prepare the necessary STL files and print a designed component and assess the quality	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1		2	3		3	
CO2		2	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2316	INTERNSHIP WITH SEMINAR	0	0	4	2

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Identify a real time industrial problem, apply fundamental knowledge to solve the problem	Ap : K3
CO2	Analyze the solution(s) and present/communicate the solution(s) and file as a report	An : K4

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	3	3	3	2	3	3
CO2	3	3	3	2	3	3

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2318	PROJECT PHASE I	0	0	12	6

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Identify a real technical problem and apply the fundamental knowledge to solve	Ap : K3
CO2	Analyze the feasible solutions and compile as a report and communicate	An : K4

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	3	3	3	2	3	3
CO2	3	3	3	2	3	3

SEMESTER IV

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2418	PROJECT PHASE II	0	0	24	12

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Identify a real technical problem and apply the fundamental knowledge to solve and analyze the problem	Ap : K3; An : K4
CO2	Evaluate the solutions and Create new engineering systems	E : K5; C : K6

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	3	3	3	2	3	3
CO2	3	3	3	2	3	3

PROGRAM ELECTIVES

PROGRAM ELECTIVE – I (MATERIALS RELATED)

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2221	COMPOSITE MATERIALS & APPLICATIONS	3	0	0	3

CO#	Course Outcome	Level
CO1	Understanding the functions and characteristics of matrix and reinforcement materials.	U : K2
CO2	Summarize the fabrication methods of thermoset and thermoplastic polymer composites	U : K2
CO3	Explain the processing routes for metal matrix composites.	U : K2
CO4	Describe the processing routes and toughening mechanisms for ceramic matrix composites.	U : K2
CO5	Discuss the applications of composite materials and understanding about nanocomposite materials.	U : K2

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3	2	1	1
CO2	1		3	2	1	1
CO3	1		3	1	1	1
CO4	1	1	3	1	1	1
CO5	1	1	3	1	1	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2222	ADVANCED ENGINEERING MATERIALS	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Introduce and discuss the concepts of selection of materials and advanced steels	U : K2
CO2	Discuss the principles and mechanisms of light weight and aerospace materials	U : K2
CO3	Discuss the principles of modern metallic materials	U : K2
CO4	Explain the principles of energy materials	U : K2
CO5	Discuss the applications of healthcare materials	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2		3		3	1
CO2	2		3		3	1
CO3	2		3		3	1
CO4	2	1	3		3	1
CO5	2	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2223	SMART MATERIALS & STRUCTURES	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Introduce and discuss the concepts of smart materials, smart systems and shape memory alloys	U : K2
CO2	Discuss the principles and mechanisms of piezoelectric and Superconducting materials	U : K2
CO3	Discuss the mechanisms of magnetostrictive and colour changing materials	U : K2
CO4	Explain the principles of MRFs, ERFs, and Conducting polymers	U : K2
CO5	Discuss the applications of smart composites and self-healing materials	Ap : K3

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2		3		3	1
CO2	2		3		3	1
CO3	2		3		3	1
CO4	2	1	3		3	1
CO5	2	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2224	INDUSTRIAL SURFACE ENGINEERING	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Understand the basics of surface dependent properties, failure and necessity for surface engineering	U : K2
CO2	Suggest means of Engineering a given surfaces by material removal / addition, liquid/ molten bath	U : K2
CO3	Discuss the different methods of surface modification of steel and ferrous components.	U : K2
CO4	Explain about surface engineering using laser, electron and ion energy beams.	U : K2
CO5	Discuss the importance of specific coatings & its characterization.	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2225	MICROELECTRO MECHANICAL SYSTEMS	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Discuss the basic concepts of Micro Electro Mechanical Systems	U : K2
CO2	Discuss the fabrication processes of MEMS	U : K2
CO3	Discuss the bulk and surface micromachining techniques used in MEMS	U : K2
CO4	Explain the assembly, packaging and testing of microsystems	U : K2
CO5	Discuss the application of BioMEMS microactuators	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2226	CERAMIC SCIENCE & TECHNOLOGY	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Recognize the properties and types of ceramics materials	U : K2
CO2	Discuss the process involved in the preparation of ceramic materials	U : K2
CO3	Explain the machining and joining techniques to make ceramic components	U : K2
CO4	Appraise the significance of using ceramics in a bio applications	Ap : K3
CO5	Identify properties and applications of various electronic ceramic materials	R : K1

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

PROGRAM ELECTIVE – II (ADVANCES IN MANUFACTURING)

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2227	VIRTUAL MANUFACTURING	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Describe virtual reality software and hardware for product modeling and process simulation	R : K1
CO2	Describe the techniques for product modeling, product visualization, digital mockup and product data management. Elaborate the methods for digital geometry processing	R : K1
CO3	Describe the color model for virtual reality and its applications in digital mockup and virtual manufacturing	R : K1
CO4	Demonstrate the principles of virtual manufacturing	R : K1
CO5	Describe the manufacturing process simulation	R : K1

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2228	ARTIFICIAL INTELLIGENCE IN MANUFACTURING	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	To Identify and describe soft computing techniques and their roles in Industry	R : K1
CO2	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problem	Ap : K3
CO3	Apply ANN principles to develop expert systems to solve a manufacturing problem in Industry	Ap : K3
CO4	To understand various optimization algorithms concepts and applications	U : K2
CO5	To enable the student to select an appropriate Artificial intelligence technique and solve an optimization problem in Manufacturing Industry	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	2		3		3	1
CO3	2		3		3	1
CO4	2	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2231	LEAN AND CELLULAR MANUFACTURING	3	0	0	3

OBJECTIVE:

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Apply the Lean manufacturing tools for a given scenario	Ap : K3
CO2	Discuss the concepts of lean six sigma	U : K2
CO3	Discuss the importance of JIT and Kanban	U : K2
CO4	Explain the principles of Jidoka and Poka Yoke	U : K2
CO5	Discuss the principle and application of group technology	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2232	SUSTAINABLE & GREEN MANUFACTURING PRACTICES	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Understanding the basics of sustainability and development challenges.	U : K2
CO2	Summarize the sustainability principles and framework.	U : K2
CO3	Describe the sustainable and green manufacturing practices.	U : K2
CO4	Explain the practical ways of following the sustainability approaches.	U : K2
CO5	Examine the impact of air, water, and noise pollutions on environment	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3	3	3	1
CO2	1		3	3	3	1
CO3	1		3	3	3	1
CO4	1	1	3	3	3	1
CO5	1	1	3	3	3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2233	ADVANCED METAL FORMING PROCESSES	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Enable the students to expose to the knowledge of plasticity and representation of state of stress in different coordinate systems	Ap : K3
CO2	Analyze the effect of different bulk deformation process parameters on friction, forces, work done and defects.	Ap : K3
CO3	Explain capabilities and applications of sheet metal processes to fabricate components of nonferrous and ferrous metals.	U : K2
CO4	Acquire knowledge on powder metallurgy and special forming processes	U : K2
CO5	Examine effects of surface treatment and friction in different metal forming processes	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

PROGRAM ELECTIVE – III (DESIGN RELATED)

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2234	COMPUTER AIDED PRODUCT DESIGN & LIFECYCLE MANAGEMENT	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Understand the importance and various phases of product design	U : K2
CO2	Explain the fundamentals of Computer graphics and geometry modelling	U : K2
CO3	Explain the fundamentals of product design process and design thinking	U : K2
CO4	Understand the various product design concepts	U : K2
CO5	Explain the fundamentals of various product design and problem solving tools	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3	2	3	1
CO5	1	1	3	2	3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2235	DESIGN FOR MANUFACTURE, ASSEMBLY AND ENVIRONMENT	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Explain the importance of tolerances in manufacturing and assembly of components	U : K2
CO2	Explain the concept of GD&T	U : K2
CO3	Summarize DFM guideline to be followed during casting and forming processes	U : K2
CO4	Explain the principles of design for assembly	U : K2
CO5	Explain the principles of design for environment.	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3	2	3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2236	FINITE ELEMENT METHODS FOR MANUFACTURING ENGINEERING	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Explain the fundamentals of Finite Element formulation	U : K2
CO2	Understand the application of 1-D elements to field problems	Ap : K3
CO3	Understand the application of 2-D planar elements to field problems	Ap : K3
CO4	Explain the concepts of FE modeling for manufacturing problems	U : K2
CO5	Understand the application of FEM to manufacturing problems	Ap : K3

CO/PO & PSO Mapping:.

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2		3		3	2
CO2	2		3		3	2
CO3	2		3		3	2
CO4	2	1	3		3	2
CO5	2	1	3		3	2

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2237	ADVANCES IN METROLOGY & AUTOMATED INSPECTION	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Understand the basic concepts of metrology and metrology for the digital age.	U : K2
CO2	Discuss in detail about the various methods of surface roughness measurement.	U : K2
CO3	Elaborate on the principles of light interference and interferometers.	U : K2
CO4	Explain about the different measuring machines and laser metrology.	U : K2
CO5	Discuss the techniques involved in image processing for metrology.	U : K2

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2238	DESIGN OF JIGS, FIXTURES AND PRESS TOOLS	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Summarize the different methods of Locating Jigs and Fixtures and Clamping principles	U : K2
CO2	Design and develop jigs and fixtures for given component	Ap : K3
CO3	Discuss the press working terminologies and elements of cutting dies	Ap : K3
CO4	Distinguish between Bending and Drawing dies.	U : K2
CO5	Discuss the different types of forming techniques	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2239	TRIBOLOGY IN DESIGN	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Understand the basics to Tribology	U : K2
CO2	Discuss in detail about Friction and Wear	U : K2
CO3	Elaborate on the principles Hydrodynamic journal bearings	U : K2
CO4	Discuss the theory and problems in Plane slider bearings	Ap : K3
CO5	Learn the technical information about Hydrostatic Lubrication	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2		3		3	1
CO2	2	1	3		3	1
CO3	2		3		3	1
CO4	2	1	3		3	1
CO5	2		3		3	1

PROGRAM ELECTIVE – IV (MACHINE TOOLS RELATED)

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2321	ADVANCED TOOL ENGINEERING	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	To know the various design consideration of tooling for various manufacturing process	U : K2
CO2	Design and Develop tooling for metal removal processes	Ap : K3
CO3	Design and Develop tooling for metal forming processes	Ap : K3
CO4	Design and Develop tooling for metal casting and joining processes	Ap : K3
CO5	Design and Develop tooling for inspection and gauging	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2322	METAL CUTTING THEORY AND PRACTICE	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Explain the mechanism of chip formation/material removal processes with cutting forces	U : K2
CO2	Describe the nomenclature of single and multi point cutting tools	Ap : K3
CO3	Summarize the thermal aspects in machining and different cooling methods	U : K2
CO4	Describe the types of cutting tool materials, life and tool wear	U : K2
CO5	Explains the different wear mechanisms and chatters in machining	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	1
CO2			3		3	1
CO3	1		3	1	3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2323	MACHINE TOOL CONTROL	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Summarize the automatic control in machine tools	U : K2
CO2	Explains different drive systems and feedback devices	U : K2
CO3	Describe the different adaptive controls and PLC in machine tools	Ap : K3
CO4	Explains tool condition monitoring through vibration and acoustic emission	Ap : K3
CO5	Discuss the different condition monitoring techniques including image processing	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2324	FLUID POWER AUTOMATION	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Explain the concepts of components, specification and application relating to the need of automation	U : K2
CO2	Examine different pumps and motors for standard applications and represent the elements using symbols	Ap : K3
CO3	Identify different control and regulation elements based on characteristics and performance	An : K4
CO4	Design a hydraulic or pneumatic circuit based on different design methodologies	Ap : K3
CO5	Explain the implications of electronic control automations using PLC and other modes	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2		3		3	1
CO2	2		3		3	1
CO3	2		3		3	1
CO4	2		3		3	1
CO5	2		3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2325	NUMERICAL CONTROLS IN MACHINE TOOLS	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Recognize the evolution, types and principle of CNC machine tools	U : K2
CO2	Acquire knowledge on constructional features of CNC machine tools	U : K2
CO3	Identify drives and axis measuring system used in CNC machine tools	Ap : K3
CO4	Demonstrate competency in manual part program and generation of CNC part program using CAM packages	U : K2
CO5	Elaborate various tooling and work holding devices used in CNC machine tools	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2326	PROGNOSTICS AND CONDITION MONITORING OF MACHINE TOOLS	3	0	0	3

OUTC CO/PO & PSO Mapping:

CO#	Course Outcome	Level
CO1	Assess the developments various health monitoring systems of the machines.	U : K2
CO2	Describe the maintenance of the system with faulty diagnosis and prognosis of the system.	U : K2
CO3	Apply the principles on various machine health monitoring systems.	U : K2
CO4	Describe various condition monitoring methods	Ap : K3
CO5	Knowledge will be gained on application and utility of Vibration Based Condition Monitoring used in various sectors and fields	U : K2

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

PROGRAM ELECTIVE – V (INDUSTRIAL MANAGEMENT RELATED)

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2327	QUALITY AND RELIABILITY ENGINEERING	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Select and use appropriate control charts and arrive at process capabilities	Ap: K3
CO2	Apply concepts such as AQL, LTPD and AOQL for industrial settings	Ap: K3
CO3	Apply and use design of experiments to optimize outputs	An: K4
CO4	Understand concepts of reliability and appreciate RCM	Ap: K3
CO5	Develop economic and life cycle analyses of products and components	U: K2

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1	1	3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2328	BUSINESS OPERATIONS INTEGRATION	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Explain the functions and characteristics of business process.	U : K2
CO2	Discuss the business process reengineering and functional area information system	U : K2
CO3	Explain the enterprise resource planning processes and architecture	U : K2
CO4	Explain the ERP software packages and its performance	U : K2
CO5	Discuss the detailed analysis of ERP modules	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2329	DATA ANALYTICS	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Apply the statistical analysis methods	U: K2
CO2	Compare and contrast various soft computing frameworks	Ap: K3
CO3	Understand data streams and concepts related to data mining	U: K2
CO4	Apply stream data model using itemsets and various clustering techniques	Ap: K3
CO5	Design and use visualization techniques	Ap: K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1	1	3		3	1
CO3	1		3		3	1
CO4	1	1	3		3	1
CO5	1	1	3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2331	SUPPLY CHAIN AND LOGISTICS MANAGEMENT	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	explain the major building blocks, major functions, major business processes, performance metrics, and major decisions in SCM and LM	U : K2
CO2	enable the student to plan and design a Supply chain Network	U : K2
CO3	examine analytically the supply chain of organizations and measure performance improvement	U : K3
CO4	understand the various distribution management channels involved in Logistics Management	U : K2
CO5	enable the student to understand the significance of Logistics Management in modern day industrial eco system	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3	1	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2332	MANUFACTURING MANAGEMENT	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	Able to acquire knowledge on facility, and problems associated with it.	U : K2
CO2	Ability to learn the various capacity and layout planning models	U : K2
CO3	Understand the concepts of demand forecasting and project management with relevant	U : K2
CO4	Able to understand the concepts of production planning and scheduling.	U : K2
CO5	Understand the various inventory and maintenance management techniques.	Ap : K3

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	1
CO2	1		3		3	1
CO3	1		3		3	1
CO4	1		3		3	1
CO5	1		3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PMF2333	MAINTENANCE ENGINEERING	3	0	0	3

OUTCOMES: At the end of this course, the students will be able to:

CO#	Course Outcome	Level
CO1	able to understand the maintenance principles, functions and practices followed in industry	U : K2
CO2	able to trace out and locate the faulty element within a large machine based on the symptoms observed from the machines.	U : K2
CO3	decide on the application of condition monitoring parameters of a machine as a preventive maintenance tool, with the final objective of reducing the breakdown situations.	U : K2
CO4	suggest suitable repair methods, tools and tackles needed for performing the repair process.	U : K2
CO5	decide on the parts replacement plan on any machine in an economical way	U : K2

CO/PO & PSO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

AUDIT COURSES

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2001	ENGLISH FOR RESEARCH PAPER WRITING	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Understand that how to improve your writing skills and level of readability.	K2:U
CO2	Learn about what to write in each section	K2:U
CO3	Understand the skills needed when writing a Title.	K2:U
CO4	Understand the skills needed when writing the Conclusion.	K2:U
CO5	Ensure the good quality of paper at very first-time submission.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1		3	3		3	
CO2		3	3		3	
CO3		3	3		3	
CO4		3	3		3	
CO5		3	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2002	DISASTER MANAGEMENT	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Ability to summarize basics of disaster.	K2:U
CO2	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	K2:U
CO3	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	K2:U
CO4	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	K2:U
CO5	Ability to develop the strengths and weaknesses of disaster management approaches.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	3	3	
CO2			3	3	3	
CO3			3	3	3	
CO4			3	3	3	

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2003	VALUE EDUCATION	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Gain knowledge on self-development.	K2:U
CO2	Learn the importance of Human values.	K2:U
CO3	Develop the overall personality.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	3	3	
CO2			3	3	3	
CO3			3	3	3	
CO4			3	3	3	
CO5			3	3	3	

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2004	PEDAGOGY STUDIES	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Know what pedagogical practices are being used by teachers informal and informal classrooms in developing countries?	K2:U
CO2	Know the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?	K2:U
CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2005	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his/her personality and achieve the highest goal in life.	K2:U
CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity.	K2:U
CO3	Study of Geeta will help in developing versatile personality of the students.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	3	3	
CO2			3	3	3	
CO3			3	3	3	
CO4			3	3	3	
CO5			3	3	3	

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2006	CONSTITUTION OF INDIA	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Know and discuss about the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	K2:U
CO2	Know and discuss about the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	K2:U
CO3	Know and discuss about the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	K2:U
CO4	understand that today's world is controlled by Computer, Information technology, but tomorrow world will be ruled by ideas, concept, and creativity.	K2:U
CO5	Know and discuss about the passage of the Hindu Code Bill of 1956.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	3	3	
CO2			3	3	3	
CO3			3	3	3	
CO4			3	3	3	
CO5			3	3	3	

OPEN ELCTIVE COURSES (OC)

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2941	BUSINESS ANALYTICS	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Identify the real world business problems and model with analytical solutions.	K3:Ap
CO2	Solve analytical problem with relevant mathematics background knowledge.	K3:Ap
CO3	Convert any real world decision making problem to hypothesis and apply suitable Statistical testing.	K3:Ap
CO4	Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce	K3:Ap
CO5	Use open source frameworks for modeling and storing data.	K3:Ap
CO6	Apply suitable visualization technique using R for visualizing voluminous data.	K3:Ap

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2942	INDUSTRIAL SAFETY	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Understand and summarize basics of industrial safety	K2:U
CO2	Understand and describe fundamentals of maintenance engineering	K2:U
CO3	Explain wear and corrosion	K2:U
CO4	Know about fault tracing	K2:U
CO5	Understand preventive and periodic maintenance	K2:U

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2943	OPERATIONAL RESERACH	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	To formulate linear programming problem and solve using graphical method.	K3:Ap
CO2	To solve LPP using simplex method	K3:Ap
CO3	To formulate and solve transportation, assignment problems	K3:Ap
CO4	To solve project management problems	K3:Ap
CO5	To solve scheduling problems	K3:Ap

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2944	COST MANAGEMENT OF ENGINEERING PROJECTS	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Understand the costing concepts and their role in decision making	K3:Ap
CO2	Understand the project management concepts and their various aspects in selection	K3:Ap
CO3	Interpret costing concepts with project execution	K3:Ap
CO4	Gain knowledge of costing techniques in service sector and various budgetary control techniques	K3:Ap
CO5	Become familiar with quantitative techniques in cost management.	K3:Ap

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2945	COMPOSITE MATERIALS	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Know the characteristics of composite materials and effect of reinforcement in composite materials.	K2:U
CO2	Know the various reinforcements used in composite materials	K2:U
CO3	Understand the manufacturing processes of metal matrix composites	K2:U
CO4	Understand the manufacturing processes of polymer matrix composites	K2:U
CO5	Analyze the strength of composite materials.	K4:An

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2946	WASTE TO ENERGY	3	0	0	3

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Understand the various types of wastes from which energy can be generated	K2:U
CO2	Gain knowledge on biomass pyrolysis process and its applications	K2:U
CO3	Develop knowledge on various types of biomass gasifiers and their operations	K2:U
CO4	Gain knowledge on biomass combustors and its applications on generating.	K2:U
CO5	Understand the principles of bio-energy systems and their features.	K2:U

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2947	INTRODUCTION TO DATA SCIENCE	3	0	0	3

COURSE OUTCOMES

After the completion of this course, students will be able to:

- Explain the fundamental concepts of data science. (K2)
- Develop Python programs to perform data analysis. (K3)
- Apply the pre-processing steps to clean the data. (K3)
- Summarize the various statistical inferences. (K2)
- Solve the data science applications using machine learning. (K3)

Sri Sivasubramaniya Nadar College of Engineering

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Rajiv Gandhi Salai (OMR), Kalavakkam – 603110.



