Sri Sivasubramaniya Nadar College of Engineering

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

Regulation 2021

Curriculum and Syllabi for

B. Tech. Information Technology

SSN COLLEGE OF ENGINEERING

(An Autonomous Institution, Affiliated to Anna University Chennai)

B.E./ B.Tech. Degree Program

Department of Information Technology
(R2021)

VISION of the Institute

To be a world class institution for technical education and scientific research for public good.

MISSION of the Institute

1. Make a positive difference to society through education.
2. Empower students from across socio economic strata.
3. Be a centre of excellence in education in emerging technologies in accordance with industry and industrial trends.
4. Build world class research capabilities on par with the finest in the world and broaden students' horizons beyond classroom education.
5. Nurture talent and entrepreneurship and enable all-round personality development in students.

VISION of the Department

To be an outstanding center for IT education and research for betterment of society.

MISSION of the Department

1. Impart sound knowledge of IT domains to the students.
2. Nurture students to contribute to dynamic industrial needs.
3. Empower faculty with the knowledge in the emerging areas of IT.
4. Promote sustained research to build information systems for the benefit of society

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the B.Tech. Information Technology program will be able to

PEO1: Apply domain knowledge and skills of information technology to succeed in professional careers and/or higher studies

PEO2: Design and implement hardware and/or software-related engineering projects applying the principles and practices of computing, grounded in mathematics and science, to meet industrial & societal demands and/or productively engage in research

PEO3: Function in multi-disciplinary teams, by creatively solving problems and communicating effectively

PEO4: Contribute to society, by functioning ethically and responsibly, and involving in professional and social activities for sustainable developments

PROGRAM OUTCOMES (POs)

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 analyse 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 modelling to complex engineering activities with an understanding of the limitations.

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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Understand, analyse, and design software intensive systems by applying knowledge of mathematical and algorithmic techniques, solution processes and architectures, and integrating modules that address larger social and professional concerns and are deployable in a production environment.

PSO2: Design, develop and deploy smart software intensive solutions based on cumulative knowledge acquired in thrust areas such as artificial intelligence, IoT, data analytics, cloud computing and cyber security, and by selecting appropriate IT tools, to create sustainable and scalable IT solutions to complex engineering problems.

PEOs Mapping with POS and PSOs

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	3	3	2	3	1	1	1	2	2	2	3	3	3
PEO2	3	3	3	3	3	1	1	1	2	2	2	3	3	3
PEO3	1	1	1					2	3	3	3	2	2	2
PEO4						3	3	3	2	2	1	1	1	1

CO-PO-PSO Mapping

Course	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
SEMESTER I														
Technical English									2	3		2		
Matrices and Calculus	3	3											1	
Engineering Physics	3	2	1											
Engineering Chemistry	3	2	1											
Problem Solving and Programming in Python	2	2	2	1										
Engineering Graphics	3	2	2			2				3				
Programming in Python Lab	3	3		1				1	3	2				
Physics and Chemistry Lab	3													
SEMESTER II														
Complex Functions and Laplace Transforms	3	3										1		
Basic Electrical and Electronics Engineering	3	2	1		2	1						1	1	1
Programming and Data Structures (TCP - EFP)	2	2.14	1.66		2				2.5	3	1.5	1	2	
Environmental Science (Non-credit)	3	2	1											
Physics for Information Science and Technology														
Design Thinking and Engineering Practices Lab	2	1	1		1			3						
SEMESTER III														
Discrete Mathematics	2	1	1									1		
Universal Human Values	2	1	1		1								2	
Programming and Design Patterns	2.2	2.2	1.6	1	1				1				1.66	
Database Technology	3	2.75	2	1	1				1				2	
Digital Logic and Computer Organization	2	1	1										1	
Introduction to Digital Communication	2	1	1		1								2	
Database Technology Lab	2	1.75	2	3	2				2	3		2	2	1
Programming and Design Patterns Lab	1	1.6	1						2	1.8			1.6	
SEMESTER IV														
Probability and Statistics	2.5	2	1.66	1	2								3	
Microprocessor and Microcontroller	2.8	1.83	1.8						3	3	2	1.66	3	
Indian Constitution (Non-credit)	2.4	1.8				2	3	3				1	1	
Advanced Data Structures and Algorithm Analysis	2	1.2	1									1	1.6	
Data Communication and Networks	2.5	2	1.66	1	2								3	
Automata Theory and Compiler Design	2.8	1.83	1.8						3	3	2	1.66	3	