Regulations 2022

Curriculum and Syllabi for

**Master of Engineering
in
Energy Engineering**

Programme Educational Objectives (PEOs)

To enable our students graduating in this programme to

- PEO 1. Have a successful professional career in core/allied industries in Energy/Thermal domains, either by employment or through entrepreneurship.
- PEO 2. Demonstrate an ability for higher studies, research and lifelong learning.

Programme Outcomes (POs)

Students who graduate from this programme will be able to

- PO 1. To independently carry out research /investigation and development work to solve practical problems.
- PO 2. To write and present a substantial technical report/document.
- PO 3. To demonstrate a degree of mastery in the areas of energy, systems, audit, energy conservation and management, heat transfer, thermal storage, design and simulation of thermal and fluid flow systems.
- PO 4. To apply ethical principles and environmental guidelines to address societal, environmental, and sustainability related issues.

Programme Specific Objectives (PSO's):

- PSO 1. Apply knowledge of science and engineering fundamentals to model, design and analyze components or processes of Energy/Thermal systems
- PSO 2. Identify, formulate, review research literature and analyze complex problems in Energy and allied areas.

PEO / PO/PSO Mapping

	PO/PSO					
	PO1	PO2	PO3	PO4	PSO1	PSO2
PEO1	3	3	3	2	3	3
PEO2	3	3	3	2	3	3

1 - weak; 2 - medium; 3 - strong

Course wise PO/PSO Mapping

Subject Name	PO1	PO2	PO3	PO4	PSO1	PSO2
Applied Fluid Mechanics and Heat Transfer	✓	✓	✓		✓	✓
Thermodynamic Analysis of Energy Systems	✓		✓	✓	✓	
Renewable Energy Systems		✓	✓	✓	✓	
Advanced Power Plant Engineering		✓	✓	✓	✓	
Research Methodology and IPR	✓	✓	✓	✓		✓
Applied Heat Transfer Lab	✓	✓	✓	✓	✓	✓
Fuels and Energy Systems Lab	✓	✓	✓	✓	✓	✓
Numerical Techniques For Differential Equations	✓		✓		✓	
Energy conservation in industrial utilities	✓	✓	✓	✓	✓	
Measurements and control for energy systems		✓	✓		✓	
Solar Energy Laboratory	✓	✓	✓	✓	✓	✓
Computational Fluid Dynamics Lab	✓	✓	✓		✓	✓
Solar Energy Technologies		✓	✓		✓	
Wind Energy Technologies		✓	✓		✓	
Bio Energy Conversion Techniques		✓	✓	✓	✓	
Electro-Mechanical Energy Conversion		✓	✓		✓	
Nuclear Engineering		✓	✓	✓	✓	
Electric and Hybrid Electric Vehicles		✓	✓	✓	✓	
Steam Generator Technology		✓	✓	✓	✓	
Fluidized Bed Systems		✓	✓	✓	✓	
Electrical Drives and Controls		✓	✓		✓	
Hydrogen and Fuel Cell Technologies		✓	✓	✓	✓	

Energy Conservation in Electrical Systems	✓	✓	✓	✓	✓	✓
Advanced Power Electronics for Renewable Energy Systems		✓	✓	✓	✓	✓
Energy Efficient Buildings	✓	✓	✓	✓	✓	
Advanced Energy Storage Technologies		✓	✓	✓	✓	
Advanced Energy Materials			✓	✓	✓	
Energy Forecasting, Modeling and Project Management	✓	✓	✓	✓	✓	
Environmental Engineering and Pollution Control	✓	✓	✓	✓	✓	
Waste Management and Energy Recovery	✓	✓	✓	✓	✓	
Nanomaterials for Energy and Environment	✓	✓	✓	✓	✓	
Digital Energy Management			✓	✓	✓	
Design and Analysis of Turbomachines		✓	✓		✓	
Computational Fluid Dynamics	✓		✓		✓	
Design of Heat Exchangers	✓	✓	✓		✓	
Energy Systems Modeling and Analysis	✓		✓	✓	✓	✓
Power Generation, Transmission and Utilization		✓	✓	✓	✓	
English for research paper writing		✓	✓		✓	
Disaster Management			✓	✓	✓	
Value Education			✓	✓	✓	
Pedagogy Studies		✓	✓		✓	
Personality development through life enlightenment skills			✓	✓	✓	
Constitution of India			✓	✓	✓	
Business Analytics			✓	✓	✓	
Industrial safety			✓	✓	✓	
Operations Research			✓		✓	✓

Cost Management of Engineering Projects			✓		✓	
Composite Materials			✓		✓	
Waste to Energy			✓	✓	✓	
Introduction to Data Science			✓		✓	
Internship with Seminar	✓	✓	✓	✓	✓	✓
Project Phase – I	✓	✓	✓	✓	✓	✓
Project Phase – II	✓	✓	✓	✓	✓	✓

**Sivasubramaniya Nadar College of Engineering, Kalavakkam - 603110(An
Autonomous Institution, Affiliated to Anna University, Chennai)**

REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM

M.E. ENERGY ENGINEERING

DETAILED SYLLABUS

SEMESTER I

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2101	APPLIED FLUID MECHANICS AND HEAT TRANSFER	3	1	0	4

COURSE OUTCOMES

Upon successful completion of the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Apply continuity and Bernoulli's equation to solve fluid flow problems, apply appropriate formulae to estimate the major and minor losses in internal flows	K3:Ap
CO2	Apply Darcy and Prandtl equations to solve turbulent flow problems, apply appropriate formulae to estimate turbulent velocity profiles	K3:Ap
CO3	Explain about boundary layer, flow over bodies, determine lift and drag forces and derive expressions for boundary layer height and displacement, momentum and energy thickness for flow over flat plates and apply momentum-integral equation	K3:Ap
CO4	Apply heat conduction equations to one dimensional configuration under steady state conditions, and extended surfaces (fins) as well as systems under transient conditions	K3:Ap
CO5	Apply natural and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and apply LMTD and NTU methods of thermal analysis to various types of heat exchangers	K3:Ap

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	
CO2	1		3		3	
CO3	1		3		3	
CO4	1	1	3		3	
CO5	1	1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2102	THERMODYNAMIC ANALYSIS OF ENERGY SYSTEMS	2	1	0	3

COURSE OUTCOMES

After completion of the course students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	perform energy and entropy analysis of thermodynamic systems	K3:A
CO2	perform exergy analysis on energy systems	K3:A
CO3	apply real gas equations for estimating the state properties	K3:A
CO4	apply combustion chemistry of hydrocarbon fuels and apply first and second laws of thermodynamics for reactive systems	K3:A
CO5	analyze different types of fuels and their properties.	K3:A

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4	2		3	1	3	
CO5	2		3	1	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2103	RENEWABLE ENERGY SYSTEMS	3	0	0	3

COURSE OUTCOMES

After completing the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	understand the concepts of solar energy.	K2:U
CO2	understand the concepts of wind energy.	K2:U
CO3	understand the concepts of biomass and biogas energy.	K2:U
CO4	understand the production, storage of hydrogen energy and its applications in different fuel cells.	K2:U
CO5	understand the concepts of geothermal and hydel energy.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2			3	1	3	
CO3			3	1	3	
CO4		1	3	1	3	
CO5		1	3	1	3	

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
PEY2104	ADVANCED POWER PLANT ENGINEERING	PE	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	understand in general about Indian power sectors, various power plants and understand how the load factor of power plants are arrived at.	K2:U
CO2	understand the basic operations of steam power plants and main components such as boilers, nozzles, cooling towers etc.	K2:U
CO3	understand the basics operation of Diesel and Gas Turbine power plants.	K2:U

CO4	understand the layout and operation of hydel and nuclear power plants.	K2:U
CO5	understand about cogeneration systems and advanced power cycles like MHD & Hybrid power plants.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2			3	1	3	
CO3			3	1	3	
CO4		1	3	1	3	
CO5		1	3	1	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2176	RESEARCH METHODOLOGY AND IPR	2	0	0	2

OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Formulate research problem

CO2: Carry out research analysis

CO3: Follow research ethics

CO4: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

CO5: Understand about IPR and filing patents in R & D.

COURSECODE	COURSE TITLE	L	T	P	C
PEY2111	APPLIED HEAT TRANSFER LAB	0	0	4	2

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Perform tests on real heat transfer devices and assess their thermal performance.	K3:Ap
CO2	Measure temperatures using different sensors and calibrate them	K3:Ap

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2	2	3	1	3	2
CO2	2	2	3	1	3	2

COURSECODE	COURSE TITLE	L	T	P	C
PEY2112	FUELS AND ENERGY SYSTEMS LAB	0	0	4	2

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Conduct tests on different fuels to assess their combustion related properties.	K3:Ap
CO2	Test energy intensive systems like refrigeration systems, pumps, turbines and fuel cells to assess their performance	K3:Ap

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2	2	3	1	3	2
CO2	2	2	3	1	3	2

SEMESTER II

COURSE CODE	COURSE TITLE	L	T	P	C
PMA2251	NUMERICAL TECHNIQUES FOR DIFFERENTIAL EQUATIONS	2	1	0	3

CO#	Course Outcomes	Knowledge Level
CO1	To solve system of linear and nonlinear equations numerically.	K3:A
CO2	To apply finite difference methods to solve the initial value problems and boundary value problems	K3:A
CO3	To apply finite difference methods to solve time dependent partial differential equations using.	K3:A
CO4	To solve time independent partial differential equations using finite difference methods.	K3:A
CO5	To understand FEM and FVM and solve one dimensional steady state heat equation using FEM and FVM	K3:A

(Common to Energy Engineering and Environmental Science and Technology)

COURSE OUTCOMES

After completing this course, students should demonstrate competency in the following skills:

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	
CO2	1		3		3	
CO3	1		3		3	
CO4	1		3		3	
CO5	1		3		3	

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
PEY2201	ENERGY CONSERVATION IN INDUSTRIAL UTILITIES	PC	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	understand India's energy scenario, act as per the guideline of EC Act 2001 & amendments and understanding the roles of BEE on energy conservation.	K2:U
CO2	carryout energy audits as a beginner applying the methodology involved.	K3: Ap
CO3	Understand the key roles of energy managers/energy auditors/EMIS, solve problems applying CUSUM techniques and perform problems related to Break Even Analysis.	K2:U
CO4	apply the fundamental concepts of industrial furnaces and thermal systems such as heat exchangers, waste heat recovery systems, energy storage, etc. in real situations.	K3: Ap
CO5	apply the fundamental knowledge gained on HVAC systems for advance level courses or designs of systems such as heat pumps, refrigerators and air conditioners.	K3: Ap

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3	1	3	
CO2	1	1	3	1	3	
CO3	1	1	3	1	3	
CO4	1		3	1	3	
CO5	1		3	1	3	

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
PEY2202	MEASUREMENTS AND CONTROL FOR ENERGY SYSTEMS	PC	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Apply error analysis to estimate uncertainties in measurement	K3:Ap
CO2	Explain working principle of instruments for measuring thermo-physical and transport properties	K2:U

CO3	Explain the working of advanced measurement techniques such as Schlieren Interferometer, Laser Doppler anemometer and Hot wire anemometer	K2:U
CO4	Explain various control systems used in measuring instruments	K2:U
CO5	Explain the functioning of data acquisition systems	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2211	SOLAR ENERGY LABORATORY	0	0	4	2

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO#	Course Outcomes	Knowledge Level
CO1	Measure solar radiation using instruments	K3:Ap
CO2	Test the performance of different solar thermal systems with and without thermal storage solar photovoltaic systems	K3:Ap

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2	2	3	1	3	2
CO2	2	2	3	1	3	2

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2212	COMPUTATIONAL FLUID DYNAMICS LAB	0	0	4	2

COURSE OUTCOMES

Upon successful completion of this laboratory course, students will be able to draw cad models using Ansys/Solidworks, perform meshing and CFD simulations using Ansys fluent workbench.

CO#	Course Outcomes	Knowledge Level
CO1	learn and Apply CAD software to draw cad models, perform meshing using Ansys/Solidworks	K3:Ap
CO2	learn and Apply CAD software to perform Simulations using Ansys/Solidworks	K3:Ap

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	2	2	3		3	2
CO2	2	2	3		3	2

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2316	INTERNSHIP WITH SEMINAR	0	0	4	2

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Identify a real time industrial problem, apply fundamental knowledge to solve the problem	K3:Ap
CO2	Analyze the solution(s) and present/communicate the solution(s) and file as a report	K4:An

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	3	3	3	2	3	3
CO2	3	3	3	2	3	3

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2318	PROJECT PHASE I	0	0	12	6

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Identify a real technical problem and apply the fundamental knowledge to solve	K3:Ap
CO2	Analyze the feasible solutions and compile as a report and communicate	K4:An

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	3	3	3	2	3	3
CO2	3	3	3	2	3	3

SEMESTER IV

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2418	PROJECT PHASE II	0	0	24	12

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Identify a real technical problem and apply the fundamental knowledge to solve and analyze the problem	K3:Ap; K4:An
CO2	Evaluate the solutions and create new engineering systems	K5:E; K6:C

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	3	3	3	2	3	3
CO2	3	3	3	2	3	3

PROGRAMME ELECTIVES - I (Second Semester) ENERGY CONVERSION

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2221	SOLAR ENERGY TECHNOLOGIES	3	0	0	3

COURSE OUTCOMES

After completing the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Estimate solar angles and compare various types of solar collectors	K4:An
CO2	Design a simple solar thermal based system	K4:An
CO3	Explain the characteristics of photovoltaic cell	K4:An
CO4	Design simple solar PV systems for domestic and industrial application	K4:An
CO5	Explain passive solar concepts to create thermal comfort	K4:An

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2222	WIND ENERGY TECHNOLOGIES	3	0	0	3

COURSE OUTCOMES

After completion of the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Identify different wind turbine components and enumerate its functions.	K2:U
CO2	Know the basic aerodynamic principles of wind energy systems.	K2:U
CO3	Know the functioning and construction of different wind turbine electrical components.	K2:U
CO4	Know about the power generation and management of wind turbines.	K2:U
CO5	Enumerate the functioning of modern wind turbines and control mechanisms involved.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2223	BIO ENERGY CONVERSION TECHNIQUES	3	0	0	3

COURSE OUTCOMES

After completion of this course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	know about biomass as an energy source and current scenario of biomass in India	K2:U
CO2	familiarize on the methods of production and analysis of biogas obtained from biomass	K2:U
CO3	determine stoichiometric air requirements for combustion of biofuels using first principles	K3:Ap
CO4	know about gasification, pyrolysis and carbonization of biofuels	K2:U
CO5	evaluate the performance of liquid biofuels for IC engines and know about emission characteristics	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2			3	1	3	
CO3			3	1	3	
CO4		1	3	1	3	
CO5		1	3	2	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2224	ELECTRO-MECHANICAL ENERGY CONVERSION	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Understand the construction of synchronous electrical machines	K2:U
CO2	Understand the functioning of synchronous electrical machines	K2:U
CO3	Understand the construction of three-phase induction electrical machines	K2:U
CO4	Understand the functioning and control of three-phase induction electrical machines	K2:U
CO5	Understand the construction and working of single phase induction motors.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2225	NUCLEAR ENGINEERING	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Explain the structure of atomic nucleus and energy from nuclear reactions	K2:U
CO2	Explain the mechanism of nuclear reactions and characteristics of nuclear fuels	K2:U
CO3	Explain the theory of neutron diffusion in a nuclear reactor	K2:U
CO4	Explain various components of a nuclear reactor and its types	K2:U
CO5	Explain types of radiation, shielding, shielding materials and reactor safety systems	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3	1	3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3	2	3	

PROGRAMME ELECTIVES - II (Second Semester)

APPLIED ENERGY SYSTEMS

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2226	ELECTRIC AND HYBRID ELECTRIC VEHICLES	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	understand fundamentals of hybrid electric and electric vehicles.	K2:U
CO2	understand the architecture of electric vehicles.	K2:U
CO3	understand the function of controls for AC and DC drives	K2:U
CO4	understand the functioning of energy storage for EVs/HEVs	K2:U
CO5	understand EV charging techniques and energy management strategies	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2			3	1	3	
CO3			3	1	3	
CO4		1	3	1	3	
CO5		1	3	2	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2227	STEAM GENERATOR TECHNOLOGY	3	0	0	3

COURSE OUTCOMES

Upon the completion of this course the students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Classify and estimate boiler efficiency and analyses heat losses involved	K4:An
CO2	Understand the function and significance of components of coal and oil feeding arrangements	K2:U
CO3	Explain the design aspects of the components of boiler	K2:U
CO4	Explain the design and operation aspects of power plant auxiliary equipment like fans, pumps, cooling tower and DM plant.	K2:U
CO5	Understand the operation and significance of components that control emission in a power plant	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3	2	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2228	FLUIDIZED BED SYSTEMS	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	know about the types of fluidized bed combustion (FBC) systems and working principle	K2:U
CO2	know about the heat transfer mechanisms involved in FBC systems	K2:U
CO3	know in detail about combustion and gasification processes	K2:U
CO4	perform basic heat transfer design calculations for FBC furnaces	K2:U
CO5	know about the industrial applications of fluidized bed systems	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3	1	3	
CO5		1	3	1	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2229	ELECTRICAL DRIVES AND CONTROLS	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	know the construction and working of AC and DC motors	K2:U
CO2	enumerate the various losses in electrical machines.	K2:U
CO3	know about solid state power controllers.	K2:U
CO4	know the principles of superconductivity to electrical machines.	K2:U
CO5	know about solid state motor controllers of AC DC drives.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2231	HYDROGEN AND FUEL CELL TECHNOLOGIES	3	0	0	3

COURSE OUTCOMES

After completion of the course, students will be able to

CO#	Course Outcomes						Knowledge Level
CO1	gain fundamental knowledge on hydrogen generation/storage technologies.						K2:U
CO2	know the details of different methods of hydrogen storage.						K2:U
CO3	know the thermodynamics of fuel cells.						K2:U
CO4	know the construction and working of different types of fuel cells.						K2:U
CO5	know the applications of fuel cells.						K2:U
CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2	
CO1			3	1	3		
CO2			3	1	3		
CO3			3	1	3		
CO4		1	3	1	3		
CO5		1	3	1	3		

PROGRAMME ELECTIVES - III (Third Semester)

ENERGY CONSERVATION AND STORAGE

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2321	ENERGY CONSERVATION IN ELECTRICAL SYSTEMS	3	0	0	3

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	understand the basics terms involved in the assessment of electrical energy utilization.	K2:U
CO2	know the functional aspects of transformers and motors.	K2:U
CO3	know the construction and working of fans, pumps and compressors.	K2:U
CO4	undertake energy conservation measures like promotion of efficient LEDs and energy efficient devices.	K3:Ap
CO5	know the methods of CO 2 mitigation.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3	1	3	
CO4	1	1	3	1	3	
CO5		1	3	1	3	1

Course Code	Course Title	Category	L	T	P	C
PEY2322	ADVANCED POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS	PE	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	know about different renewable energy systems like solar, wind, biomass etc.	K2:U
CO2	gain theoretical knowledge on electrical drives	K2:U
CO3	know the basics of power converters for solar photovoltaic systems.	K2:U
CO4	know the basics of power converters for wind power systems.	K2:U
CO5	know about wind-PV hybrid renewable energy systems.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2			3	1	3	
CO3			3	1	3	
CO4		1	3	1	3	
CO5		1	3	1	3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2323	ENERGY EFFICIENT BUILDINGS	3	0	0	3

COURSE OUTCOMES

After completion of the syllabus student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	understand the need for energy efficient buildings.	K2:U
CO2	understand the influence of shading and building materials on thermal response of buildings.	K4:An
CO3	know about HVAC systems for buildings.	K2:U
CO4	Estimate heat load of buildings and suggest methods for minimizing thermal load on buildings.	K4:An
CO5	Know about renewable energy options for the cooling of buildings and active/passive cooling methods for energy conservation in buildings.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2			3	1	3	
CO3			3	1	3	
CO4	1	1	3	1	3	
CO5	1	1	3	1	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2324	ADVANCED ENERGY STORAGE TECHNOLOGIES	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	gain fundamental knowledge on hydrogen generation/storage technologies.	K2:U
CO2	know the details of different methods of hydrogen storage.	K2:U
CO3	know the thermodynamics of fuel cells.	K2:U
CO4	know the construction and working of different types of fuel cells.	K2:U
CO5	know the applications of fuel cells.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3	1	3	
CO3			3	1	3	
CO4		1	3	1	3	
CO5		1	3	1	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2325	ADVANCED ENERGY MATERIALS	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	To understand the fundamentals and basics of materials for solar energy.	K2:U
CO2	To provide the knowledge of the synthesis of materials.	K2:U
CO3	To understand about the characterization of materials.	K2:U
CO4	To provide an understanding of energy harvesting materials.	K2:U
CO5	To provide an understanding of the energy storage materials	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2			3	1	3	
CO3			3	1	3	
CO4			3	1	3	
CO5			3	1	3	

PROGRAMME ELECTIVES - IV (Third Semester)**ENERGY MANAGEMENT AND ENVIRONMENT**

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2326	ENERGY FORECASTING, MODELING AND PROJECT MANAGEMENT	3	0	0	3

COURSE OUTCOMES Upon completion of the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	know about the energy scenario of India.	K2:U
CO2	Apply energy forecast models for the estimation of energy demands	K3:Ap
CO3	Apply optimization models for energy optimization.	K3:Ap
CO4	Prepare project feasibility report, perform project cost estimation and risk analysis	K4:An
CO5	Understand and follow the National Energy Policy and guidelines of different energy framework proposed by government energy agencies.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3	1		3		3	
CO4		1	3	1	3	
CO5		1	3	1	3	

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
PEY2327	ENVIRONMENTAL ENGINEERING AND POLLUTION CONTROL	PE	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Get an insight about greenhouse effect, global warming, ozone depletion	K2: U
CO2	Know about air pollution and methods of monitoring and controlling	K2: U
CO3	Know about water pollution, wastewater treatment and sludge disposal	K2: U
CO4	Know about solid waste management	K2: U
CO5	Know about different waste disposal technologies.	K2: U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2	1		3	3	3	
CO3			3	3	3	
CO4	1	1	3	3	3	
CO5	1	1	3	3	3	

PEY2328	WASTE MANAGEMENT AND ENERGY RECOVERY	PE	3	0	0	3

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO#	Course Outcomes	Knowledge Level
CO1	know about the different types of wastes and sources	K2: U
CO2	know different separation and processing of wastes	K2: U
CO3	know different waste disposal and processing methods	K2: U
CO4	know on the waste transformation technologies like combustion and gasification	K2: U
CO5	know about the risks involved in waste handling and methods of recycling of wastes	K2: U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3	1	3	
CO2	1		3	1	3	
CO3	1		3	1	3	
CO4	1	1	3	1	3	
CO5	1	1	3	2	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2329	NANOMATERIALS FOR ENERGY AND ENVIRONMENT	3	0	0	3

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Theoretically know about the classification and characterization of different nanomaterials	K2: U
CO2	Know about nano materials for Solar cell applications	K2: U
CO3	Know on the application of nanoscience to energy storage devices like batteries	K2: U
CO4	Gain fundamental knowledge on micro fuel cell technology	K2: U
CO5	Know about biofuel production and carbon capture with nanomaterials and associated safety/health issues of nanomaterials	K2: U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	
CO2	1		3		3	
CO3	1		3		3	
CO4	1	1	3		3	
CO5	1	1	3	2	3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2331	DIGITAL ENERGY MANAGEMENT	3	0	0	3

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Know and understand digital technologies for smart grid applications	K2: U
CO2	Learn the concepts of CBIS and smart grid technologies	K2: U
CO3	Understand about SCADA systems and smart energy management	K2: U
CO4	Understand WAMPAC systems	K2: U
CO5	Learn about smart metering and monitoring	K2: U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2			3	1	3	
CO3			3	1	3	
CO4			3	1	3	
CO5			3	1	3	

PROGRAMME ELECTIVES – V

ENERGY SYSTEMS DESIGN AND ENERGY UTILIZATION

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2332	DESIGN AND ANALYSIS OF TURBOMACHINES	3	0	0	3

COURSE OUTCOMES

After completing the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	know about the basics of turbomachines, Euler's equation and stagnation properties of fluids	K2: U
CO2	know the construction and working of centrifugal and axial flow compressors.	K3: Ap
CO3	know the types of combustion chambers and their construction and working.	K3:Ap
CO4	gain theoretical knowledge on the construction and working of axial/radial turbines.	K3:Ap
CO5	understand the performance of different aircraft/jet engines.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2333	COMPUTATIONAL FLUID DYNAMICS	3	0	0	3

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	understand about the fundamental discretization methods	K2:U
CO2	Apply Navier-Stokes equations for fluid flow and heat transfer problems.	K3:Ap
CO3	Apply CFD for 1D conduction heat transfer problems using numerical methods.	K3:Ap
CO4	formulate stream function-vorticity based equations for fluid flow problems and apply SIMPLE algorithm	K3:Ap
CO5	understand different turbulence models.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	1		3		3	
CO2	1		3		3	
CO3	1		3		3	
CO4	1		3		3	
CO5	1		3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2334	DESIGN OF HEAT EXCHANGERS	3	0	0	3

COURSE OUTCOMES

Upon successful completion of the course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Apply LMTD and NTU methods of thermal analysis to various types of heat exchangers	K3:Ap
CO2	Apply the procedure for thermal analysis and design double pipe and finned tube heat exchangers	K3:Ap
CO3	Apply the procedure for thermal analysis and design shell and tube heat exchangers	K3:Ap
CO4	Apply the procedure for thermal analysis and design plate fin heat exchangers	K3:Ap
CO5	Apply the procedure for thermal analysis and design condensers and cooling towers	K3:Ap

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2	1		3		3	
CO3	1		3		3	
CO4	1	1	3		3	
CO5	1	1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2335	ENERGY SYSTEMS MODELING AND ANALYSIS	3	0	0	3

OBJECTIVES:

COURSE OUTCOMES

Once completing this course, students will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Understand about the aspects of system modelling.	K2:U
CO2	Understand about simulation, apply Newton Raphson method for the solution of non-linear algebraic equations.	K3:A
CO3	Understand different optimization techniques.	K2:U
CO4	Apply energy-economy models for energy-demand estimation.	K3:A
CO5	Apply optimization techniques for energy systems.	K3:A

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2	1		3		3	
CO3	1		3		3	
CO4			3	1	3	
CO5			3		3	1

COURSE CODE	COURSE TITLE	L	T	P	C
PEY2336	POWER GENERATION, TRANSMISSION AND UTILIZATION	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	know conventional power generation systems.	K2:U
CO2	know about non-conventional power generation systems.	K2:U
CO3	familiarize about electrical power transmission and challenges.	K2:U
CO4	know about different electrical power utilities.	K2:U
CO5	perform power tariff calculations and economic analysis of power generation.	K3: Ap

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	1	3	
CO2			3	1	3	
CO3			3	1	3	
CO4		1	3	1	3	
CO5		1	3	1	3	

AUDIT COURSES (AC)

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2001	ENGLISH FOR RESEARCH PAPER WRITING	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Understand that how to improve your writing skills and level of readability.	K2:U
CO2	Learn about what to write in each section	K2:U
CO3	Understand the skills needed when writing a Title.	K2:U
CO4	Understand the skills needed when writing the Conclusion.	K2:U
CO5	Ensure the good quality of paper at very first-time submission.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1		3	3		3	
CO2		3	3		3	
CO3		3	3		3	
CO4		3	3		3	
CO5		3	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2002	DISASTER MANAGEMENT	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Ability to summarize basics of disaster.	K2:U
CO2	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	K2:U
CO3	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	K2:U
CO4	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	K2:U
CO5	Ability to develop the strengths and weaknesses of disaster management approaches.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	3	3	
CO2			3	3	3	
CO3			3	3	3	
CO4			3	3	3	
CO5			3	3	3	

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2003	VALUE EDUCATION	2	0	0	0

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2004	PEDAGOGY STUDIES	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Know what pedagogical practices are being used by teachers informal and informal classrooms in developing countries?	K2:U
CO2	Know the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?	K2:U
CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3		3	
CO2			3		3	
CO3			3		3	
CO4		1	3		3	
CO5		1	3		3	

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2005	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his/her personality and achieve the highest goal in life.	K2:U
CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity.	K2:U
CO3	Study of Geeta will help in developing versatile personality of the students.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	3	3	
CO2			3	3	3	
CO3			3	3	3	
CO4			3	3	3	
CO5			3	3	3	

COURSE CODE	COURSE TITLE	L	T	P	C
AGE2006	CONSTITUTION OF INDIA	2	0	0	0

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Know and discuss about the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	K2:U
CO2	Know and discuss about the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	K2:U
CO3	Know and discuss about the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	K2:U
CO4	understand that today's world is controlled by Computer, Information technology, but tomorrow world will be ruled by ideas, concept, and creativity.	K2:U
CO5	Know and discuss about the passage of the Hindu Code Bill of 1956.	K2:U

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1			3	3	3	
CO2			3	3	3	
CO3			3	3	3	
CO4			3	3	3	
CO5			3	3	3	

OPEN ELCTIVE COURSES (OC)

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2941	BUSINESS ANALYTICS	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Identify the real world business problems and model with analytical solutions.	K3:Ap
CO2	Solve analytical problem with relevant mathematics background dknowledge.	K3:Ap
CO3	Convert any real world decision making problem to hypothesis and apply suitable Statistical testing.	K3:Ap
CO4	Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce	K3:Ap
CO5	Use open source frameworks for modeling and storing data.	K3:Ap
CO6	Apply suitable visualization technique using R for visualizing voluminous data.	K3:Ap

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2942	INDUSTRIAL SAFETY	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Understand and summarize basics of industrial safety	K2:U
CO2	Understand and describe fundamentals of maintenance engineering	K2:U
CO3	Explain wear and corrosion	K2:U
CO4	Know about fault tracing	K2:U
CO5	Understand preventive and periodic maintenance	K2:U

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2943	OPERATIONAL RESERACH	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	To formulate linear programming problem and solve using graphical method.	K3:Ap
CO2	To solve LPP using simplex method	K3:Ap
CO3	To formulate and solve transportation, assignment problems	K3:Ap
CO4	To solve project management problems	K3:Ap
CO5	To solve scheduling problems	K3:Ap

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2944	COST MANAGEMENT OF ENGINEERING PROJECTS	3	0	0	3

CO#	Course Outcomes	Knowledge Level
CO1	Understand the costing concepts and their role in decision making	K3:Ap
CO2	Understand the project management concepts and their various aspects in selection	K3:Ap
CO3	Interpret costing concepts with project execution	K3:Ap
CO4	Gain knowledge of costing techniques in service sector and various budgetary control techniques	K3:Ap
CO5	Become familiar with quantitative techniques in cost management.	K3:Ap

COURSE OUTCOMES

Students, upon completion of this course will be able to

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2945	COMPOSITE MATERIALS	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Know the characteristics of composite materials and effect of reinforcement in composite materials.	K2:U
CO2	Know the various reinforcements used in composite materials	K2:U
CO3	Understand the manufacturing processes of metal matrix composites	K2:U
CO4	Understand the manufacturing processes of polymer matrix composites	K2:U
CO5	Analyze the strength of composite materials.	K4:An

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2946	WASTE TO ENERGY	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Understand the various types of wastes from which energy can be generated	K2:U
CO2	Gain knowledge on biomass pyrolysis process and its applications	K2:U
CO3	Develop knowledge on various types of biomass gasifiers and their operations	K2:U
CO4	Gain knowledge on biomass combustors and its applications on generating.	K2:U
CO5	Understand the principles of bio-energy systems and their features.	K2:U

COURSE CODE	COURSE TITLE	L	T	P	C
PGE2947	INTRODUCTION TO DATA SCIENCE	3	0	0	3

COURSE OUTCOMES

Students, upon completion of this course will be able to

CO#	Course Outcomes	Knowledge Level
CO1	Explain the fundamental concepts of data science.	K2:U
CO2	Develop Python programs to perform data analysis.	K3:Ap
CO3	Apply the pre-processing steps to clean the data.	K3:Ap
CO4	Summarize the various statistical inferences.	K2:U
CO5	Solve the data science applications using machine learning.	K3:Ap

Sri Sivasubramaniya Nadar College of Engineering

(An Autonomous Institution, Affiliated to Anna University, Chennai)



Regulation 2021

Curriculum and Syllabus for
B.E. in Mechanical Engineering

BACHELOR OF ENGINEERING (B.E) IN MECHANICAL ENGINEERING

Curriculum - R2021

Choice Based Credit System

I to VIII Semesters Curriculum

Program Educational Objectives (PEO):

PEO1: Have a successful professional career as a Mechanical engineer in core/allied industries, either by employment or through entrepreneurship

PEO2: Demonstrate an ability for higher studies, research and lifelong learning.

Program Outcomes (PO's)

Program outcomes are the skills and knowledge which the students should have acquired at the time of graduation. A program outcome indicates what a student can do from course-wise knowledge acquired during the program. Students who graduate from this program shall exhibit the following:

PO	Graduate Attribute	Programme Outcome
1	Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex Mechanical engineering problems
2	Problem Analysis	Identify, formulate, research literature, and analyse complex Mechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	Design/Development of solutions	Design solutions for complex Mechanical engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and cultural, societal, and environmental considerations
4	Investigation of complex problems	Conduct investigations of complex Mechanical Engineering problems using research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex Mechanical engineering activities, with an understanding of the limitations
6	The Engineer and society	Apply reasoning informed by contextual

		knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex Mechanical engineering problems
7	Environment and sustainability	Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex Mechanical engineering problems in societal and environmental contexts
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice
9	Individual and teamwork	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary setting
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
11	Project management and finance	Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSO's):

PSO1: Apply knowledge of mathematics, science and engineering fundamentals to model, design and analyse components or processes of thermal and mechanical systems

PSO2: Identify, formulate, review research literature and analyses complex problems in processing and manufacturing of Materials, reaching substantiated conclusions using principles of mathematics, science and engineering management

PEO - PO/PSO Mapping

PEO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
PEO1	3	3	2	1	2	1	2	3	3	3	3	1	3	1
PEO2	3	3	3	1	3	1	1	3	3	3	1	3	3	3

MAPPING OF COURSES WITH PO's AND PSO's

COURSE NAME		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
I year/I semester															
1	Technical English									2	3		2		
2	Matrices and Calculus	3	3											1	
3	Engineering Physics	3	2	1										1	
4	Engineering Chemistry	3	2	1										1	
5	Problem Solving and Programming in Python	2	2	1	1									1	
6	Engineering Graphics	3	2	2			2				3			1	1
7	Programming in Python Lab	3	3		1				1	1	1			1	
8	Physics and Chemistry Lab	3												1	
I year/II semester															
9	Complex Functions and Laplace Transforms	3	3											1	
10	Fundamentals of Mechanical Engineering and practices	3			1					2			1	1	
11	Environmental Science	3	1	1											
12	Engineering Mechanics	3	2	2										3	
13	Humanities I Elective														
14	Basic Electrical and Electronics Engineering	3	2	1		1	1							1	1
15	Design Thinking and Engineering Practices Lab	2	1	1			1			3				1	1
II year/III semester															
16	Statistics and Numerical Methods for Mechanical Engineering	3	3											3	
17	Engineering Thermodynamics	3	3	1										3	
18	Fluid Mechanics and Machinery	3	3	1										3	