Course	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
Network Programming Lab	2	1.33		2	1								1	
Digital Systems and Microprocessor Lab	3	2	1	1					2				2.6	
SEMESTER V														
Principles of Software Engineering and Practices	1	1.4	1	1		3			1	1.5	1.33		2.4	
Data Analytics and Visualization	3	2.25	2	3	2				1	3		3	3	3
Principles of Operating Systems	3	2	1									1	1	
Artificial Intelligence	2.66	2	1.66										2.66	2
Software Development Project - II	1.33	1.66	1.4	1.75	1				1.66	2.5	1.25	3	2.75	1.4
Operating Systems Practices Lab	2.8	2.6	1.8						2	2.25		1.8	3	
SEMESTER VI														
Pattern Recognition and Machine Learning	3	2	1.75	1	1				3	3		2	2.75	2.25
Web Programming	1.83	1.8	1		1	3			1			1	1.6	1.5
Internet of Things and C programming	2.25	1.6	1		1.5	2			2	2		2	1.8	3
Mobile Application Development Lab	3	2.33	1.66		3			2		1		1	2.33	2
SEMESTER VII														
Network and Communication Security	1.6	3	1.2			3		3					2.6	2
Cloud and Distributed Computing	2	2	1	1	1.66							1	1	2
Industrial Training /Internship*	3	2.5	2	2.6	3	3	3	3	1.71	3	3	3	2.6	3
Project Work – Phase 1	2	3	1.66	3	2	3	3		1	3	3	2.66	3	2.2
SEMESTER VIII														
Project Phase II	3	2.5	2	2.6	3	3	3	3	1.71	3	3	3	2.6	3
PROFESSIONAL ELECTIVES														
Information Theory and Applications	3	1.25		1									2	
Optimization Techniques for Machine Learning	2.75	1.5	1	1									2	2
Data Warehousing and Data Mining	2	2.5	2.75		2.25								2.75	2
Cyber Security	1.25	2.25	1		2							1	1	2
Sensors and Actuators	2	2.25	1	1						2		1	1.5	2
Software Architecture and Principles	1.66	2	2	1			2		1.5	1.5	1.25	2	1	
Computer Graphics and Multimedia	2	1		1	1.83					1			1	
Electronic Devices and Circuits	2.2	2	1	1						2		1	1	
Signals, Systems and Applications	3	1	1	1						2		1	1.25	
Advanced Artificial Intelligence Techniques	2.8	1.4	1	1.8	1.75								1.6	2
Business Analytics	2	2	1	2	2		2	2		2		1	1.4	2

Course	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
Software Quality Assurance	1.33	1.4	1	1	1.25								1	1
Block Chain Technologies	3	2.5	2	1.5	2.33		2	2		2		1	2	2.25
Control Systems	3	2	1	1						2		1	1	
Introduction to AR/VR/MR/XR	3	1.66	1.5	2	1.66	2						2	2.33	
Deep Learning Concepts and Architectures	1.8	2	1	2	1	2				2		1	1	2
Bio-inspired Optimization Techniques	1.66			1	1					3		2	2	3
Big Data Management	2	1.5	1	1	1.5					1		1	2	2
Software Project Management	1.8	1.33	1	1.66	1							1	1	2
Information Privacy	1.33	1.5	1.25		1	3	2	3					1.5	2.33
Software Defined Networks	1	1	1	1	1							1	1	2
Video: Editing, Production, and Cinematography	1	1.4	2	1.6	3	3			2			1	1	
Natural Language Processing	2	2	2	3	2					2		3	2	2
Image Processing and Computer Vision	3	3	2	3	3								2.4	2
Healthcare Analytics	2	1.66	2	2	2							1	1.33	2
Microservices and DevOps	1.2	2	1.8	1	1.6						1.4	1.5		2
Cyber Forensics and Information Security	2	1	1		3	3				2		1		2
IOT Architectures and Applications	2.2	2.4	1	2	3				1	2.2		1	1.8	3
3D Modeling, Rendering, Animation, and Motion Graphics	1	2		2	2								1	
Text Analysis	2.66	2.6	3	3	2	2				2		3	2.33	2
Image and Video Analysis	3	3	2	3	3								2.4	2
Social Network Analysis	2	2	1	2	1					2				2
Full Stack Development	1.25	1.5	1.33	1	2.33						2.5			2.66
Ethical Hacking	2	1	1		2	3		3				1		2
Real Time Embedded Systems	3	3	3	3	3								3	3
Emerging Technologies for AR/VR/MR/XR	3	1.5	1.33	1.66	2.5	2				1		2	2.25	
Reinforcement Learning	3	2	1.75	1	1				3	3		2	2.75	2.25
Speech Technology	3	2	1.66	2	3				1	3		3	2.5	2.5
Forensic Analytics	2	1.5	2	1	2							1	1.75	2
Human Computer Interaction	1.6	1	1.6						1	1.2	1		1.6	
FinTech Security	2	1	1		2	2.8		3		2		1		2
Mobile Autonomous Robots	3	3	3	3	3		2						3	3
User Experience and Interaction Design for AR/VR/MR/XR	1.25	1.33	1	1	2.33							1	1.25	
OPEN ELECTIVES														
Fundamentals of AR and VR	3	1.66	1.5	2	1.66	2						2	2.33	

Course	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
Databases and Applications Development	2	1.5	1.33		2				2				1	1
Introduction to Artificial Intelligence	2.2	1.8	1	1.5	1								2	2
Introduction to Data Structures and Algorithms	2	1.75	1										2	
Introduction to Object-Oriented Programming and Patterns	2	2.6	1.6	1									1	
Introduction to Data Science	2.8	1.2	1	2	1.25							1	1.6	2
Introduction to Cyber Security	1.16	1.6	1		1.83		2	3					1.16	2
Introduction to Software Engineering	1	1.4	1	1		3			1	1.4	1.25		2.5	
IoT Architectures and Programming	2.2	2	1.6	2.33	3	3	2				1	1	2.2	2.8
Introduction to Deep Learning	2				1				2	2		1		2
Introduction to Machine Learning	1.8	1			1					3		2	2	3
Web services and DevOps	1	2.33	1.4	1.8	1.4			1.5	1.33		1	1	1	2
Management I Electives														
Principles of management					3				2	2	2	1		
Total quality management					2	3	2	2	1		1	1		
Work ethics, Corporate social responsibility and Governance						3	2	3	1	1	3	2		
Humanities I Electives														
Language and Communication									2	3		2	1	1
Fundamentals of Linguistics									2	3		2	1	1
Film Appreciation									2	3		2	1	1
Human relations at work						2		2	3	2		2	1	1
Application of Psychology in everyday life						2		2	3	2		2	1	1
Understanding Society and Culture through Literature									2	3		2	1	1