19	Manufacturing Processes I	3	3	1	2		1			2	1	1	1		3
20	Mechanics of Solids	3	2	2										3	
21	UHV: Understanding Harmony						2		3	3	2		3		
22	Fluid Mechanics& Machinery Lab	3	2		2					2			1	3	
23	Mechanics of Solids Lab	3	2							2			1	3	
II year/IV semester															
24	Kinematics of Machinery	3	2	2										3	
25	Manufacturing Processes II	3	3	1	2	2	1			2	1	1	1		3
26	Thermal Engineering	3	2	1									1	3	
27	Metrology and Measurements	3	2							2				2	
28	Material Science & Engineering Metallurgy	3													2
29	Indian Constitution						2		2	2	2		2		
30	Thermal Engineering Lab	3	2		2					2			1	3	
31	Industrial Analytics Lab – I	3	2		2	3							3		3
III year/V semester															
32	Dynamics of Machines	3	2	2										3	
33	Computer Aided Design and Manufacturing	3												2	
34	Design of Machine Elements	3	2	2									1	3	
35	Fundamentals of Heat Transfer	3	3	1	2					2			1	3	
36	Total Quality Management	1					1		1				1		
37	Professional Elective - I														
38	Dynamics Lab	3			2					1				3	
39	Computer Aided Design and Manufacturing lab	1				3								3	2
III year/VI semester															
40	Design of Mechanical Drives	3	3	1									1	3	
41	Mechatronics and Automation	3	2		2	1				2					2
42	Automobile Engineering	3													
43	Optimization Techniques	3	2	1			2							3	
44	Professional Elective - II														
45	Open Elective – I														
46	Industrial Analytics Lab –	3	2		2	3						3	1		3

	II														
47	Design and Fabrication Project	3	2	3		2				2	3	3	2	3	3
IV year/VII semester															
48	Industrial Practices	2					3			1					3
49	Robot Technology	3	2	2											2
50	Finite element Analysis	3	2	1										3	
51	Professional Elective - III														
52	Professional Elective - IV														
53	Professional Elective - V														
54	Simulation Laboratory	3	1	3		3								3	
55	Project work – Phase I	3					3	3	3	3	2	1	3	3	3
56	Industrial Training /Internship*	1	1	1	1	1	1	1	1		1				
IV year/VIII semester															
57	Professional Elective - VI														
58	Open Elective – II														
59	Project work – Phase II	2	2	3	2	3	3	3	3	3	2	2	3	3	3

SYLLABI – R2021

SEMESTER I

Course Code	Course Title	L	T	P	C
UEN2176	Technical English	2	0	2	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO 1: To read and comprehend texts (technical) effectively.					
CO 2: To write proposals, reports, emails, letters, SOPs meeting professional expectations.					
CO 3: To Improve Vocabulary (use of right collocations, idioms and phrases etc).					
CO 4: To enhance their grammatical competency for writing and speaking.					
CO 5: To improve their ability to listen and comprehend at deeper levels					

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3		2		
2									2	3		2		
3									2	3		2		
4									2	3		2		
5									2	3		2		

Course Code	Course Title	L	T	P	C
UMA2176	MATRICES AND CALCULUS	3	1	0	4
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Identify the nature of quadratic form by reducing it to canonical form					
CO2: Analyse the convergence of a given infinite series					
CO3: Find evolute of a given curve and envelope of family of curves					
CO4: Find the extrema of function of two variables					
CO5: Evaluate the double and triple integrals					
CO6: Apply extreme points of functions and multiple integrals in engineering problems (Targeted CO)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2											1	
2	3	2											1	
3	3	2											1	
4	3	2											1	
5	3	2											1	
6	3	2										1	1	

Course Code	Course Title	L	T	P	C
UPH2176	ENGINEERING PHYSICS	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Analyze crystal structures and the influence of imperfections on their properties.					

CO2: Demonstrate and explain the general concepts of elastic and thermal properties of materials.
CO3: Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
CO4: Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
CO5: Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1										1	
2	3	2	1										1	
3	3	2	1										1	
4	3	2	1										1	
5	3	2	1										1	

Course Code	Course Title	L	T	P	C
UCY2176	ENGINEERING CHEMISTRY	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to demonstrate understanding on:					
CO1: The unique properties of nano-particles and their applications					
CO2: The principles of electrochemistry and its application for quantitative analysis					
CO3: The various types of corrosion under normal to severe corrosive environments and their control measures					
CO4: Construction of phase diagram and its application to analyse simple eutectic systems					
CO5: The synthesis, properties and applications of important industrial polymers					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1										1	
2	3	2	1										1	
3	3	2	1										1	
4	3	2	1										1	
5	3	2	1										1	

Course Code	Course Title	L	T	P	C
UGE2176	PROBLEM SOLVING AND PROGRAMMING IN PYTHON	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Solve programming problems and express solutions in pseudo code.					
CO2: Develop simple programs using basic constructs.					
CO3: Construct programs using conditions and iterations decompose a problem into functions.					

CO4: Make use of strings, lists, tuples and dictionaries data structures.

CO5: Perform Input/Output Operations using files.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	0	0									1	
2	2	2	0	0									1	
3	2	3	2	1									1	
4	2	3	2	1									1	
5	2	2	2	1									1	

Course Code	Course Title	L	T	P	C
UGE2177	ENGINEERING GRAPHICS	1	0	4	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Draw Plane curves and perform Free hand sketching of three - dimensional objects (K2)					
CO2: Draw the Orthographic projections of points, lines and plane surfaces (K2)					
CO3: Draw the Projections of solids (K2)					
CO4: Draw the Projections of sectioned solids and Development of surfaces (K2)					
CO5: Draw the Isometric and Perspective projections of solids (K2)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3									3		1	1	
2	3									3		1	1	
3	3									3		1	1	
4	3									3		1	1	
5	3									3		1	1	

Course Code	Course Title	L	T	P	C
UGE2197	PROGRAMMING IN PYTHON LAB	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Write, test, and debug simple Python programs					
CO2: Build Python programs with conditionals and loops					
CO3: Solve a problem using functions in python programming					
CO4: Construct python programs using compound data like lists, tuples, and dictionaries					
CO5: Build a simple application in teams using files and appropriate datatypes by applying the best programming practices					

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2						1					1	
2	3	3		1				1					1	
3	3	3		1				1					1	

4	3	3		1				1					1	
5	3	3		2				1	3	2			1	

Course Code	Course Title	L	T	P	C
UGS2197	PHYSICS AND CHEMISTRY LABORATORY	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Apply principles of elasticity, optics and thermal properties for engineering applications.					
CO2: Investigate the optical and electrical properties of materials					
CO3: Analyse ions like Fe ²⁺ , Fe ³⁺ , H ⁺ using different instruments					
CO4: Determine the Molecular weight and Degree of Polymerisation using viscometer					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												1	
2	3												1	
3	3												1	
4	3												1	

SEMESTER II

Course Code	Course Title	L	T	P	C
UMA2276	COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS	3	1	0	4
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Solve problems in Analytic functions and construction of analytic functions using C-R equations.					
CO2: Solve problems using integration techniques, find Taylor's and Laurent's Series expansions.					
CO3: Obtain the Laplace Transforms and inverse transforms of standard functions.					
CO4: Solve Differential Equations using different techniques.					
CO5: Evaluate Line, Surface and Volume integrals.					
CO6: Apply Complex integration, Laplace transforms, Ordinary differential equations and vector calculus in engineering problems (Targeted CO)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2											1	
2	3	2											1	
3	3	2											1	
4	3	2											1	
5	3	2											1	
6	3	2										1	1	

Course Code	Course Title	L	T	P	EL	C
UME2201	FUNDAMENTALS OF MECHANICAL ENGINEERING (THEORY INTEGRATED LAB – LCT)	2	0	3	3	4.5
Course Outcomes: Upon successful completion of the course, students will be able to						
CO1: Explain the uses of basic mechanical engineering components, fabricate and demonstrate prototype models of simple fixtures/machines (K3)						
CO2: Make use of various types of mechanisms to fabricate and demonstrate prototype of simple mechanical systems (K3)						
CO3: Explain and demonstrate the function, working, selection and steps for installation of various components based on given hydraulic system requirements (K3)						
CO4: Make use of electronic drives and sensors to fabricate and demonstrate prototype of simple mechanical systems (K3)						
CO5: Explain the fundamental concepts of thermodynamics & heat transfer and demonstrate the working of related thermal devices (K3)						

COs	POs																		PSO		
	1 - PI		2 - PI		3	4 – PI		5 - PI		6	7	8	9 – PI		10 – PI		11	12 – PI		1	2
CO1	3	1.3.1 1.4.1				1	4.1.3						2	9.1.2	2	10.1.2 10.2.2		1	12.2.2	1	1
Targeted CO CO2	3	1.3.1 1.4.1	2	2.1.2 2.4.1		1	4.1.3	1	5.2.2				2	9.1.2	2	10.1.2 10.2.2		1	12.2.2	1	1
Targeted CO CO3	3	1.3.1 1.4.1	2	2.1.2 2.4.1		1	4.1.3	1	5.2.2				2	9.1.2	2	10.1.2 10.2.2		1	12.2.2	1	1
Targeted CO CO4	3	1.3.1 1.4.1	2	2.1.2 2.4.1		1	4.1.3	1	5.2.2				2	9.1.2	2	10.1.2 10.2.2		1	12.2.2	1	1
CO5	3	1.3.1 1.4.1				1	4.1.3						2	9.1.2	2	10.1.2 10.2.2		1	12.2.2	1	1

Course Code	Course Title	L	T	P	C
UCY2276	ENVIRONMENTAL SCIENCE	3	0	0	0
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: The structure and functions of the ecosystems and diversity among life forms within an ecosystem					
CO2: The importance of various natural resources and its sustainable use					
CO3: The various environmental issues such as pollution, population explosion etc and suggest remedial measures.					
CO4: The role of engineering techniques to minimize environmental stress					
CO5: The role of various environmental machineries and to ensure proper environmental regulation					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		1											
2	3	2	1											
3	3	2	1											
4	3	2	1											
5	3													

COURSE CODE	COURSE TITLE	L	T	P	C
UME2202	ENGINEERING MECHANICS	3	0	0	3

OUTCOMES

On successful completion of this course, the student will be able to

CO1: Illustrate the vectoral and scalar representation of forces and moments (K3)

CO2: Analyze the rigid body in equilibrium (K3)

CO3: Evaluate the properties of surfaces and solids (K3)

CO4: Calculate dynamic forces exerted in rigid body (K3)

CO5: Determine the friction and the effects by the laws of friction (K3)

COs	POs														PSOs		
	1	2	3 – PI		4	5 – PI		6	7	8	9	10	11	12 - PI		1	2
CO1	3	2	1													3	
CO2	3	2	1													3	
CO3	3	2	1													3	
Targeted CO: CO4	3	2	1	3.1.1		1	5.2.2							1	12.2.2	3	
Targeted CO: CO5	3	2	1	3.1.1		1	5.2.2							1	12.2.2	3	

Course Code	Course Title	L	T	P	C
UEE2276	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3

Course Outcomes: Upon successful completion of the course, students will be able to

CO1: Solve and analyse DC and AC circuits.

CO2: Explain the operating principle of AC and DC machines.

CO3: Know the concepts electrical power utilization.

CO4: Describe the working principle of various electronic devices and its applications

CO5: Describe the working principle of various sensors and transducers.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2		2	1						1	1	1
2	3	2	1			1							1	2
3	3	2	1		2	1							1	1

4	3	2	1										1	
5	3	2	1										1	

Course Code	Course Title	L	T	P	C
UGE2297	DESIGN THINKING AND ENGINEERING PRACTICES LAB	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Draw pipeline plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household woodwork (K2)					
CO2: Practice machining to make holes on different materials; fabricate sheet metal components (K2)					
CO3: Dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model of various components (K2)					
CO4: Construct domestic electrical circuits and verify their output parameters (K3)					
CO5: Construct electronics circuits and verify their output (K3)					

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2		1					2	1		1			
2	3	2		1					2	1		1			
3	3	2		1					2	1		1			
4	3	3	3	3					3	1		1			
5	3	3	3	3					3	1		1			

SEMESTER III

Course Code	Course Title	L	T	P	C
UMA2352	STATISTICS AND NUMERICAL METHODS FOR MECHANICAL ENGINEERING	2	1	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Compute roots of nonlinear equations, solving the system of equations and finding the eigenvalues of a matrix numerically. (K2)					
CO2: Find interpolating polynomial and to perform numerical integration. (K2)					
CO3: Solve numerical solution to ordinary differential equation using different techniques (K2)					
CO4: Evaluate partial differential equations of first and higher order using numerical (K2)					
CO5: Identify and apply the suitable testing of hypothesis under normal, t, F and chi squared distribution (K2)					
CO6: Apply of numerical methods in solving engineering problems using software coding (K3)(Targeted CO)					

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3											3	
2	3	3											3	

3	3	3											3	
4	3	3											3	
5	3	3											3	
6	3	3			1							1	3	

Course Code	Course Title	L	T	P	C
UME2301	ENGINEERING THERMODYNAMICS	3	1	0	4
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Apply first law of thermodynamics to closed systems, steady flow processes and solve problems (K3)					
CO2: Apply second law of thermodynamics to heat engines, refrigerators, heat pumps and solve problems (K3)					
CO3: Explain properties of steam, ideal gas, gas mixtures, steam, refrigerant and solve problems (K3)					
CO4: Explain gas and vapour power cycles, refrigeration cycles and solve problems (K3)					
CO5: Explain real gas properties, thermodynamic property relations and solve problems (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1										3	
2	3	3	1										3	
3	3	3	1										3	
4	3	3	1									1	3	
5	3	1	1										3	

Course Code	Course Title	L	T	P	C
UME2302	FLUID MECHANICS AND MACHINERY	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Explain fluid properties and their behaviour and apply the concepts of hydrostatics. (K3)					
CO2: Apply continuity and Bernoulli's equation to solve fluid flow problems, apply appropriate formulae to estimate the major and minor losses in internal flows (K3)					
CO3: Explain about boundary layer, flow over bodies, determine lift and drag forces and derive expressions for boundary layer height and displacement, momentum and energy thickness for flow flat plates and apply momentum-integral equation (K3)					
CO4: Apply Buckingham's Pi theorem to arrive at relationship between a given set of variables using dimensionless parameters and apply the concepts of similarity for designing prototypes and models (K3)					
CO5: Explain the construction and working of hydraulic machineries like pumps and turbines and apply suitable formulae to determine their performance (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3											3	

2	3	3	1										3	
3	3	3	1										3	
4	3	3	2	1									3	
5	3	3	1				1					1	3	

Course Code	Course Title	L	T	P	EL	C
UME2303	MANUFACTURING PROCESSES –I (THEORY CUM PRACTICE)	3	0	2		4
Course Outcomes: Upon successful completion of the course, students will be able to						
CO1: Select materials, types and allowances of patterns used in casting and analyze the various elements of moulds. (K3)						
CO2: Make use of different metal joining processes to fabricate various weld joint configurations (K3)						
CO3: Identity metal forming processes for different real time applications (K3)						
CO4: Choose and develop appropriate manufacturing techniques/procedure to fabricate sheet metal components (K3)						
CO5: Select proper methods to manufacture plastic components and make use of injection moulding and hand lay methods to fabricate them (K3)						

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	2	1	1			2	1	1	1		3
2	3	3	1	2	1	1	1		2	1	1	1		3
3	3	3	1	2	1	1			2	1	1	1		3
4	3	3	1	2	1	1			2	1	1	1		3
5	3	3	1	2		1			2	1	1	1		3

Course Code	Course Title	L	T	P	C
UME2304	MECHANICS OF SOLIDS	3	0	0	3
Course Outcomes: On successful completion of this course, the student will be able to					
CO1: Apply the concepts of stress and strain in simple and compound bars (K3)					
CO2: Solve problems for the load transferring mechanism in beams and stress distribution due to shearing force and bending moment (K3)					
CO3: Apply basic equation of simple torsion in designing of shafts and helical spring (K3)					
CO4: Calculate the slope and deflection in beams using different methods (K3)					
CO5: Analyze and design thin and thick shells for the applied internal and external pressures (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2										3	
2	3	2	2										3	
3	3	2	2										3	
4	3	2	2										3	
5	3	2	2										3	

Course Code	Course Title	L	T	P	C
UHS2376	UHV: Understanding Harmony	2	0	2	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.					
CO2: Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.					
CO3: Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.					
CO4: Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.					
CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.					

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2		3	3	2		3		
CO2						2		3	3	2		3		
CO3						2		3	3	2		3		
CO4						2		3	3	2		3		
CO5						2		3	3	2		3		

Course Code	Course Title	L	T	P	C
UME2311	FLUID MECHANICS AND MACHINERY LABORATORY	0	0	3	1.5
CO1: Practically measure flow rates using venturimeter, orifice meter and rotameter and pressure drop in flow through pipes. (K3)					
CO2: Conduct the performance testing of different pumps and hydraulic turbines. (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2		2					2			1	3	
2	3	2		2					2			1	3	

Course Code	Course Title	L	T	P	C
UME2312	MECHANICS OF SOLIDS LABORATORY	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Demonstrate Tension, Torsion, Hardness, Compression and Deformation tests on solid materials (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2							2			1	3	

SEMESTER IV

Course Code	Course Title	L	T	P	C
UME2401	KINEMATICS OF MACHINERY	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Discuss the basics of mechanism (K2)					
CO2: Calculate velocity and acceleration in simple mechanisms (K3)					
CO3: Formulate analytical techniques in determining the stresses in cases of curved flexible members (K3)					
CO4: Solve problems on gears and gear trains(K3)					
CO5: Examine friction in machine elements (K2)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2										3	
2	3	2	2										3	
3	3	2	2										3	
4	3	2	2										3	
5	3	2	2										3	

Course Code	Course Title	L	T	P	EL	C
UME2402	MANUFACTURING PROCESSES – II (THEORY CUM PRACTICE)	3	0	2		4
Course Outcomes: Upon successful completion of the course, students will be able to						
CO1: Develop relations for chip reduction coefficient, shear angle, shear strain, forces, power, specific energy and temperature in orthogonal cutting (K3)						
CO2: Make use of turning machine tools to produce various features on a cylindrical component (K3)						
CO3: Make use of shaper, planner, slotter and milling machine tools to produce flat surfaces and gears (K3)						
CO4: Utilize different types of grinding machines to produce smooth flat and cylindrical surfaces and understand the basics of broaching machines (K3)						
CO5: Apply the fundamentals concepts to CNC machining to prepare and simulate computer part programs (K3)						

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	2	2	1			2	1	1	1		3
2	3	3	1	2		1			2	1	1	1		3
3	3	3	1	2	1	1			2	1	1	1		3
4	3	3	1	2	2	1			2	1	1	1		3
5	3	3	1	2	2	1			2	1	1	1		3

Course Code	Course Title	L	T	P	C
UME2403	THERMAL ENGINEERING	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Explain fuel characteristics, combustion reactions and calculate combustion parameters (K3)					
CO2: Explain functioning and features of IC engine, its components and auxiliaries and calculate performance (K3)					
CO3: Explain working of steam nozzles, steam turbines and calculate performance parameters (K3)					
CO4: Explain working of reciprocating air compressor and calculate performance parameters (K3)					
CO5: Explain working of refrigeration and airconditioning systems and use refrigerant tables, charts, psychrometric chart to calculate performance parameters (K3)					

COs		POs														PSOs		
	1	2	3 – PI		4	5 – PI		6	7 – PI		8	9	10	11	12 – PI		1	2
CO1	3	2	1														3	
CO2	3	2	1					1	1						1		3	
CO3	3	2	1												1		3	
Targeted CO: CO4	3	2	1	3.1.6		1	5.2.2								1	12.2.2	3	
Targeted CO: CO5	3	2	1	3.1.6		1	5.2.2	1	1	7.1.1					1	12.2.2	3	

Course Code	Course Title	L	T	P	C
UME2404	METROLOGY AND MEASUREMENTS (THEORY CUM PRACTICE)	3	0	2	4
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Interpret characteristics of measuring instruments (K2)					
CO2: Apply methods of measurement for various physical quantities (K2)					
CO3: Use instruments for linear and angular measurement (K2)					
CO4: Use devices for gear, screw threads and surface finish measurements (K2)					
CO5: Identify instruments for mechanical measurements (K2)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2							2			1		2
2	3	2							2			1		2
3	3	2			2				2			1		2
4	3	2							2			1		2
5	3	2							2			1		2

Course Code	Course Title	L	T	P	C
UME2405	MATERIAL SCIENCE & ENGINEERING METALLURGY	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification (K2)					
CO2: Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes (K2)					
CO3: Discuss the effect of alloying elements on ferrous and non-ferrous metals (K2)					
CO4: Summarize the properties and applications of modern materials (K2)					
CO5: Discuss the effect of corrosion on metals (K2)					

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	2			2								2
2	3	1	2			2								2
3	3					2								2
4	3						1					1		2
5	3													2

Course Code	Course Title	L	T	P	C
UHS2476	Indian Constitution	2	0	2	0
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Understand history and philosophy of Indian constitution.					
CO2: Realize powers and functions of Indian government.					
CO3: Acquire awareness on structure and functions of local administration.					
CO4: Enhance knowledge about organization and composition of judiciary.					
CO5: Explore the distribution of financial powers and emergency provisions.					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						2		2	2	2		2		
2						2		2	2	2		2		
3						2		2	2	2		2		
4						2		2	2	2		2		
5						2		2	2	2		2		

Course Code	Course Title	L	T	P	C
UME2411	THERMAL ENGINEERING LABORATORY	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Demonstrate tests to determine fuel properties, IC engine indicated power, frictional power and to draw engine valve and port timing diagrams (K3)					
CO2: Demonstrate tests to determine performance characteristics of IC engines with various loading methods (K3)					
CO3: Demonstrate tests to evaluate the performance of refrigeration and HVAC systems (K3)					

COs	POs														PSOs			
	1	2	3	4 – PI		5	6	7	8	9 – PI		10 – PI		11	12 – PI		1	2
CO1	3	2		2						2					1		3	
Targeted CO: CO2	3	2		2	4.1.3					2	9.1.2	2	10.1.2 10.2.2		1	12.2.2	3	
CO3	3	3		3						2					1		3	

Course Code	Course Title	L	T	P	C
UME2412	INDUSTRIAL ANALYTICS LAB – I	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Acquire practical knowledge on Stastical Process Control and Data analysis tools used in Manufacturing and Production Industries (K3)					
CO2 : Demonstrate the ability to analyse and comprehend the manufacturing metrics for Quality Control and Process improvements (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2		2	3						3	1		3
2	3	2		2	3						3	1		3

SEMESTER V

Course Code	Course Title	L	T	P	C
UME2501	DYNAMICS OF MACHINES	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Calculate static and dynamic forces of mechanisms (K3)					
CO2: Calculate the balancing masses and their locations of reciprocating and rotating masses (K3)					
CO3: Compute the frequency of free vibration (K3)					
CO4: Compute the frequency of forced vibration and damping coefficient (K3)					
CO5: Calculate the speed and lift of the governor and estimate the gyroscopic effect on automobiles, ships and airplanes (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2										3	
2	3	2	2										3	
3	3	2	2										3	
4	3	2	2										3	
5	3	2	2										3	

Course Code	Course Title	L	T	P	C
UME2502	COMPUTER AIDED DESIGN AND MANUFACTURING	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics (K2)					
CO2: Explain the fundamentals of parametric curves, surfaces and Solids (K2)					
CO3: Summarize the different types of Standard systems used in CAD (K2)					
CO4: Explain NC & CNC programming concepts (K2)					
CO5: Develop part program for Lathe & Milling Machines (K2)					

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1											2		
2	3												2		
3	3				1								1		
4	3												2		
5	3												2		

Course Code	Course Title	L	T	P	C
UME2503	DESIGN OF MACHINE ELEMENTS	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Explain the influence of steady and variable stresses in machine element design (K3)					
CO2: Apply the concepts of design to shafts, keys and couplings (K3)					
CO3: Apply the concepts of design to temporary and permanent joint (K3)					
CO4: Apply the concepts of design to energy absorbing members (K3)					
CO5: Apply the concepts of design to bearings (K3)					

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2									1	3	
2	3	2	2									1	3	
3	3	2	2									1	3	
4	3	2	2									1	3	
5	3	2	2									1	3	

Course Code	Course Title	L	T	P	C
UME2504	FUNDAMENTALS OF HEAT TRANSFER (THEORY CUM PRACTICE)	3	0	2	4
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Apply heat conduction equations to one dimensional configuration under steady state conditions (K3)					
CO2: Apply heat conduction equations to extended surfaces (fins) and systems under transient conditions (K3)					

CO3: Apply natural and forced convective heat transfer correlations to internal and external flows through/over various surface configurations (K3)
CO4: Explain the phenomena of boiling and condensation and apply LMTD and NTU methods of thermal analysis to various types of heat exchangers (K3)
CO5: Describe basic laws for Radiation and apply these principles to radiation heat transfer between different types of surfaces (K3)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	2					2			1	3	
2	3	3	1	2					2			1	3	
3	3	3	1	2					2			1	3	
4	3	3	1	2					2			1	3	
5	3	3	1	2					2			1	3	

Course Code	Course Title	L	T	P	C
UBA2542	TOTAL QUALITY MANAGEMENT	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Describe basic concepts of total quality management (TQM) and customer relations(K2)					
CO2: Describe principles of total quality management (K2)					
CO3: Explain traditional and new management tools and bench marking process (K2)					
CO4: Explain concepts of six sigma, quality function development and total productive maintenance (K2)					
CO5: Describe various quality systems, quality auditing and guidelines for safety and Hazard (K2)					

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1					1		1				1		
2	1					1		1				1		
3	1					1		1				1		
4	1					1		1				1		
5	1					1		1				1		

Course Code	Course Title	L	T	P	C
UME2511	DYNAMICS LABORATORY	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Perform experiments on gear parameters, kinematics of mechanisms, gyroscopic effect and working of Laboratory equipment (K3)					
CO2: Execute tests to determine mass moment of inertia of mechanical element, governor effort and range sensitivity, natural frequency and damping coefficient, torsional frequency, critical speeds of shafts, balancing mass of rotating and reciprocating masses, and transmissibility ratio (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			2					1				3	
2	3			2					1				3	

Course Code	Course Title	L	T	P	C
UME2512	COMPUTER AIDED DESIGN AND MANUFACTURING LABORATORY	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Explain methods and procedures in Computer Aided Design (K3)					
CO2: Construct solid modelling using standard software (K3)					
CO3: Draw 3D and Assembly drawing using CAD software (K3)					
CO4: Demonstrate manual part programming with G and M codes using CAM (K3)					

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1													
2	1				3					2			3	2
3	1				3					2			3	2
4	1				3								2	

SEMESTER VI

Course Code	Course Title	L	T	P	C
UME2601	DESIGN OF MECHANICAL DRIVES	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Apply the concepts of design to belts, chains and rope drives (K3)					
CO2: Apply the concepts of design to spur, helical gears (K3)					
CO3: Apply the concepts of design to bevel and worm gears (K3)					
CO4: Apply the concepts of design to gear boxes (K3)					
CO5: Apply the concepts of design to cams, brakes and clutches (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1									1	3	
2	3	3	1									1	3	
3	3	3	1									1	3	
4	3	3	1									1	3	
5	3	3	1									1	3	

Course Code	Course Title	L	T	P	C
UME2602	MECHATRONICS AND AUTOMATION (THEORY CUM PRACTICE)	3	0	2	4
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Describe the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems, actuators and sensor and technology (K2)					

CO2: Describe Mechatronics components and systems using the basic building blocks of various systems mathematically, along with different modes of controller (K2)
CO3: Describe the architecture of Pin Diagram, Addressing Modes, Programming and interfacing circuits of Microprocessor and Microcontroller (K2)
CO4: Explain the architecture, programming and application of programmable logic controllers to problems and challenges in the areas of Mechatronic engineering (K2)
CO5: Explain image processing and Artificial Intelligence techniques and various stages in Mechatronics system design from the given case studies (K2)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2		2	1				2					2
2	3	2		2	1				2					2
3	3	2		2	1				2					2
4	3	2		2	1				2					2
5	3	2	2	2	1				2					2

Course Code	Course Title	L	T	P	C
UME2603	AUTOMOBILE ENGINEERING	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Explain the working of various components of automobile engine and their functions (K2)					
CO2: Explain the working of various parts of automobile drive train system and their functions (K2)					
CO3: Explain the working of various types of automobile steering and suspension systems (K2)					
CO4: Explain various types of automobile brakes, wheels and tyres and their construction (K2)					
CO5: Explain functions and features of automobile sensors, actuators, instruments and controls (K2)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3						1					1		
2	3											1		
3	3											1		
4	3											1		
5	3					1	1					1		

Course Code	Course Title	L	T	P	C
UME2604	OPTIMIZATION TECHNIQUES	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Apply the linear model techniques to solve Engineering and Business problems (K3)					
CO2: Apply the sequencing model techniques to solve Engineering and Business problems (K3)					
CO3: Apply the network model techniques to solve Engineering and Business problems (K3)					
CO4: Apply the inventory model techniques to solve Engineering and Business problems (K3)					
CO5: Apply the decision model techniques to solve Engineering and Business problems (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	1			2								3
2	3	2	1			2								3
3	3	2	1			2								3
4	3	2	1			2								3
5	3	2	1			2								3

Course Code	Course Title	L	T	P	C
UME2611	INDUSTRIAL ANALYTICS LABORATORY II	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Acquire practical knowledge on applications of Software tools for solving problems in Operations Management (K3)					
CO2: Demonstrate the ability to model and analyse the Industrial Systems using Simulation Software (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2		2	3						3	1		3
2	3	2		2	3						3	1		3

Course Code	Course Title	L	T	P	C
UME2617	DESIGN AND FABRICATION PROJECT	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Design and fabricate a complete working model of a component (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3		2				2	3	3	2	3	3

SEMESTER VII

Course Code	Course Title	L	T	P	C
UME2701	INDUSTRIAL PRACTICES	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: To apply quality philosophies and tools to facilitate continuous improvement and ensure customer delight. (K3)					
CO2: To Demonstrate the ability to design, use, and interpret control charts and perform analysis of Process capability(K2)					
CO3: To enable the learners to understand the framework of Quality Systems (K2)					
CO4: To learn a range of creative thinking tool and how to practically apply these to the innovation and entrepreneurial process (K2)					
CO5: To enable learners to write in English precisely and effectively (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					3								3
2	2					3			1					3
3	2	2				3			1		1			3
4							3		2		2	3		3
5									3	3	2	3		3

Course Code	Course Title	L	T	P	C
UME2702	ROBOT TECHNOLOGY	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation (K2)					
CO2: Examine different sensors and actuators for applications like maze solving and self-driving cars (K2)					
CO3: Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots (K2)					
CO4: Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning (K2)					
CO5: Describe the impact and progress in AI and other research trends in the field of robotics (K2)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2			1	1	1				1		2
2	3	2	2											2
3	3	3	2											2
4	3	2	1											2
5	2	1	1		1	1		1				1		2

Course Code	Course Title	L	T	P	C
UME2703	FINITE ELEMENT ANALYSIS	3	0	0	3
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Summarize the basics of finite element formulation. (K3)					
CO2: Apply finite element formulations to solve one dimensional Problems. (K3)					
CO3: Apply finite element formulations to solve two dimensional scalar Problems. (K3)					
CO4: Apply finite element method to solve two-dimensional Vector problems. (K3)					
CO5: Apply finite element method to solve problems in dynamics and iso parametric Formulation. (K3)					

COs	POs														PSOs		
	1	2	3 – PI		4	5 – PI		6	7	8	9	10	11	12 - PI		1	2
CO1	3	2	1													3	
CO2	3	2	1													3	
CO3	3	2	1													3	
Targeted CO: CO4	3	2	1	3.1.1		1	5.2.2							1	12.2.2	3	
Targeted CO: CO5	3	2	1	3.1.1		1	5.2.2							1	12.2.2	3	

Course Code	Course Title	L	T	P	C
UME2711	SIMULATION LABORATORY	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Perform simulations using Matlab (K3)					
CO2: Execute the method to calculate the stresses and strains induced in plates, brackets and beams and heat transfer problems (K3)					
CO3: Implement the calculation procedure for the natural frequency and mode shape analysis of 2D components and beams (K3)					

COs	POs														PSOs	
	1	2	3 – PI	4	5 – PI	6	7	8	9 – PI	10 – PI	11	12 – PI	1	2		
CO1	3	1	3		3							1		3		
CO2	3	1	3		3							1		3		
Targeted CO: CO3	3	1	3	3.1.6	3	5.2.2			2	9.1.2	2	10.1.2 10.2.2	1	12.2.2	3	

Course Code	Course Title	L	T	P	C
UME2717	PROJECT WORK – PHASE I	0	0	3	1.5
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Discover potential research areas in the field of Mechanical Engineering (K3)					
CO2: Compare and contrast the several existing solutions for the problems identified (K3)					
CO3: Formulate and propose a plan for creating a solution for the research plan identified (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3					3	3	3	3	2		3	3	3
2	2					3	3	3	3	2		3	3	3
3	2					3	3	3	3	2		3	3	3

Course Code	Course Title	L	T	P	C
UEE2716	INDUSTRIAL TRAINING / INTERNSHIP	0	0	0	2
COURSE OUTCOMES					
On Completion of the project work students will be in a position to					
CO1: Formulate a real world problem, identify the requirement and develop the design solutions (K3)					
CO2: Express the technical ideas, strategies and methodologies (K2)					
CO3: Test and validate through conformance of the developed prototype and analysis the cost effectiveness. Prepare report and present the oral demonstrations (K3)					
CO4: Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project (K3)					

SEMESTER VIII

Course Code	Course Title	L	T	P	C
UME2818	PROJECT WORK – PHASE II	0	0	16	8
Course Outcomes: Upon successful completion of the course, students will be able to					
CO1: Discover potential research areas in the field of Mechanical Engineering (K3)					
CO2: Compare and contrast the several existing solutions for the problems identified (K3)					
CO3: Formulate and propose a plan for creating a solution for the research plan identified (K3)					
CO4: Conduct the experiments as a team and interpret the results(K3)					
CO5: Report and present the findings of the work conducted. (K3)					

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	2	2	3	3	3	3	2	1	3	3	3
2	2	3	3	2	2	3	3	3	3	2	2	3	3	3
3	2	2	3	3	2	3	3	3	3	2	2	3	3	3
4	2	2	3	3	3	3	3	3	3	2	3	3	3	3
5	2	2	3	1	3	3	3	3	3	3	3	3	3	3

COs

C101	PBA 1101 Economic Analysis for Business	CO 1
		CO 2
C102	PBA1102 Statistics for Managerial Decisions	CO 1
		CO 2
		CO 3
		CO 4
C103	PBA1103 Organizational Behaviour	CO 1
		CO 2
		CO 3
		CO 4
		CO 5
C104	PBA1104 Accounting for Management	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO 6
		CO 7
C105	PBA 1105 Legal Aspects of Business	
		CO 1
		CO 2
		CO 3
C106	PBA1106 Principles of Management	
		CO 1
		CO 2
		CO 3
		CO 4
C107	PBA 1111 Data Analysis I	
		CO 1

		CO 2
		CO 3
		CO 4
		CO 5
		CO 6
		CO 7
		CO 8
C108	PB1115 Managerial Communications 1	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO 6
		CO 7
		CO 8
C201	PBA 1201 Marketing management	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO 6
		CO 7
C202	PBA1202 Human Resource Management	
		CO 1
		CO 2
		CO 3
C203	PBA 1203 Financial Management	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
C204	PBA1204 Operations Management	

		CO 1
		CO 2
		CO 3
		CO 4
C205	PBA 1205 Business Research Methods	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO 6
C206	PBA 1206 Business Information Systems	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO 6
		CO 7
C207	PBA 1207 Applied Operations Research	
		CO 1
		CO 2
		CO 3
		CO 4
C208	PBA1211 Data Analysis II	
		CO 1
		CO 2
		CO 3
C209	PBA1215 Managerial Communications 2	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO 6

		CO 7
		CO 8
C301	PBA1301 Strategic Management	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
C302	PBA1316 Summer Internship	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO 6
		CO 7
		CO 8
C303	PBA1321 Advertising & Public Relations	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
C304	PBA1322 Consumer Behaviour	
		CO 1
		CO 2
		CO 3
C305	PBA1323 Customer Relationship Management	
		CO 1
		CO 2
		CO 3
		CO 4
C306	PBA1324 Sales & Distribution Management	
		CO 1
		CO 2

		CO 3
C307	PBA1325 Service Marketing	
		CO 1
		CO 2
		CO 3
		CO 4
C308	PBA1326 Strategic Brand Management	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO 6
C309	PBA1327 Banking Services Management	
		CO 1
		CO 2
		CO 3
C310	PBA1328 Corporate Finance	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
C311	PBA1329 Financial Statement Analysis	
		CO 1
		CO 2
		CO 3
		CO 4
C312	PBA1331 Industrial Relations and labour Laws	
		CO 1
		CO 2
		CO 3
C313	PBA1332 Organizational Theory, Design & Development	
		CO 1
		CO 2

		CO 3
		CO 4
		CO 5
C314	PBA 1333 Strategic Human Resource Management	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
C315	PBA1334 Supply Chain and Logistics Management	
		CO 1
		CO 2
		CO 3
C316	PBA1335 Total Quality Management	
		CO 1
		CO 2
		CO 3
C317	PBA1336 Services Operation Management	
		CO 1
		CO 2
		CO 3
C401	PBA1421 International Marketing	
		CO 1
		CO 2
C402	PBA1422 Retail Management	
		CO 1
C403	PBA1425 Security Analysis and Portfolio Management	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO6
C404	PBA1428 Training & Development	
		CO 1