SUSTAINABLE DEVELOPMENT GOALS (SDG)

SDG		Description
SDG1	No Poverty	End poverty in all its forms everywhere
SDG 2	Zero Hunger	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
SDG 3	Good health and well being	Ensure healthy lives and promote well-being for all at all ages
SDG 4	Quality education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
SDG 5	Gender Equality	Achieve gender equality and empower all women and girls
SDG 6	Clean water and sanitation	Ensure availability and sustainable management of water and sanitation for all
SDG 7	Affordable and clean energy	Ensure access to affordable, reliable, sustainable and modern energy for all
SDG 8	Decent work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
SDG 9	Industry, Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation
SDG 10	Reducing Inequality	Reduce income inequality within and among countries
SDG 11	Sustainable cities and communities	Make cities and human settlements inclusive, safe, resilient, and sustainable
SDG 12	Responsible consumption and production	Ensure sustainable consumption and production patterns
SDG 13	Climate action	Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy
SDG 14	Life below water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
SDG 15	Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
SDG 16	Peace, justice and string Institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
SDG 17	Partnerships for the goals	Strengthen the means of implementation and revitalize the global partnership for sustainable development

MAPPING OF SUBJECT RELEVANT TO SDG

	Sustainable Development Goals																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Technical English				✓													
Matrices and Calculus				✓													
Engineering Physics				✓													
Engineering Chemistry				✓													
Problem Solving and Programming in Python				✓													
Engineering Graphics				✓													
Programming in Python Lab				✓													
Physics and Chemistry Lab				✓													
Complex Functions and Laplace Transforms				✓													
Basic Electrical and Electronics Engineering				✓													
Programming and Data Structures (TCP - EFP)				✓													
Environmental Science (Non-credit)			✓	✓		✓	✓						✓	✓	✓		
Physics for Information Science and Technology				✓													
Design Thinking and Engineering Practices Lab				✓													
Discrete Mathematics				✓													
Universal Human Values			✓	✓						✓							
Programming and Design Patterns				✓													
Database Technology				✓					✓								
Digital Logic and Computer Organization				✓					✓								
Introduction to Digital Communication				✓													
Database Technology Lab				✓					✓								
Programming and Design Patterns Lab				✓					✓								
Probability and Statistics				✓													
Microprocessor and Microcontroller				✓					✓								
Essence of Indian Traditional Knowledge / Indian Constitution				✓													

	Sustainable Development Goals																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Advanced Data Structures and Algorithm Analysis				✓					✓								
Data Communication and Networks				✓					✓		✓						
Automata Theory and Compiler Design				✓					✓								
Network Programming Lab				✓					✓								
Digital Systems and Microprocessor Lab				✓					✓								
Principles of Software Engineering and Practices				✓													
Data Analytics and Visualization				✓					✓								
Principles of Operating Systems				✓													
Artificial Intelligence				✓					✓		✓						
Software Development Project – II				✓					✓								
Operating Systems Practices Lab				✓					✓								
Pattern Recognition and Machine Learning				✓					✓								
Web Programming				✓													
Internet of Things and C programming				✓		✓											
Mobile Application Development Lab				✓					✓								
Network and Communication Security				✓	✓				✓		✓						
Cloud and Distributed Computing				✓					✓		✓						
Industrial Training /Internship*				✓													✓
Project Work – Phase 1				✓	✓			✓	✓		✓				✓		
Project Phase II				✓	✓			✓	✓		✓				✓		
Information Theory and Applications				✓					✓								
Optimization Techniques for Machine Learning				✓					✓		✓						
Data Warehousing and Data Mining				✓					✓		✓						
Cyber Security				✓	✓						✓						
Sensors and Actuators				✓					✓		✓						
Software Architecture				✓							✓						

	Sustainable Development Goals																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
and Principles																	
Computer Graphics and Multimedia				✓													
Electronic Devices and Circuits				✓			✓				✓	✓					
Signals, Systems and Applications				✓							✓						
Advanced Artificial Intelligence Techniques				✓							✓						
Business Analytics				✓													
Software Quality Assurance				✓					✓		✓						
Block Chain Technologies				✓					✓		✓						
Control Systems				✓					✓		✓						
Introduction to AR/VR/MR/XR				✓							✓						
Deep Learning Concepts and Architectures				✓							✓						
Bio-inspired Optimization Techniques				✓													
Big Data Management				✓					✓		✓						
Software Project Management				✓													
Information Privacy				✓	✓				✓		✓						
Software Defined Networks				✓					✓								
Video: Editing, Production, and Cinematography				✓							✓						
Natural Language Processing				✓							✓						
Image Processing and Computer Vision				✓					✓		✓						
Healthcare Analytics				✓					✓		✓						
Microservices and DevOps				✓													
Cyber Forensics and Information Security				✓	✓				✓		✓						
IOT Architectures and Applications				✓		✓			✓		✓						
3D Modeling, Rendering, Animation, and Motion Graphics				✓							✓						
Text Analysis				✓													
Image and Video				✓					✓		✓				✓		