		CO 2
		CO 3
		CO 4
		CO 5
C405	PBA1429 Project Management	
		CO 1
		CO 2
		CO 3
C406	PBA1418 Final Semester Project	
		CO 1
		CO 2
		CO 3
		CO 4
		CO 5
		CO 6
		CO 7

MBA Regulations 2018

CO Statements

To have a broader understanding of principles relating to micro and macroeconomics.
Familiarity with the application of these principles in business.
Demonstrate an understanding of basic concepts in Statistics and their applications.
Identifying the business problem and applying suitable statistical tests for the predetermined data set to solve the business problem.
Formulate and use appropriate models of data analysis to find feasible solution for business-related problems.
Understand and communicate from the statistical outputs into managerial recommendations.
Describe and explain the basic organizational behavior theories and principles, and analyze their influences in the workplace.
Analyze and explain individual human behavior in the workplace and the factors that influence them.
Describe the factors that influence group behavior such as group cohesiveness, communication, conflict, leadership, power and politics.
Portray how Organizational Culture, Climate, Change & Development can have influence on organizational effectiveness.
Analyze a given situation and identify causes for the situation and recommend alternate courses of action.
To identify financial transactions, journalize them, draw up a trial balance and prepare final accounts
To read, analyse, interpret, and evaluate the financial performance of companies using financial tools such as ratio analysis, fund flow and cash flow analyses
To compare and evaluate the performance of the companies
To be able to interpret cost accounting statement and apply various methods of costing
To be able to analyse and evaluate information for cost ascertainment, planning, control and decision making
To be able to solve cases and extract relevant information in the above areas
To be able to prepare financial planning statements and their usage in strategic decision making and control
Familiarity with the laws that have an influence on business
An appreciation of the spirit behind the various laws that influence business
A basic understanding of what can be done and what cannot be done within the legal framework.
Demonstrate the basic concepts of management and its theories
Describe the functions of management and roles of managers
Describe how the managerial tasks of planning, organizing, directing and controlling can be executed in a variety of circumstances
Appreciate the use of qualitative and quantitative information to formulate best control methods
Understand key concepts in the field of Business Intelligence and its important role in helping businesses achieve their goals

Be more productive and creative in their use of Excel for business data analysis and reporting
Use powerful excel functions like Lookup functions and others to undertake more dynamic calculations and analysis: as well as use Text functions to manipulate data into desired formats
Employ Goal Seek and Scenario Manager to conduct sensitivity analysis and solve practical business problems
Utilize Pivot tables and slicers to conduct more effective data manipulation and analysis
Create effective charts and dashboards in Excel for improved data visualization
Import data using Power Pivot
Design and develop model to enhance decision making process
Develop the ability to write official e-mails
Demonstrate ability to speak in a group or address a gathering in different contexts.
Demonstrate the ability to write and construct effective paragraphs on different topics for different purposes with appropriate format, organization and language
Understand the method of creating and presenting on a selected topic.
Memorize and reproduce the meaning of words and usages in English
Recognize and practice the skills of listening
Exhibit the capability to interpret/summarize a given reading material in a written form
Demonstrate understanding of cross cultural aspects of communication
Demonstrate a familiarity and understanding of principles and concepts in management.
Demonstrate knowledge of contemporary issues that have an impact on the business and industry.
Apply the relevant knowledge gained to read situations, analyze and solve business problems.
Ability to communicate effectively, to achieve organizational and individual goals.
Work in teams of diverse people to meet organizational goals.
Demonstrate leadership skills appropriate for managerial roles in organizations.
Identify and appreciate the ethical issues in management decision area.
Discuss and describe the various functions of a Human Resource Manager including staffing and selection, training and development, performance appraisal, compensation and Career Mgt.
Apply human resource management concepts across a variety of contexts, situations and incidents to draw up suitable plans for various HR functions for a given situation.
Identify and evaluate the HR practices in a company in the context of its culture and business environment.
Understand the role and functions of finance in organisations and apply them in the appropriate context
Understand the importance of time value of money, valuation of financial assets and apply them from the investment point of view
Understand the various types of risks, measurement of risks and ability to analyze them from the context of financial assets
Able to analyse and determine optimum cost of capital and analyse capital investment decisions of projects based on capital budgeting techniques
Able to assess working capital needs and effective management of current assets and financing decisions

Critical understanding of an integrated and structured approach to planning and decision-making for a competitive advantage through operational excellence
Appreciation of the role of Operations Management functions, recognise its interfaces with other functional areas and with its external environment
Basic knowledge of problem solving techniques in the field of operations management
Apply appropriate management tools in the design, operation and improvement in the creation of a firm's products and services
To demonstrate a basic understanding of various aspects of business research methodologies.
To describe the research process to solve business problem.
Carry out literature review that synthesizes and evaluates literature in a specific topic area.
To identify appropriate techniques associated with qualitative and quantitative business methodologies.
To design a research activity for a given business situation.
To design and develop a business research report and to learn how to communicate the results and acknowledge the ethical implications of the research.
Describe and distinguish the various types of business information systems and their roles in running a business organization.
Describe the fundamental concepts of database and design simple database using E-R diagram and normalization concepts.
Describe and apply various methodologies, tools and techniques to analyze and design business information systems.
Describe business intelligence tools, techniques and its applications.
Describe the new information technologies available to businesses today and its applications.
Demonstrate an awareness of ethical issues related to usage of IS.
Plan and undertake a group project, prepare and deliver structured verbal and written report.
Define and explain the various concepts and techniques of operations research and their applicability to business situations.
Translate a real-world problem, given in words, into a mathematical formulation.
Use the relevant mathematical model(s) to make optimal decisions under conditions of certainty, risk and uncertainty
Use appropriate software tools to solve problems in operations research and interpret the results to aid decision making under various operational constraints in an organization
Demonstrate an understanding of basic concepts in Statistics and their applications using SPSS / R
Formulate and use appropriate models of data analysis to find feasible solution for business-related problems using SPSS / R
Understand and communicate from the statistical outputs into managerial recommendations using SPSS / R
Develop the ability to write official e-mails
Demonstrate ability to speak in a group or address a gathering in different contexts.
Demonstrate the ability to write and construct effective paragraphs on different topics for different purposes with appropriate format, organization and language
Understand the method of creating and presenting on a selected topic.
Memorize and reproduce the meaning of words and usages in English
Recognize and practice the skills of listening

Exhibit the capability to interpret/summarize a given reading material in a written form
Demonstrate understanding of cross cultural aspects of communication
Define Mission, Vision, and Objectives of an Organization.
Assess the external and internal business environments of an industry / company using different tools and frameworks.
Perform Strategic gap analysis for a given business case.
Identify and relate corporate and business level strategies of a business organization.
Outline the strategy implementation process and the challenges for a given business situation.
Carry out an operating role in a professional manner by applying the concepts learnt in the first year and meet the objectives set by the company.
Sufficiently quantify the various aspects of the role being carried out by recording appropriate data and use the data as a justification for the solutions suggested.
Identify limitations and bottlenecks in the current way the roles are being carried out and provide solutions for improvement.
Describe the culture, organizational structure and internal environment of the company and relate it to its market position and implications on the role carried out.
Summarize and articulate the learning from the internship, both in relation to personal learning and management related aspects.
Relate the management concepts learnt to the functioning of the company and to the role carried out.
Prepare a summer internship report covering all the above outcomes.
Make a professional presentation to a panel containing the essence of the summer internship along with the data and provide answers to questions raised by the panel.
Demonstrate an understanding of all concepts in advertising and public relations.
Draw up an advertising and media plan for a product and create an agency brief for the same
Draw up a creative brief for a product / market situation
Describe and interpret any advertising campaign of another company with respect to objectives, creative design and executions.
Identify and describe the PR effort any company based by exploring newspaper archives.
Demonstrate an understanding of how customers make decisions and assess the relevant implications for marketing practitioners
Identify the major individual, social and cultural factors that affect consumers' decision making process
Outline the major stages which consumers usually go through when making a consumption-related decision
Demonstrate an understanding of the role customer relationship management in the performance of a business organization.
Demonstrate an understanding of the role of technology in managing relationships with customers.
Design a CRM strategy for a company by incorporating suitable analytical and conceptual tools.
Identify the CRM practices / strategies employed in any commercial enterprise and map these to the conceptual knowledge acquired.
Demonstrate an understanding of the principles of sales and distribution management in B2C and B2B markets.
Develop a hypothetical sales and distribution plan for a given product / category by incorporating all relevant variables and principles

Appreciate the sales and distribution function in any real-time organization
Demonstrate an understanding of the difference between marketing physical products and intangible services including dealing with the extended service marketing mix
Describe the role of services sector operates in a developing economy
Define and illustrate the main components of services marketing theory and describe how they can be practically applied in the service sector
Describe the challenges faced in services delivery in general and in specific reference to any company's service
Demonstrate understanding of key branding concepts and process to develop brand strategy
Describe various theories and models to build strong brand.
Apply branding principles and marketing communication mix to improve brand performance.
Demonstrate the ability to conduct a brand audit using both primary and secondary sources and propose strategic recommendations based on the audit results.
Apply brand strategies to introduce new brands and managing brands over time.
Work effectively as team to discuss, analyze, prepare and present a brand audit report
To demonstrate an understanding of a bank's functioning and its various activities
To compare the performance of different banks based on their financial statements
TO demonstrate an understanding of the legal framework in which banks operate
Demonstrate an understanding of the role and responsibilities of Corporate Finance in relation to other functions in an organization.
Demonstrate an understanding of various alternatives for raising of funds by a corporate, theories if any, and their advantages and limitations.
Understand the relationship between shareholders wealth maximization and the linkage to dividends and the theoretical concepts.
Do a risk analysis for capital budgeting and suggest measures to mitigate the same.
Carry out the valuation of an enterprise with a given set of data using different models and highlight their significance.
Demonstrate a thorough understanding of the various methods and ratios used to analyse and evaluate the performance of a company
Compare the performances of two companies in the same industry or across two different industries.
Identify factors that cause the differences in the above comparison
Draw inferences from the analysis and identify possible areas of strengths and weaknesses of the companies being analyzed along with possible course of action, if required.
Demonstrate an understanding of the role and importance of industrial relations in a country's development.
Demonstrate an understanding of various legislations pertaining to labour, social security and labor welfare, their historical significance, purpose and importance.
Demonstrate an ability to identify issues in a given situation and analyze them with respect to the legislations.
Explain the linkage between the environment, structure and strategy
Enumerate the various factors affecting organizational design and their structural implications for managers

Understand the importance of culture and its implications for practicing managers
Determine a change management strategy and identify the appropriate OD interventions
Demonstrate knowledge on the organizational life cycle and managing innovation process
Understand the meaning and nature of strategic HRM and its influence on business strategy
Describe the linkage of business strategy with HR planning
Describe the significance of SHRM for gaining and sustaining competitive advantage
Explain the issues related to cross-cultural HRM
Demonstrate an understanding of strategic HR issues faced by an organization in periods of turbulence and uncertainty.
Understand the concepts underlying the philosophy of supply chain management, appreciate the major drivers of supply chain and define the key metrics that track the performance of the supply chains
Understand the importance of sourcing and procurement in supply chains, role and decision making on network design using quantitative techniques and supply chain planning.
Appreciate the role of logistics in customer value delivery chain and understand the role and functions of warehousing, transportation and packaging in enabling the supply chains.
Show a critical understanding of the basic principles in TQM
Appreciation of the six sigma methodology
Applying quality philosophies and tools to facilitate continuous process improvement ensuring customer delight
Demonstrate an understanding of concepts and contemporary tools necessary to effectively to design and manage a service operation.
Appreciate the role and importance of information technology in services sector in today's competitive world.
Demonstrate a familiarity with the best practices of service organizations around the world.
Demonstrate an understanding of global business and environment
Carry out a country analysis and determine its attractiveness for doing business
Demonstrate an understanding of the operations of a retail outlet
Demonstrate an understanding of the various topics in the field of securities analysis and portfolio management.
Identify the different risks that an entity is exposed to and able to assess the risk.
Demonstrate an understanding of the securities market operations and the role of regulators.
Carry out a fundamental analysis of an industry and a company by using various techniques.
Demonstrate a familiarity of using technical analysis for evaluating securities.
Build a model portfolio given a risk-reward profile of financial assets by using the techniques taught.
Demonstrate the understanding of the need and importance of strategic Training and Development Process

Ability to identify the training needs of an organization
Demonstrate an understanding of different training methods as applicable for different situations and needs.
Design suitable evaluation methods for measuring training effectiveness.
Explain the importance of various aspects of career management and its role in organization's growth.
Demonstrate a critical understanding of the basic principles in Project Management
Demonstrate an ability to plan, schedule, allocate resources and control the activities of a project
Apply project management principles in business situations to optimize resource utilization and time optimization
Understand the environment of the industry in which the company is operating and the position of the company in the industry.
Collaboratively identify an active or passive problem or need area/s in the company that can be investigated by using appropriate research methodology.
Identify secondary sources of information that have relevance to the problem identified through literature survey.
Work out an appropriate research plan to be used for investigation and implement the same.
Make recommendations to the company that have good probability of being implemented.
Generate a comprehensive professional research report that meets both the company's and academic requirements.
Make a professional presentation containing the essence of the project to a panel and provide answers to questions raised by the panel.

LIST OF POs
PO1: Demonstrate a familiarity and understanding of principles and concepts in management.
PO2: Demonstrate knowledge of contemporary issues that have an impact on the business and industry.
PO3: Apply the relevant knowledge gained to read situations, analyze and solve business problems.
PO4: Ability to communicate effectively, to achieve organizational and individual goals.
PO5: Work in teams of diverse people to meet organizational goals.
PO6: Demonstrate leadership skills appropriate for managerial roles in organizations.
PO7: Identify and appreciate the ethical issues in management decision area.
PO8: Ability to pursue lifelong learning.

V COLLEGE OF ENGINEERING, KALAVAKKAM - 6031
Autonomous Institution Affiliated to Anna University Ch
CHOICE BASED CREDIT SYSTEM
Master in Business Administration

CO101	PBA 2101 PRINCIPLES OF MANAGEMENT	CO 1
		CO2
		CO3
CO102	PBA 2101 ORGANISATIONAL BEHAVIOUR	CO1
		CO 2
		CO 3
		CO 4
		CO 5
CO0103	PBA 2103 ECONOMIC ANALYSIS FOR BUSINESS	CO1
		CO2
CO104	PBA2104 ACCOUNTING FOR MANAGEMENT	CO1
		CO2
		CO3
		CO4
CO 0105	PBA2105 STATISTICS FOR MANAGERIAL DECISIONS	CO1
		CO2
		CO3
CO0106	PBA 2106 LEGAL ASPECTS OF BUSINESS	CO1
		CO2
CO107	PBA 2107 INFORMATION MANAGEMENT	CO1
		CO2
		CO3
		CO4
		CO5
		CO6
CO0108	PBA2111 DATA ANALYSIS AND BUSINESS MODELLING	CO1
		CO2
		CO3
CO0109	PBA2119 BUSINESS COMMUNICATION	CO1
		CO2
		CO3
		CO4
		CO5

		CO6
CO0110	PBA2115 SEMINAR I	CO1
		CO2
		CO3
		CO4
	SECOND SEMESTER	
CO0201	PBA 2201 APPLIED OPERATIONS RESEARCH	CO1
		CO2
		CO3
		CO4
CO0202	PBA 2202 HUMAN RESOURCE MANAGEMENT	CO1
		CO2
		CO3
CO0203	PBA 2203 FINANCIAL MANAGEMENT	CO1
		CO2
		CO3
		CO4
		CO5
CO0204	PBA2204 OPERATIONS MANAGEMENT	CO1
		CO2
		CO3
		CO4
CO0205	PBA 2205 MARKETING MANAGEMENT	CO1
		CO2
		CO3
		CO4
		CO5
CO0206	PBA 2206 BUSINESS RESEARCH METHODS	CO1
		CO2
		CO3
		CO4
		CO5
		CO6
CO207	PBA 2207 INTRODUCTION TO BUSINESS ANALYTICS	CO1
		CO2
		CO3
CO0208	PBA2211 DATA ANALYSIS AND VISUALISATION	CO1
		CO2
		CO3
		CO4
		CO5
CO0209	PBA 2215 SEMINAR II	CO1
		CO2
		CO3

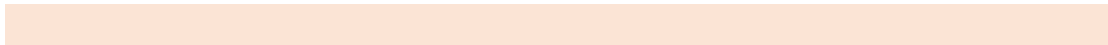
		CO4
		*CROSS F
CO0210	PBA2221 BUSINESS ETHICS AND CORPORATE GOVERNANCE	CO1
		CO2
		CO3
		CO4
		CO5
CO0211	PBA2222 ENTREPRENEURSHIP DEVELOPMENT	CO1
		CO2
		CO3
		CO4
CO0212	PBA2223 BUSINESS ANALYSIS	CO1
		CO2
		CO3
		CO4
		CO5
		CO6
CO0213	PBA 2224 SUSTAINABLE DEVELOPMENT	CO1
		CO2
		CO3
		CO4
		CO5
	THIRD SEMESTER	
CO0301	PBA 2301 STRATEGIC MANAGEMENT	CO1
		CO2
		CO3
		CO4
		CO5
CO0302	PBA 2316 SUMMER INTERNSHIP	CO1
		CO2
		CO3
		CO4
		CO5
		CO6
		CO7
		CO8
CO0303	PBA2321 ADVERTISING AND PUBLIC RELATIONS	CO1
		CO2
		CO3
		CO4
		CO5
CO0304	PBA2322 CONSUMER BEHAVIOUR	CO1
		CO2
		CO3

CO0305	PBA 2323 CUSTOMER RELATIONSHIP MANAGEMENT	CO1
		CO2
		CO3
		CO4
CO0306	PBA 2324 SALES AND DISTRIBUTION MANAGEMENT	CO1
		CO2
		CO3
		CO4
CO0307	PBA2325 SERVICES MARKETING	CO1
		CO2
		CO3
CO0308	PBA2326 STRATEGIC BRAND MANAGEMENT	CO1
		CO2
		CO3
		CO4
CO0309	PBA2327 MARKETING RESEARCH	CO1
		CO2
		CO3
		CO4
		CO5
CO0310	PBA2328 INTERNATIONAL MARKETING	CO1
		CO2
		CO3
		CO4
	FINANCE SPECIALIZATION	
CO0311	PBA2329 BANKING SERVICES MANAGEMENT	CO1
		CO2
		CO3
		CO4
CO0312	PBA2331 CORPORATE FINANCE	CO1
		CO2
		CO3
		CO4
		CO5
CO0313	PBA2332 FINANCIAL STATEMENT ANALYSIS	CO1
		CO2
		CO3
		CO4
CO0314	PBA2333 FINANCIAL SERVICES	CO1
		CO2
		CO3
CO0315	PBA2334 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT	CO1
		CO2
		CO3

		CO4
		CO5
	HUMAN RESOURCE SPECIALISATION	
CO0316	PBA2335 INDUSTRIAL RELATIONS AND LABOUR LAWS	CO1
		CO2
		CO3
CO0317	PBA 2336 COMPENSATION AND BENEFITS	CO1
		CO2
		CO3
		CO4
CO0318	PBA2337 STRATEGIC HUMAN RESOURCE MANAGEMENT	CO1
		CO2
		CO3
		CO4
		CO5
CO0319	PBA2338 PERFORMANCE MANAGEMENT	CO1
		CO2
		CO3
		CO4
CO0320	PBA2339 INTERNATIONALHUMAN RESOURCE MANAGEMENT	CO1
		CO2
		CO3
		CO4
		CO5
	OPERATIONS SPECIALIZATION	
CO0321	PBA2341 SUPPLY CHAIN AND LOGISTICS MANAGEMENT	CO1
		CO2
		CO3
		CO4
CO0322	PBA2342 PROJECT MANAGEMENT	CO1
		CO2
		CO3
CO0323	PBA2343 SERVICES OPERATIONS MANAGEMENT	CO1
		CO2
		CO3
CO0324	PBA2344 MATERIALS MANAGEMENT	CO1
		CO2
		CO3
	BUSINESS ANALYTICS SPECIALIZATION	
CO0325	PBA2345 TOOLS FOR BUSINESS ANALYTICS	CO1
		CO2
		CO3
		CO4
		CO5

CO0326	PBA2346 FUNCTIONAL ANALYSIS	CO1
		CO2
		CO3
		CO4
		CO5
CO0327	PBA2347 ARTIFICIAL INTELLIGENCE FOR BUSINESS	CO1
		CO2
		CO3
		CO4
		CO5
CO0328	PBA 2348 BLOCKCHAIN TECHNOLOGY	CO1
		CO2
		CO3
		CO4
		CO5
CO0329	PBA 2349 BIG DATA ANALYSIS	CO1
		CO2
		CO3
		CO4
		CO5
	FOURTH SEMESTER	
CO0401	PBA 2418 FINAL SEMESTER PROJECT	CO1
		CO2
		CO3
		CO4
		CO5
		CO6
		CO7
CO0402	PBA2421 MARKETING ANALYTICS	CO1
		CO2
		CO3
		CO4
CO0403	PBA 2422 RETAIL MANAGEMENT	CO1
		CO2
		CO3
		CO4
	FINANCE SPECIALIZATION	
CO0404	PBA2423 FINANCIAL MODELLING AND ANALYSIS	CO1
		CO2
		CO3
		CO4
		CO5
CO0405	PBA2425 BEHAVIORAL FINANCE	CO1
		CO2

		CO3
		CO4
	HUMAN RESOURCE SPECIALIZATION	
CO0406	PBA2426 ORGANISATIONAL THEORY, DESIGN AND DEVELOPMENT	CO1
		CO2
		CO3
		CO4
		CO5
CO0407	PBA2427 TRAINING AND DEVELOPMENT	CO1
		CO2
		CO3
		CO4
	OPERATIONS SPECIALIZATION	
CO0408	PBA 2428 TOTAL QUALITY MANAGEMENT	CO1
		CO2
		CO3
	BUSINESS ANALYTICS SPECIALIZATION	
CO0409	PBA2429 BUSINESS ANALYTICS SPECIALISATION	CO1
		CO2
		CO3
		CO4
		CO5
CO0410	PBA 2431 BUSINESS ANALYTICS - PROJECT WORK	CO1
		CO2
		CO3
		CO4
		CO5





Demonstrate an understanding of the evolution of Management, theories and managerial functions and role of Managers

Demonstrate an understanding of the evolution of management, theories and managerial functions and

Appreciate the use of qualitative and quantitative techniques in different functions of management.

Explain the basic organizational behavior concepts and principles, and analyze their influences in the wo

Analyze and explain individual human behavior in the workplace and the factors that influence them.

Discuss the factors that influence group behavior such as group cohesiveness, communication, conflict, I

Portray how Organizational Culture, Climate, Change & Development can have influence on organization

Analyze a given situation and identify causes for the situation and recommend alternate courses of actio

To have a broader understanding of principles relating to micro and macroeconomics

Familiarity with the application of these principles in business

Demonstrate an understanding of the accounting principles, concepts and the process leading to prepar

Read, interpret and analyze the final statements of a corporate entity and carry out a comparison of con

Explain the concepts of cost accounting and tools and their relevance to management decision making.

Demonstrate an understanding of the budgeting process and draw up budgets based on information pro

Demonstrate and understanding of basic concepts in Statistics and its applications.

Applying suitable statistical techniques and tools to solve business problems.

Make suitable recommendations based on results of statistical analysis.

Demonstrate a basic understanding of laws that have an influence on business and what can be done an

Appreciate the spirit behind the various laws that influence business.

Describe various types of business information systems and their roles in running a business organizati

Compare and contrast types of databases and demonstrate a basic understanding of database design.

Classify the various analytical tools that can be utilized for decision making.

Outline the process of developing an information system for an organization.

Describe the new information technologies available to businesses today and its applications.

Demonstrate an awareness of ethical issues related to usage of Information Systems

Understand and apply basic functions and other features of the spreadsheet.

Use the necessary advanced functions and features for data analysis and manipulation.

Construct a model for selected scenarios and carry out a sensitivity analysis.

Develop the ability to write official communication

Demonstrate familiarity with words and phrases commonly used in Business

Demonstrate the ability to speak in a group or address a gathering in different contexts

Understand the method of creating and presenting on a given topic

Demonstrate the ability to listen effectively

Paraphrase a given text
Ability to synthesize information using logical thinking of a chosen topic with pointed questions
Gain collaborative and leadership skills
Ability to make presentation and answer questions.
Ability to listen to diverse topics

Define and explain the various concepts and techniques of operations research and their applicability to
Translate a real-world problem, given in words, into a mathematical formulation.
Use the relevant mathematical model(s) to make optimal decisions under conditions of certainty, risk and
Use appropriate software tools to solve problems in operations research and interpret the results to aid
Explain the various functions of a Human Resource Manager including staffing and selection, training and
Apply human resource management concepts across a variety of contexts, situations and incidents to dr
Identify and evaluate the HR practices in a company in the context of its culture and business environme
Explain the role and functions of finance in organisations
Apply the principle of time value of money in the valuation of financial assets from an investment point o
Identify the various types of risks, their measurement and demonstrate their relevance in the context of
Demonstrate an ability to compare and select projects from a capital budgeting perspective.
Assess the need and types of working capital and its effective management.
Understanding of an integrated approach between operations and other functional areas and with overa
Appreciation of the role and importance of Operations Management function in the performance of an o
Understanding and application of management tools and problem solving techniques in the field of oper
Demonstrate an awareness of contemporary practices in operations management.
Describe the role of marketing in business and explain the key concepts of marketing.
Identify and describe the factors which influence consumer and industrial buying behavior.
Describe the elements of marketing mix in marketing a product or service.
Identify and illustrate the various distribution and communication strategies.
Demonstrate an ability to develop marketing strategies and prepare a marketing plan
Describe and design a suitable research process to solve business problem.
Describe and design a suitable research process to solve business problem.
Describe and apply appropriate methods to collect qualitative and quantitative data for analysis.
Apply appropriate statistical tools to analyze data and solve research problems.
Design and present a research report with all necessary information.
Demonstrate an awareness and understanding of the ethical implications of doing research.
Understand the importance of analytics in business decision making
Appreciate the different types of analytical models to gain relevant insights.
Apply and solve problems using the tools and techniques in analytics
Demonstrate and understanding of basic concepts in Statistics and preparing the data for Data Analysis
Identify suitable statistical tool for describing data or Hypothesis testing, Procedure to apply suitable too
Understand and communicate the decision recommendations or research inference from the statistical o
Work with Visualization tools and analyse data by utilising various visualization concepts
Perform exploratory data analysis
Ability to synthesize information using logical thinking of a chosen topic with pointed questions
Gain collaborative and leadership skills
Ability to make presentation and answer questions.

Ability to listen to diverse topics

FUNCTIONAL ELECTIVES

Understand ethical concepts that are relevant to moral issues in business.

Identify ethical issues in business decisions and how companies have addressed them.

Understanding of issues that arise from social, technological and natural environments of businesses

Understand the concept of moral dilemmas in business and ways by which companies have addressed them

Understand the role of corporate governance in businesses and its mechanism of implementation.

Gain an understanding of entrepreneurial competence to run a business efficiently.

Prepare business plans and understand feasibility.

Prepare plan for launching a business taking into account the various policies' support

Appreciate the factors leading to success and failure from entrepreneurs.

Demonstrate an understanding of the role of a business analyst and the competencies required.

Ability to investigate a business situation and understand the role of various stakeholders.

Gaining a system based understanding of business rules, the associated key performance indicators and

Ability to document a business process, analyse and identify the areas for improvements.

Establish requirements and ability to document the business requirements.

Ability to deliver a feasible business solution with benefits.

Develop an understanding of sustainability management as an approach to aid in evaluating and minimizing

Demonstrate an understanding of corporate sustainability and responsible Business Practices

Understand, measure and interpret sustainability performances.

Demonstrate knowledge of innovative practices in sustainable business and community

Deep understanding of sustainable management of resources and commodities

Explain the process of formulation of vision, mission and objectives for an organization and their significance

Assess the external and internal business environments of an industry / company and their impact on strategy

Perform Strategic gap analysis for a given business case.

Differentiate between corporate and business level strategies of a business organization.

Outline the strategy implementation process and the common challenges faced by an organization.

Carry out an operating role in a professional manner by applying the concepts learnt in the first year and

Sufficiently quantify the various aspects of the role being carried out by recording appropriate data and

Identify limitations and bottlenecks in the current way the roles are being carried out and provide solutions

Describe the culture, organizational structure and internal environment of the company and relate it to its

Summarize and articulate the learning from the internship, both in relation to personal learning and marketing

Relate the management concepts learnt to the functioning of the company and to the role carried out.

Prepare a summer internship report covering all the above outcomes.

Make a professional presentation to a panel containing the essence of the summer internship along with

Describe the purpose and process of advertising by an organization within the societal, economic and legal

Describe the various media options available to an advertiser and process for selecting a suitable media

Describe the process of creating and producing advertisements in the context of a market situation.

Describe and interpret any advertising campaign of another company with respect to objectives, creative

Explain the role and usage of Public Relations and methods of measuring the impact.

Identify and prioritize the major individual, social and cultural factors that affect consumer behaviour and

Outline the major stages which consumers usually go through when making a purchase-related decision

Apply the various consumer behaviour theories, concepts and models in marketing situations.

Demonstrate the role of customer relationship management in marketing, sales and services.
Demonstrate an understanding of customers and their profiles to design an appropriate CRM strategy.
Demonstrate an understanding in managing customer lifecycle using CRM tools and techniques.
Describe the functionalities of Operational and Analytical CRM.
Demonstrate an understanding of the methods and strategies necessary for planning, motivating and ev
Demonstrate an understanding of the structure and management methods for Distribution Channels
Develop a suitable sales and distribution organization for a given product/ market situation.
Appreciate the sales and distribution function in any real-time organization.
Demonstrate an understanding of the unique characteristics of services, its role in the global economy a
Describe the process of drawing up a marketing strategy and marketing plan for a service offering.
Describe the challenges faced in services delivery, process of measuring quality of services and ensuring
Demonstrate understanding of key branding concepts and the process to build strong brand.
Apply branding principles to design marketing communications programs.
Demonstrate the ability to measure brand equity and propose strategic recommendations based on the
Apply branding strategies to introduce new brands and managing brands over time.
To obtain a knowledge of some basics (concepts, tools and techniques) in Marketing Research (MR).
To learn how to apply the MR techniques in real marketing situations.
To make the student understand how to conduct different types of MR.
To enable the student, appreciate how data analysis improves decision making.
To enable the student to convert a statistical result into actionable points of decision making.
Demonstrate an understanding of global business and environment
Carry out a country analysis and determine its suitability and attractiveness for doing business
Describe the process of evaluating entry strategies and drawing up the marketing mix for an internationa
Demonstrate a familiarity of the important processes involved in export of products from India.

Demonstrate an understanding of the banking sector, functioning of banks and practices for a profitable
Analyze the performance of different banks based on their financial statements.
Demonstrate an understanding of the legal framework in which banks operate.
Demonstrate an awareness of recent developments in the banking sector.
Demonstrate an understanding of the roles and responsibilities of Corporate Finance
Demonstrate an understanding of various alternatives for raising of funds by a corporate and their theor
Examine the relationship between shareholders wealth maximization and dividends and the related the
Carry out a risk analysis for capital budgeting and suggest measures to mitigate risks
Carry out the valuation of an enterprise using different models
Understand the linkage between the financial statements and the different components of financial stat
Understand the different techniques to analyse companies both qualitatively and quantitatively and hov
Learn, understand and analyse the impact of changes of individual components of financial statements c
Use Excel and other tools to analyse financial statements, build in assumptions and estimates to build a f
Understand the functioning of the Indian financial system and its role in the economy.
Analyse the various types of financial products and services and their functions.
Demonstrate an awareness of the current structure and regulations governing the Indian financial servic
Understanding of the process of investments and the relationship between risk and return.
Demonstrate an understanding of the securities market operations and the role of regulators.
Carry out a fundamental analysis of an industry and a company by using various techniques.

Demonstrate a familiarity of using technical analysis for evaluating securities.
Construct, evaluate and manage a portfolio.

Demonstrate an understanding of the role and importance of industrial relations in a country's development
Demonstrate an understanding of various legislations pertaining to labour, social security and labour welfare
Identify labour issues in a given situation and analyze them with respect to the legislations.
Explain the significance of compensation and enumerate the strategic choices.
Explain the factors affecting the pay levels and pay mix and design a pay package.
Describe the various components of employee benefits, its objectives and suitability.
Analyze and understand the various issues in designing compensation for special groups.
Demonstrate an understanding of strategic HRM and its influence on business strategy
Illustrate the linkage of business strategy with HR planning
Explain the significance of SHRM for gaining and sustaining competitive advantage
Explain cross-cultural HR issues in the context of international operations of a company.
Demonstrate an understanding of strategic HR issues faced by an organization in periods of turbulence and change
Demonstrate an understanding of the significance of Performance Management and explain the overall process
Elucidate and compare various strategies in implementing Performance Management.
Describe the linkage between Performance Management and Reward Systems.
Analyze the role of HR in Performance Management with a perspective on ethics
Demonstrate an understanding of theories, concepts and practices in IHRM.
Describe the approaches in international staffing and the training of the expatriates
Demonstrate an appreciation of the complexities, challenges and choices in international compensation
Identify and explain the leadership and cross-cultural issues in IHRM.
Design repatriation programs taking into consideration the complexities of the process.

Understand the concepts underlying the design of supply chain and its alignment to business objectives
Appreciate the importance of sourcing, network design and demand forecasting to enhance supply chain performance
Understand the role of logistics in enabling customer value delivery by the supply chain.
Awareness of current trends in Logistics and Supply Chains.
Demonstrate an understanding of the basic principles in Project Management.
Demonstrate an ability to plan, schedule, allocate resources and control the activities of a project.
Demonstrate a familiarity with Project Management tools to optimize time and resource utilization.
Demonstrate an understanding of concepts and contemporary tools necessary to effectively design and manage projects
Appreciate the role, importance and dimensions of service quality in delivering value to customers.
Demonstrate a familiarity with a few best practices of service organizations.
Demonstrate a critical understanding of the basic principles in MM.
Appreciate its linkages with other functions.
Applying tools which facilitate effective utilization of materials in organization
Understanding various tools and demonstrate running python with basic functions, conditions and loops
Understanding various functions in the NumPy and pandas packages
Apply python for data preparation, cleaning, transformation and aggregation
Perform exploratory data analysis using python
Apply necessary libraries to perform model building in python

Apply appropriate analytical methods to solve business problems in Marketing.
Apply appropriate analytical methods to solve business problems in Finance
Apply appropriate analytical methods to solve business problems in Operations
Apply appropriate analytical methods to solve business problems in HR
Demonstrate knowledge and critical understanding of analytics in different domains
Describe basic concepts of artificial intelligence and its applications in business.
Discuss various machine learning and deep learning techniques used for solving business problems.
Explain the basic NLP concepts and future application of AI in business.
Understand the futuristic implications of AI and approaches to promote ethical practices while developing AI.
Demonstrate developing simple artificial intelligence applications.
To get an idea about the history of Blockchain.
Understand key features, different types of platforms & languages of blockchain technology.
Students will be familiar with cryptocurrency concepts.
Understand the design principles of ethereum.
Learn about hyperledger fabric models and its architecture.
Appreciate the computational software's and techniques for handling big data in business applications.
Learn the concepts, data model and architecture of streams.
Understand core technical concepts related to Business Intelligence, Big Data Analytics along with Hadoop.
Learn the various applications in Big Data.
Understand the visualization techniques.

Understand the environment of the industry in which the company is operating and the position of the company in the industry.
Collaboratively identify an active or passive problem or need area/s in the company that can be investigated.
Identify secondary sources of information that have relevance to the problem identified through literature.
Work out an appropriate research plan to be used for investigation and implement the same.
Make recommendations to the company that have good probability of being implemented.
Generate a comprehensive professional research report that meets both the company's and academic requirements.
Make a professional presentation containing the essence of the project to a panel and provide answers to the queries.
To gauge how well the marketing efforts are performing.
To turn data into information
To ascertain what students may do differently in order to get successful productivity throughout various stages of the project.
To improve consumer profiling in order to boost profitability
Identify the various elements that are required to develop a detailed plan and strategy for a retail operation.
Demonstrate an understanding of consumer behaviour and decision-making processes with respect to retail operations.
Plan and design retail operations including interior and exterior atmospherics, merchandise management, and pricing.
Demonstrate an understanding of the role played by technology in retail operations

Understand the nuances of financial modeling and use Excel to build financial models
Analyze the financial statements of the company and linking it using a model
Develop technical skills to embark on any financial forecasting and capital budgeting decisions of the firm
Assess a firm's equity value using different valuation techniques.
Implement sensitivity and scenario analysis in finance using tools
Understand the need and importance to explore investor's behavioral biases that influence the stock market.
Appreciate the underlying theories and concepts explaining the nuances of behavioral finance.

Enables to develop appropriate Investment Portfolio and adopt Asset Allocation strategies by considering
Describe the inherent biases of managers and investors that affect the corporate decisions of the firm.

Explain the linkage between the environment, structure and strategy.
Enumerate the various factors affecting organizational design and their structural implications for management.
Explain the importance of culture and ethics in an organization and implications for practicing managers.
Develop a change management strategy for an organization and identify the appropriate OD interventions.
Demonstrate a knowledge on the organizational life cycle and managing innovation process.
Demonstrate an understanding of the need and importance of training and development in an organization.
Identify the training needs of an organization, choose appropriate training methods and design suitable training programs.
Explain the importance of various aspects of career management and its role in organization's growth.
Awareness of current developments in training tools and methods.