	Sustainable Development Goals																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Analysis																	
Social Network Analysis				✓	✓				✓		✓	✓					
Full Stack Development				✓							✓						
Ethical Hacking				✓	✓				✓								
Real Time Embedded Systems				✓					✓		✓						
Emerging Technologies for AR/VR/MR/XR				✓					✓		✓						
Reinforcement Learning				✓					✓		✓						
Speech Technology				✓					✓								
Forensic Analytics				✓	✓				✓		✓						
Human Computer Interaction				✓					✓		✓						
FinTech Security				✓					✓		✓						
Mobile Autonomous Robots				✓					✓		✓						
User Experience and Interaction Design for AR/VR/MR/XR				✓					✓		✓						
Language and Communication				✓				✓									
Fundamentals of Linguistics				✓				✓									
Film Appreciation																	
Human relations at work				✓	✓			✓			✓						
Application of Psychology in everyday life				✓							✓						
Understanding Society and Culture through Literature				✓							✓						
Principles of management			✓	✓	✓												
Total quality management			✓	✓	✓				✓								
Work ethics, Corporate social responsibility and Governance	✓	✓	✓	✓	✓			✓		✓							

I to VIII semesters Curriculum (Choice Based Credit System)

	SEMESTER I								
S. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**EL**	**C**
	THEORY								
1	UEN2176	Technical English	HS	4	2	0	2	0	3
2	UMA2176	Matrices and Calculus	BS	4	3	1	0	0	4
3	UPH2176	Engineering Physics	BS	3	3	0	0	0	3
4	UCY2176	Engineering Chemistry	BS	3	3	0	0	0	3
5	UGE2176	Problem Solving and Programming in Python	ES	3	3	0	0	0	3
6	UGE2177	Engineering Graphics	ES	5	1	0	4	0	3
	PRACTICALS								
7	UGE2197	Programming in Python Lab	ES	3	0	0	3	0	1.5
8	UGS2197	Physics and Chemistry Lab	BS	3	0	0	3	0	1.5
			TOTAL	**28**	**15**	**1**	**12**	**0**	**22**

	SEMESTER II								
S.No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**EL**	**C**
	THEORY								
1	UMA2276	Complex Functions and Laplace Transforms	BS	4	3	1	0	0	4
2	UEE2276	Basic Electrical and Electronics Engineering	ES	3	3	0	0	0	3
3	UIT2201	Programming and Data Structures	ES	5	3	0	2	0	4
4	ACY2276	Environmental Science	MC*	3	3	0	0	0	0
5		Humanities I Elective	HS	4	2	0	2	0	3
6	UPH2251	Physics for Information Science and Technology	BS	3	3	0	0	0	3
	PRACTICALS								
7	UGE2297	Design Thinking and Engineering Practices Lab	ES	3	0	0	3	0	1.5
8	UIT2211	Software Development Project – I	ES	3	0	0	3	0	1.5
		TOTAL		**28**	**17**	**1**	**10**	**0**	**20**

*Non credit

	SEMESTER III								
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**EL**	**C**
	THEORY								
1	UMA2377	Discrete Mathematics	BS	4	3	1	0	0	4
2	UHS2376	Universal Human Values 2: Understanding Harmony	HS	4	2	0	2	0	3
3	UIT2301	Programming and Design Patterns	ES	3	3	0	0	0	3
4	UIT2302	Database Technology	PC	3	3	0	0	0	3
5	UIT2304	Digital Logic and Computer Organization	PC	3	3	0	0	0	3
6	UIT2305	Introduction to Digital Communication	ES	3	3	0	0	0	3
	PRACTICALS								
7	UIT2311	Database Technology Lab	PC	3	0	0	3	0	1.5
8	UIT2312	Programming and Design Patterns Lab	ES	3	0	0	3	0	1.5
TOTAL				**26**	**17**	**1**	**8**	**0**	**22**

	SEMESTER IV								
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**EL**	**C**
	THEORY								
1	UMA2476	Probability and Statistics	BS	4	3	1	0	0	4
2	UIT2401	Microprocessor and Microcontroller	PC	3	3	0	0	0	3
3	AHS2476	Indian Constitution	MC*	3	3	0	0	0	0
4	UIT2402	Advanced Data Structures and Algorithm Analysis	PC	8	3	0	2	3	5
5	UIT2403	Data Communication and Networks	PC	3	3	0	0	0	3
6	UIT2404	Automata Theory and Compiler Design	PC	3	3	0	0	0	3
	PRACTICALS								
7	UIT2411	Network Programming Lab	PC	3	0	0	3	0	1.5
8	UIT2412	Digital Systems and Microprocessor Lab	PC	3	0	0	3	0	1.5
TOTAL				**30**	**18**	**1**	**8**	**3**	**21**

*Non credit

	SEMESTER V								
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**EL**	**C**
	THEORY								
1	UIT2501	Principles of Software Engineering and Practices	PC	3	3	0	0	0	3
2	UIT2502	Data Analytics and Visualization	PC	5	3	0	2	0	4
3	UIT2503	Principles of Operating Systems	PC	3	3	0	0	0	3
4	UIT2504	Artificial Intelligence	PC	3	3	0	0	0	3
5		Professional Elective I	PE	3	3	0	0	0	3
6		Management Elective	HS	3	3	0	0	0	3
	PRACTICALS								
7	UIT2511	Software Development Project – II	PC	3	0	0	3	0	1.5
8	UIT2512	Operating Systems Practices Lab	PC	3	0	0	3	0	1.5
TOTAL				**26**	**18**	**0**	**8**	**0**	**22**

	SEMESTER VI								
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**EL**	**C**
	THEORY								
1	UIT2601	Pattern Recognition and Machine Learning	PC	5	3	0	2	0	4
2	UIT2602	Web Programming	PC	8	3	0	2	3	5
3	UIT2603	Internet of Things and C programming	PC	5	3	0	2	0	4
4		Professional Elective II	PE	3	3	0	0	0	3
5		Open Elective I	OE	3	3	0	0	0	3
	PRACTICALS								
6	UIT2611	Mobile Application Development Lab	PC	4	0	0	4	0	2
TOTAL				**28**	**15**	**0**	**10**	**3**	**21**

	SEMESTER VII								
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**EL**	**C**
	THEORY								
1	UIT2701	Network and Communication Security	PC	3	3	0	0	0	3
2	UIT2702	Cloud and Distributed Computing	PC	4	2	0	2	0	3
3		Professional Elective III	PE	3	3	0	0	0	3
4		Professional Elective IV	PE	3	3	0	0	0	3
5		Professional Elective V	PE	3	3	0	0	0	3
	PRACTICALS								
7	UIT2718	Project Work – Phase 1	EEC	9	0	0	0	9	3
8	UIT2716	Industrial Training /Internship*	EEC	0	0	0	0	0	2
TOTAL				**25**	**14**	**0**	**2**	**9**	**20**

* The students will undergo 4 weeks Industrial training / Internship during previous vacation.

	SEMESTER VIII								
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**EL**	**C**
	THEORY								
1		Professional Elective VI	PE	3	3	0	0	0	3
`2		Open Elective II	OE	3	3	0	0	0	3
	PRACTICALS								
3	UIT2818	Project Work – Phase 2	EEC	24	0	0	0	24	8
TOTAL				**30**	**6**	**0**	**0**	**24**	**14**

Total No of Credits: 162

Summary

Semester	HS	BS	ES	PC	PE	OE	EEC	MC*	TOTAL
I	**3**	**11.5**	**7.5**						**22**
II	**3**	**7**	**10**					**0**	**20**
III	**3**	**4**	**7.5**	**7.5**					**22**
IV		**4**		**17**				**0**	**21**
V	**3**			**16**	**3**				**22**
VI				**15**	**3**	**3**			**21**
VII				**6**	**9**		**5**		**20**
VIII					**3**	**3**	**8**		**14**
Total SSN-R2021	**12**	**26.5**	**25**	**61.5**	**18**	**6**	**13**	**0**	**162**

*****Non credit

HSMC – Electives –Humanities I (II semester)

S. No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	UEN2241	Language and Communication	3	3	0	0	3
2	UHS2244	Fundamentals of Linguistics	3	3	0	0	3
3	UEN2244	Film Appreciation	3	3	0	0	3
4	UHS2241	Human relations at work	3	3	0	0	3
5	UHS2245	Application of Psychology in everyday life	3	3	0	0	3
6	UHS2242	Understanding Society and Culture through Literature	3	3	0	0	3

HSMC – Electives –Management (V semester)

S. No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	UBA2541	Principles of Management	3	3	0	0	3
2	UBA2542	Total quality Management	3	3	0	0	3
3	UBA2543	Work Ethics, Corporate Social Responsibility, and Governance	3	3	0	0	3

Professional Elective I (V semester)

S. No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	UIT2521	Information Theory and Applications	3	3	0	0	3
2	UIT2522	Optimization Techniques for Machine Learning	3	3	0	0	3
3	UIT2523	Data Warehousing and Data Mining	3	3	0	0	3
4	UIT2524	Cyber Security	3	3	0	0	3
5	UIT2525	Sensors and Actuators	3	3	0	0	3
6	UIT2526	Software Architecture and Principles	3	3	0	0	3
7	UIT2527	Computer Graphics and Multimedia	4	2	0	2	3
8	UEE2303	Electronic Devices and Circuits	3	3	0	0	3

Professional Elective II (VI semester)

S. No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	UIT2621	Signals, Systems and Applications	3	3	0	0	3
2	UIT2622	Advanced Artificial Intelligence Techniques	4	2	0	2	3
3	UIT2623	Business Analytics	4	2	0	2	3
4	UIT2624	Software Quality Assurance	3	3	0	0	3
5	UIT2625	Block Chain Technologies	3	3	0	0	3
6	UIT2626	Control Systems	3	3	0	0	3
7	UIT2627	Introduction to AR/VR/MR/XR	3	3	0	0	3

Professional Elective III (VII semester)

S. No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	UIT2721	Deep Learning Concepts and Architectures	4	2	0	2	3
2	UIT2722	Bio-inspired Optimization Techniques	4	2	0	2	3
3	UIT2723	Big Data Management	4	2	0	2	3
4	UIT2724	Software Project Management	3	3	0	0	3
5	UIT2725	Information Privacy	3	3	0	0	3
6	UIT2726	Software Defined Networks	3	3	0	0	3
7	UIT2727	Video: Editing, Production, and Cinematography	4	2	0	2	3