Demonstrate an understanding of the basic principles in TQM.
Application of quality philosophies and tools to facilitate continuous process improvement.
Appreciation of the current trends in quality management including six sigma methodology.

The students will be able to enhance the social media skills.
The students will be able to develop a mass communication strategy and guide campaigns.
To get an idea of social media policies.
Understand the fundamentals and concepts of web analytics.
How to effectively use the resulting insights to support website design decisions, campaign optimization.
Identify the data problem in a specific domain and define the scope of the problem.
Using BA / BI tools to visualize the data sets and build stories.
Identify the pain points and create business models.
Evaluate the created business model.
Present the knowledge and skills acquired from the data analysis.

d development, performance appraisal, compensation and Career Management.

LIST OF POs
PO1: Demonstrate a familiarity and understanding of principles and concepts in management.
PO2: Demonstrate knowledge of contemporary issues that have an impact on the business and industry.
PO3: Apply the relevant knowledge gained to read situations, analyze and solve business problems.
PO4: Ability to communicate effectively, to achieve organizational and individual goals.
PO5: Work in teams of diverse people to meet organizational goals.
PO6: Demonstrate leadership skills appropriate for managerial roles in organizations.
PO7: Identify and appreciate the ethical issues in management decision area.
PO8: Ability to pursue lifelong learning.

R2018 Common to all Branches-ODD SEM (Mech, CSE,IT, ECE,EEE, BME, Chemical, CIVIL)

Code	Course code	Course Name	CO code	Course Outcomes
C103	UPH1176	Engineering Physics	C103.1	Analyze crystal structures and the influence of imperfections on their properties.
			C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
			C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
			C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.
C108	UGS1197	Physics and Chemistry Lab	C108.1	Obtain basic Knowledge about physics concepts applied in optics, thermal physics and properties of matter.
			C108.2	Obtain basic knowledge in water quality parameters and to understand the principles and procedure for pH metry, Potentionmetry and conductometry

R2018-EVEN SEM

Code	Course code	Course Name	CO code	Course Outcomes
C121	UPH1254	Physics for Biomedical Engineering	C121.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.
			C121.2	Comprehend the basics of semiconductor physics and its application to simple devices like PN junction devices.
			C121.3	Understand magnetic and superconducting phenomena exhibited by materials and their applications to biomedical field.
			C121.4	Exemplify and identify the characteristics and limitations of biomedical imaging techniques based on sound, radiations and nuclear emissions.
			C121.5	Explain the properties and characteristics of biocompatible materials and how they have been tailored to realize different bio-functional devices
C123	UPH1251	PHYSICS FOR CIVIL ENGINEERING	C123.1	Gain knowledge on classical and quantum free electron theories and formation of energy band structures.
			C123.2	Acquire knowledge on magnetic and superconducting materials and their applications.
			C123.3	Acquire knowledge on applying illuminance principles to lighting and photo elastic testing method.
			C123.4	Gain knowledge on the effective design of building based on heating and cooling load requirements.
			C123.5	Understand the structure-property relationship of new materials and their realization in various domains.
C122	UPH1276	PHYSICS FOR INFORMATION SCIENCE	C122.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.
			C122.2	Acquire knowledge on basics of semiconductor physics and its application to PN junction devices.
			C122.3	Gain knowledge on magnetic properties of materials and their applications to data storage.
			C122.4	Relate the use of optical materials to display devices.
			C122.5	Understand quantum mechanics of nanostructures and their application to Nano electronics and Spintronics.

C124	UPH1277	PHYSICS FOR ELECTRONICS	C124.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.
			C124.2	Acquire knowledge on basics of semiconductor physics and its application to simple devices like PN junction devices.
			C124.3	Relate the magnetic and superconducting phenomena to their applications.
			C124.4	Demonstrate an understanding of dielectric materials, their operational limits and applications.
			C124.5	Understand the structure-property relationship of various nano and opto electronic materials and their realization in various domains.
C125	UPH1252	MATERIALS SCIENCE FOR MECHANICAL ENGINEERING	C125.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.
			C125.2	Acquire knowledge on basics of semiconductor physics and its application to simple devices like PN junction devices.
			C125.3	Relate the magnetic and superconducting phenomena to their applications.
			C125.4	Obtain knowledge on mechanical properties of materials and their measurement.
			C125.5	Understand the structure-property relationship of new materials and their realization in various domains.
C126	UPH1253	PHYSICS OF MATERIALS	C126.1	Gain knowledge on phase diagrams and various material processing methods,
			C126.2	Acquire knowledge on basics of conducting materials, superconductors and their applications
			C126.3	Get knowledge on the functioning of semiconducting materials and their applications
			C126.4	Understand the functioning of various dielectric and magnetic materials, have the necessary understanding on various advanced materials.

R2021 Common to all Branches -ODD SEM (Mech, CSE,IT, ECE,EEE, BME, Chemical, CIVIL)

Code	Course code	Course Name	CO code	Course Outcomes
C103	UPH2176	Engineering Physics	C103.1	Analyze crystal structures and the influence of imperfections on their properties.
			C103.2	Demonstrate and explain the general concepts of elastic and thermal properties of materials.
			C103.3	Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
			C103.4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
			C103.5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.
C108	UGS2197	Physics and Chemistry Lab	C108.1	Apply principles of elasticity, optical, electrical, and thermal properties for engineering applications.
			C108.2	To understand the principles and procedure for pH meter, Potentiometry and conductometry

R2021 EVEN SEM

Code	Course code	Course Name	CO code	Course Outcomes
C124	UPH2176	PHYSICS FOR INFORMATION SCIENCE AND TECHNOLOGY	C124.1	Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.
			C124.2	Acquire knowledge on basics of semiconductor physics and its application to PN junction devices.
			C124.3	Gain knowledge on magnetic properties of materials and their applications to data storage.
			C124.4	Relate the use of optical materials to display devices.

R2018 Common to all Branches-ODD SEM (Mech, CSE,IT, ECE,EEE, BME, Chemical, CIVIL)

Code	Course code	Course Name	CO code	Course Outcomes
C104	UCY1176	Engineering Physics	C103.1	Applying principles of chemistry to determine impurities present in water and their removal
			C103.2	On the properties of Alloys and some important polymers and issues related to polymers
			C103.3	Applying the principles of electrochemistry to corrosion and thermal analysis to construct phase diagram
			C103.4	Characteristics of different types of fuels and combustion
C108	UGS1197	Physics and Chemistry Lab	C108.1	Obtain basic Knowledge about physics concepts applied in optics, thermal physics and properties of matter.
			C108.2	Obtain basic knowledge in water quality parameters and to understand the principles and procedure for pH metry, Potentiometry and conductometry

R2021 Common to all Branches -ODD SEM (Mech, CSE,IT, ECE,EEE, BME, Chemical, CIVIL)

Code	Course code	Course Name	CO code	Course Outcomes
C104	UCY2176	Engineering Chemistry	C103.1	Explain the unique properties of nano-particles and their applications
			C103.2	Apply the principles of electrochemistry for quantitative analysis.
			C103.3	Detect/ identify various types of corrosion under normal to severe corrosive environments and provide different control measures for different types of corrosion applications
			C103.4	Construct phase diagram of a given system and analyse its properties for application purposes.
			C103.5	Explain the synthesis and properties of important industrial polymers.
C108	UGS2197	Physics and Chemistry Lab	C108.1	Apply principles of elasticity, optical, electrical, and thermal properties for engineering applications.
			C108.2	To understand the principles and procedure for pH meter, Potentiometry and conductometry

Department of Mathematics SSNCE

R2018-Department of Mathematics

Code	Course code	Course Name	CO Code	Course Outcomes
C101	UMA1176	ALGEBRA AND CALCULUS	C101.1	Obtain the expansion of trigonometric functions using De-Moivre's theorem.
			C101.2	Determine the Eigen values and Eigen vectors and diagonalize the given matrix.
			C101.3	Evaluate the circle of curvature, evolutes and envelope of a given curve.
			C101.4	Find Taylor's expansion for functions of two variables, solve problems using Jacobians and find the extreme points of a function of two variables.
			C101.5	Solve problems using beta and gamma functions and evaluate problems in double integral and triple integral.
C102	UMA1276	COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS	C102.1	Solve problems in Analytic functions and construction of analytic functions using C-R equations.
			C102.2	Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function.
			C102.3	Obtain the Laplace Transforms of standard functions.
			C102.4	Solve Differential Equations of Second order and Simultaneous linear equations with constant coefficients of first order using Laplace Transform.
			C102.5	Solve problems using divergence and curl and evaluate line, Surface and Volume integrals.
C201	UMA1376	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS	C201.1	Solve engineering problems using Fourier series.
			C201.2	Understand and solve partial differential equations of first and higher order.
			C201.3	Use Fourier series techniques to solve partial differential equations.
			C201.4	Apply Fourier transform techniques to solve some of the physical problems of engineering.
			C201.5	Apply Z - transform techniques to solve some of the physical problems of engineering.
C202	UMA1377	DISCRETE MATHEMATICS	C202.1	write simple proofs using Propositional and First Order Logics
			C202.2	solve problems using different counting techniques
			C202.3	prove simple graph properties.
			C202.4	explain basic concepts in group theory such as semigroups, monoids and groups.
			C202.5	solve problems in partial ordering relations, equivalence relations and lattices.
C203	UMA1351		C203.1	Solve the problems using the concepts of vector spaces, subspaces and linear transformation
			C203.2	Apply linear transformation to diagonalise a given matrix and hence to find the eigen values of the given matrix

Department of Mathematics SSNCE

		LINEAR ALGEBRA AND NUMERICAL METHODS	C203.3	Apply Gram-Schmidt's orthogonalization process to diagonalise a given matrix and to solve the given system of equations by least square approximations
			C203.4	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to the linear system of equations
			C203.5	Decompose the matrix using different methods such as QR and singular value decomposition
C204	UMA1451	NUMERICAL METHODS IN CIVIL ENGINEERING	C204.1	Introduce the basic concepts of empirical laws and curve fitting.
			C204.2	Introduce the numerical techniques of interpolation in various intervals in real life situations.
			C204.3	Understanding of numerical techniques of differentiation and integration with plays an important role in engineering and technology disciplines.
			C204.4	To solve ordinary differential equations.
			C204.5	To solve various types of partial differential equations.
C205	UMA1452	NUMERICAL METHODS (ELECTRICAL AND ELECTRONICS ENGINEERING)	C205.1	Understand the basic concepts and techniques of solving algebraic and transcendental equations.
			C205.2	Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations
			C205.3	Apply the numerical techniques of differentiation and integration for engineering problems.
			C205.4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
			C205.5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
C206	UMA1476	STATISTICS AND NUMERICAL METHODS	C206.1	Identify and apply the suitable testing of hypothesis under normal and t and F distribution.
			C206.2	Solve problems in analysis of variance.
			C206.3	Compute roots of nonlinear equations, solving the system of equations and finding the eigen values of matrix numerically.
			C206.4	Find interpolating polynomial and to perform numerical differentiation and numerical integration.
			C206.5	Solve numerical solution to ordinary differential equation using different techniques.
C207	UMA1477	PROBABILITY THEORY AND STOCHASTIC PROCESSES	C207.1	Identify standard distributions and apply them.
			C207.2	Solve problems in two dimension random variables and find the correlation between them.
			C207.3	Analyze different types of random processes.
			C207.4	Find the relation between Auto correlation function and Power density spectrum.
			C207.5	Find the response of random inputs to linear time

Department of Mathematics SSNCE

				invariant systems.
C208	UMA1478	PROBABILITY AND STATISTICS	C208.1	Identify standard distributions and apply them.
			C208.2	Solve problems in two dimension random variables and find the correlation between them.
			C208.3	Identify and apply the suitable testing of hypothesis under normal and t and F distribution.
			C208.4	Solve problems in analysis of variance.
			C207.5	Analyze quality control by applying control chart methods.

R2018 Program Outcomes:	
1.	Engineering knowledge: Acquire the knowledge of mathematics, science, engineering fundamentals, and electronics and communication engineering, with an ability to understand, analyze and apply to the solution of engineering problems.
2.	Problem analysis: Identify, formulate, research literature, analyze and solve electronics and communication engineering problems.
3.	Design/development of solutions: Design solutions for electronics and communication engineering problems with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	Conduct investigations of complex problems: Design and conduct experiments, analyze and interpret data, and synthesize information to provide valid conclusions.
5.	Modern tool usage: Apply appropriate techniques, resources, and modern hardware and software engineering tools to solve electronics and communication engineering problems.
6.	The engineer and society: Apply reasoning to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7.	Environment and sustainability: Demonstrate the understanding of the impact of the professional engineering solutions in societal and environmental contexts, and need for sustainable development.
8.	Ethics: Demonstrate the knowledge of professional and ethical responsibilities.
9.	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10.	Communication: Comprehend and communicate confidently and effectively in both verbal and written form.
11.	Project Management and Finance: Apply the engineering and management principles for efficient project management.
12.	Life-long Learning: Recognize the need and acquire confidence for independent and life-long learning.

Department of Mathematics SSNCE

R 2021-Department of Mathematics

Code	Course code	Course Name	CO Code	Course Outcomes
C101	UMA2176	MATRICES AND CALCULUS	C101.1	Reduce quadratic form to canonical form by orthogonal transformation and identify the nature of the quadratic form.
			C101.2	Analyse the convergence of a given infinite series
			C101.3	Find evolute of a given curve and envelope of family of curves
			C101.4	Find the extrema of function of two variables
			C101.5	Evaluate the double and triple integrals
C102	UMA2276	COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS	C102.1	solve problems in Analytic functions and construction of analytic functions using C-R equations
			C102.2	solve problems using integration techniques, find Taylor's and Laurent's Series expansions
			C102.3	obtain the Laplace Transforms and inverse transforms of standard functions.
			C102.4	solve Differential Equations using different techniques
			C102.5	evaluate Line, Surface and Volume integrals
C201	UMA2376	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS	C201.1	obtain Fourier series expansion of periodic functions.
			C201.2	solve the problems in partial differential equations.
			C201.3	able to solve initial and boundary value problems using Fourier series techniques.
			C201.4	obtain Fourier transform of various functions.
			C201.5	evaluate difference equations using Z- transform technique.
C202	UMA2377	DISCRETE MATHEMATICS	C202.1	write simple proofs using Propositional and First Order Logics
			C202.2	solve problems using different counting techniques
			C202.3	prove simple graph properties.
			C202.4	explain basic concepts in group theory such as semigroups, monoids and groups.
			C202.5	solve problems in partial ordering relations, equivalence relations and lattices.
C203	UMA2351	LINEAR ALGEBRA AND NUMERICAL METHODS	C203.1	identify and apply the suitable testing of hypothesis under normal, t and F-distribution.
			C203.2	solve problems in analysis of variance.
			C203.3	compute roots of nonlinear equations and to solve the system of equations numerically.
			C203.4	find interpolating polynomial and to perform numerical integration.
			C203.5	obtain numerical solution to ordinary differential equation using different techniques
		Statistics and Numerical Methods	C204.1	Compute roots of nonlinear equations, solving the system of equations and finding the eigenvalues of a matrix numerically.

Department of Mathematics SSNCE

C204	UMA2352	for Mechanical Engineering		
			C204.2	Find interpolating polynomial and to perform numerical integration.
			C204.3	Solve numerical solution to ordinary differential equation using different techniques.
			C204.4	Evaluate partial differential equations of first and higher order using numerical techniques.
			C204.5	Identify and apply the suitable testing of hypothesis under normal, t, F and chi squared distribution.
C205	UMA2353	LINEAR ALGEBRA AND NUMERICAL METHODS	C205.1	Solve the problems using the concepts of vector spaces, subspaces and linear transformation
			C205.2	Apply linear transformation to diagonalise a given matrix and hence to find the eigen values of the given matrix
			C205.3	Apply Gram-Schmidt's orthogonalization process to diagonalise a given matrix and to solve the given system of equations by least square approximations
			C205.4	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to the linear system of equations
			C205.5	Decompose the matrix using different methods such as QR and singular value Decomposition
C206	UMA2451	NUMERICAL METHODS FOR CHEMICAL ENGINEERING WITH PRACTICE	C206.1	Obtain the numerical solution of algebraic and transcendental equations with its applications to chemical engineering problems through software coding.
			C206.2	Find the interpolating polynomials and apply the techniques of regression in chemical engineering problems through software coding.
			C206.3	Solve and apply the numerical techniques of integration in chemical engineering problems.
			C206.4	solve first and second order ordinary differential equations numerically and through software coding.
			C206.5	find numerical solutions to boundary value problems in partial differential equations and obtain solution through software coding.
C207	UMA2452	PROBABILITY THEORY AND STOCHASTIC PROCESSES	C207.1	Represent graphs in terms of matrices and to explain the basic concepts in graph theory.
			C207.2	construct the minimal spanning tree of graphs
			C207.3	partition the vertex set in to colour classes
			C207.4	explain the concepts of digraphs and apply max-flow min-cut theorem
			C207.5	apply the graph theory concepts in real time problems.
C208	UMA2454	STATISTICS AND RANDOM PROCESSES	C208.1	identify standard distributions and apply them.
			C208.2	solve problems in two dimensional random variables and find the correlation between them.
			C208.3	study the concept of Random process, Stationary process and Markov process

Department of Mathematics SSNCE

			C208.4	: identify and apply the suitable testing of hypothesis under normal, t, F and chi square distribution
			C207.5	solve problems in analysis of variance
C209	UMA2455	PROBABILITY AND STATISTICS	C209.1	identify standard distributions and apply them.
			C209.2	solve problems in two dimensional random variables and find the correlation between them.
			C209.3	identify and apply the suitable testing of hypothesis under normal, t, F and chi square distribution
			C209.4	solve problems in analysis of variance.
			C209.5	analyze quality control by applying control chart methods.

R2021 Program Outcomes:	
1. Engineering knowledge: Acquire the knowledge of mathematics, science, engineering fundamentals, and electronics and communication engineering, with an ability to understand, analyze and apply to the solution of engineering problems.	
2. Problem analysis: Identify, formulate, research literature, analyze and solve electronics and communication engineering problems.	
3. Design/development of solutions: Design solutions for electronics and communication engineering problems with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	
4. Conduct investigations of complex problems: Design and conduct experiments, analyze and interpret data, and synthesize information to provide valid conclusions.	
5. Modern tool usage: Apply appropriate techniques, resources, and modern hardware and software engineering tools to solve electronics and communication engineering problems.	
6. The engineer and society: Apply reasoning to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	
7. Environment and sustainability: Demonstrate the understanding of the impact of the professional engineering solutions in societal and environmental contexts, and need for sustainable development.	
8. nEthics: Demonstrate the knowledge of professional and ethical responsibilities.	
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	
10. Communication: Comprehend and communicate confidently and effectively in both verbal and written form.	
11. Project Management and Finance: Apply the engineering and management principles for efficient project management.	
12. Life-long Learning: Recognize the need and acquire confidence for independent and life-long learning.	