Professional Elective IV (VII semester)

S. No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	UIT2728	Natural Language Processing	4	2	0	2	3
2	UIT2729	Image Processing and Computer Vision	4	2	0	2	3
3	UIT2731	Healthcare Analytics	4	2	0	2	3
4	UIT2732	Microservices and DevOps	4	2	0	2	3
5	UIT2733	Cyber Forensics and Information Security	4	2	0	2	3
6	UIT2734	IOT Architectures and Applications	4	2	0	2	3
7	UIT2735	3D Modeling, Rendering, Animation, and Motion Graphics	4	2	0	2	3

Professional Elective V (VII semester)

S. No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	UIT2736	Text Analysis	4	2	0	2	3
2	UIT2737	Image and Video Analysis	4	2	0	2	3
3	UIT2738	Social Network Analysis	4	2	0	2	3
4	UIT2739	Full Stack Development	4	2	0	2	3
5	UIT2741	Ethical Hacking	4	2	0	2	3
6	UIT2742	Real Time Embedded Systems	4	2	0	2	3
7	UIT2743	Emerging Technologies for AR/VR/MR/XR	4	2	0	2	3

Professional Elective VI (VIII semester)

S. No.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	UIT2821	Reinforcement Learning	4	2	0	2	3
2	UIT2822	Speech Technology	4	2	0	2	3
3	UIT2823	Forensic Analytics	4	2	0	2	3
4	UIT2824	Human Computer Interaction	4	2	0	2	3
5	UIT2825	FinTech Security	4	2	0	2	3
6	UIT2826	Mobile Autonomous Robots	4	2	0	2	3
7	UIT2827	User Experience and Interaction Design for AR/VR/MR/XR	4	2	0	2	3

Appendix: Elective Baskets

I. Artificial Intelligence and Machine Learning

(This will be offered as Honours Track as well)

1) Information Theory and Applications
2) Optimization Techniques for Machine Learning
3) Digital Signal Processing
4) Advanced Artificial Intelligence Techniques
5) Bio-inspired Optimization Techniques
6) Deep Learning Concepts and Architectures
7) Natural Language Processing
8) Text Analysis
9) Image Processing and Computer Vision
10) Image and Video Analysis
11) Reinforcement Learning
12) Speech Processing and Synthesis

II. Internet of Things

1) Electronic Devices and Circuits
2) Sensors and Actuators
3) Control Systems
4) Software Defined Networks
5) IoT Architectures and Programming
6) Real-time Embedded Systems
7) Mobile Autonomous Robots

III. Data Management and Analysis

1) Data Warehousing and Data Mining
2) Business Analytics
3) Big Data Management
4) Healthcare Analytics
5) Social Network Analysis
6) Forensic Analytics

IV. Engineering Scalable Systems

1) Software Architecture
2) Software Quality Assurance
3) Software Project Management
4) Microservices and DevOps
5) Full Stack Development
6) Human Computer Interaction

V. Information Security

1) Cyber Security
2) Block Chain Technologies
3) Information Privacy
4) Cyber Forensics and Information Security
5) Ethical Hacking
6) Fintech Security

VI. Augmented/Virtual/Mixed/Extended Reality

1) Computer Graphics and Multimedia
2) Introduction to AR/VR/MR/XR
3) Video: Editing, Production, and Cinematography
4) 3D Modeling, Rendering, Animation, and Motion Graphics
5) Emerging Technologies for AR/VR/MR/XR
6) User Experience and Interaction Design for AR/VR/MR/XR

COURSECODE	COURSETITLE	L	T	P	C
UEN2176	TECHNICAL ENGLISH	2	0	2	3

OBJECTIVES:

- To enhance competence in reading comprehension for Science and Technology.
- To improve the writing proficiency specific to proposals, reports, and letters.
- To develop speaking skills for technical presentations, GDs and public speaking.
- Tostrengthenthelisteningskillsofthestudentstoenablethemtolistenandcomprehendlecturesandtalks.
- To strengthen the grammatical competency

UNIT 1 BASICS OF COMMUNICATION 9

Language development:	Subject-Verb Agreement, Tenses(simple), Conjunctions, Numerical adjective
Vocabulary development:	Root words–Prefixes &Suffixes, Standard abbreviations
Reading:	Comprehension of short technical texts-skimming and scanning,
Writing:	Describing an object, the process of an event/experiment and others, Paragraph Writing.
Listening:	Listening for taking notes and seeking clarifications (classroom lectures/tedtalks etc.),
Speaking:	Self-introduction and introducing others/short conversations informal and informal contexts

UNIT 2 MAKING PRESENTATIONS 9

Language development:	The pronouns-antecedent agreement, Tenses-continuous, If conditionals, Adverbs
Vocabulary development:	Collocations and fixed expressions, Avoidance of Jargons
Reading:	Comprehension of longer texts–(Interpretative and Critical levels of meaning),
Writing:	Writing definitions (single sentence and extended), Expository and Persuasive Essays,
Listening:	Listening Comprehension Tasks,
Speaking:	Making technical presentations

UNIT 3 LISTENING TO SPEAK 9

Language development:	Prepositions, Tenses-perfect, Articles, Embedded sentences,
Vocabulary development:	Compound words, Formal and informal vocabulary,
Reading:	Reading reviews, advertisements, SOPs for higher studies
Writing:	Writinginstructionandrecommendations,formalandinformalletters/emails,Writing SOPs
Listening:	Listening to longer technical talks and discussion
Speaking:	Demonstrating working mechanisms

UNIT 4 READING FOR SPEAKING 9

Language development:	Reported speech, Active and Passive voices, Framing 'Wh' and 'Yes' or 'No' questions,
Vocabulary development:	Technical vocabulary, Verbal analogies,
Reading:	Reading industrial case studies, interpreting technical text and making notes
Writing:	Interpreting charts and graphs, writing blogs and vlogs
Listening:	Listening to telephonic conversations and online interviews
Speaking:	Participating in group discussions

UNIT5 PROFESSIONAL NEEDS 9

Language development:	Phrasal verbs, clauses, compound and complex sentences
Vocabulary development:	Single-word substitutes, Vocabulary retention strategies,
Reading:	Reading for IELTS, GER, TOEFL
Writing:	Writing proposals and- reports, writing minutes of the meeting,
Listening:	Listening Skills for Proficiency Tests like IELTS
Speaking:	Job Interviews (face to face and online)–basics

TOTAL HOURS: 45

TEXTBOOK:

- Praveen Sam,D.and Shoba N,A., Course in Technical English, Cambridge University Press, NewDelhi,2020.

REFERENCES:

- Sudharshana, N.P., and Saveetha, C., English for Technical Communication, Cambridge University Press, New Delhi,2016.
- Raman, Meenakshi, Sharma, and Sangeetha, Technical Communication Principles and practice, Oxford University Press, New Delhi,2014.
- Kumar, Suresh,E.,EngineeringEnglish,OrientBlackswan,Hyderabad,2015.
- BoothL. Diana, Project Work, Oxford University Press,2014.
- Grussendorf, Marion, English for Presentations, Oxford UniversityPress,2007.
- Means,L.Thomas and Elaine Langlois, English & Communication For + Colleges, Cengage Learning, USA, 2007.

COURSEOUTCOMES:

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

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											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	-	-	-	-	-	-	2	3	-	2
CO2	-	-	-	-	-	-	-	-	2	3	-	2
CO3	-	-	-	-	-	-	-	-	2	3	-	2
CO4	-	-	-	-	-	-	-	-	2	3	-	2
CO5	-	-	-	-	-	-	-	-	2	3	-	2

COURSE CODE	COURSE TITLE	L	T	P	C
UMA 2176	**MATRICESAND CALCULUS (Common to all B.E./B. Tech. degree programs)**	**3**	**1**	**0**	**4**

OBJECTIVES:

The objective of this course is to enable the student to

- To reduce quadratic form to canonical form of a matrix and identify its nature
- To analyse the convergence of infinite series
- To study the concept of evolute and envelope
- To find the extreme values for a function of two variables
- To compute area of closed surface and volume of solids using multiple integrals

UNIT I MATRICES 12

Characteristic equation - Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors, Cayley-Hamilton Theorem – statement and applications, Diagonalization of matrices – Similarity transformation - Quadratic form - Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II SEQUENCES AND SERIES 12

Sequences - Definition and examples, Series - Types of Convergence, Series of positive terms, Tests of convergence - Comparison test, Integral test and D'Alembert's ratio test, Alternating series – Leibnitz's test, Series of positive and negative terms, Absolute and conditional convergence.

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 12

Curvature, radius of curvature - Cartesian and parametric co-ordinates – Centre of curvature – Circle of curvature in Cartesian form, Evolutes, Envelopes (including two parameter family), Evolute as envelope of normal.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and its properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integrals in Cartesian and polar coordinates – Change of order of integration, Area enclosed by plane curves – Change of variables in double integrals, Triple integrals.

TOTAL HOURS: 60

TEXTBOOKS:

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2016.

REFERENCES:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Ninth Edition, Laxmi Publications Pvt Ltd., 2016.
2. James Stewart, Calculus: Early Transcendental, Cengage Learning, New Delhi, 7th Edition, 2013.
3. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011.
4. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 2015.

COURSE OUTCOMES

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

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

CO – PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	3	2										
CO4	3	2										
CO5	3	2										
CO6	3	2										1

COURSECODE	COURSE TITLE	L	T	P	C
UPH 2176	**ENGINEERING PHYSICS (Common to all B.E./B.Tech. programs)**	**3**	**0**	**0**	**3**

OBJECTIVES:

Enable the students to

- 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.

UNIT I CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials– single crystals - Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal Imperfections – Point, line (Edge and Screw dislocations –Burger vectors) Surface (stacking faults) and Volume defects.

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Properties of matter: Elasticity- Hooke's law - Relationship between three moduli of elasticity– stress -strain diagram– Poisson's ratio –Factors affecting elasticity– Torsional stress & deformations – Twisting couple – Torsion pendulum - theory and experiment–bending of beams-bending moment– cantilever: theory and experiment–uniform and non-uniform bending: theory and experiment-I-shaped girders.

Thermal Physics: Modes of heat transfer – thermal conduction, convection and radiation – Newton's law of cooling - thermal conductivity- Lee's disc method for bad conductor – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel) – Formation of ice on ponds.

UNIT III ACOUSTICS AND ULTRASONICS 9

Acoustics: Classification and characteristics of Sound - decibel - Weber–Fechner law – Sabine's formula - derivation using growth and decay method —factors affecting acoustics of buildings and their remedies - Methods of determination of Absorption Coefficient. Ultrasonics: Production of ultrasonics by Magnetostriction and piezoelectric methods – acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton Effect. Theory and experimental verification – Properties of Matter waves – wave particle duality - Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states - Scanning electron microscope - Transmission electron microscope.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Photonics: Spontaneous and stimulated emission- Population inversion -Einstein's A and Bcoefficients – Conditions for Laser action - Types of lasers – Nd: YAG, & CO2 lasers-Basics of diode lasers-Industrial and Medical Applications. Fibre optics: Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) –Losses in fibers - attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors. - pressure and displacement.

TOTAL HOURS: 45

TEXTBOOKS:

1. Gaur, R.K., and Gupta, S.L., Engineering Physics, Dhanpat Rai Publishers, 2012.
2. Serway, R.A., & Jewett, J.W., Physics for Scientists and Engineers, Cengage Learning, 2010.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. Principles of Physics, Wiley, 2015.
2. Tipler, P.A. & Mosca, G. Physics for Scientists and Engineers with Modern Physics, WH Freeman, 2007.
3. Avadhanulu, M. N., Kshirsagar, P. G, A textbook of Engineering Physics, S. Chand & Co. Ltd., Ninth Revised Edition, 2012.

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: **UPH 2176 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**
UCY 2176	**ENGINEERING CHEMISTRY (Common to all B.E./B. Tech degree Programs)**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge to the students on the basic concepts of chemistry and properties of materials for various engineering applications

UNIT I ATOMIC AND MOLECULAR NANO CHEMISTRY 9

Atoms- Atomic orbitals, Molecules- Molecular orbitals. Nanoparticles and its uniqueness. Distinction between molecules, nanoparticles and bulk materials. Classification of nanoparticles. Size dependent Properties-Thermal, Optical, Chemical, Electronic and Mechanical. Synthesis of nanomaterials - bottom-up and top-down approaches-Techniques- Colloidal, hydrothermal, electrodeposition, chemical vapour deposition, laser ablation. Objectives of surface modification of nanoparticles. Synthesis and applications - Carbon Nano Tubes (CNT) - Gold nanoparticle

UNIT II ELECTROCHEMISTRY 9

Conductivity of electrolytes - factors influencing conductivity- Conductometric titration and its applications -estimation of strong acid, estimation of mixture of strong and weak acids and estimation of $BaCl_2$. Electrochemical cell-redox reaction-origin of electrode potential, Types of electrodes, Measurement of electrode potential and emf of the electrochemical cell -reference electrode- saturated calomel electrode and Ag/AgCl electrode - Ion selective electrode-glass electrode measurement of pH –Potentiometric titrations-estimation of ferrous ion and estimation of strong acid. Problems based on all the above concepts.

UNIT III CORROSION AND ITS CONTROL 9

Corrosion-Definition-Classification of corrosion-Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – selection of materials - sacrificial anode and impressed current cathodic methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT IV PHASE EQUILIBRIA 9

Phase Rule - Definition and explanation of terms involved with suitable examples- Phase – Components – Degrees of Freedom –Applications and limitations of Phase Rule, One component system - H_2O Two component systems – Construction of phase diagram by Thermal Analysis (or) Cooling curves – Condensed Phase Rule - Simple eutectic systems: Pb-Ag system – System with congruent melting point: Zn-Mg – System with incongruent melting point: Ni-Cd

UNIT V SYNTHESIS AND APPLICATIONS OF INDUSTRIAL POLYMERS 9

Polymers and Polymerization: definition, classification - types of polymerization: addition and condensation –mechanism of addition polymerization (cationic, anionic, free radical and coordination polymerization)-Properties: Glass Transition temperature, Average Molecular weight and its determination by viscosity method. Polymer composites (fibre reinforced plastics)-preparation, properties and application of engineering plastics Epoxy resin, Polyurethans, Nylon 6:6, Polycarbonate, PS, PVC and PET

TOTALHOURS: 45

TEXTBOOKS:

1. Engineering Chemistry' by Jain P.C. and Monika Jain**,** Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015
2. Engineering Chemistry by S.S.Dara, S.Chand & Co.Ltd, New Delhi ,2011

. **REFERENCES:**

1. T. Pradeep- NANO: The Essentials: Understanding Nanoscience and Nanotechnology, McGraw Hill Education; 2017(1st edition)
2. Gurdeep Raj, Phase Rule, GOEL Publishing House, Meerut, 2011.
3. R. Gopalan, K. Rangarajan, P.S. Subramanian. "Elements of Analytical Chemistry" Sultan Chand & Sons,2003.
4. F.W. Billmayer, Textbook of Polymer Science, 3rd Edison, Wiley. N.Y. 1991.

COURSE OUTCOMES:

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

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: UCY 2176 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**
UGE 2176	**PROBLEM SOLVING AND PROGRAMMING IN PYTHON (Common to all B.E./B. Tech degree Programs)**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To learn algorithmic problem-solving techniques.
- To learn the fundamentals of python programming.
- To compose programs in Python using conditions, iterations and decompose a problem into functions
- To construct programs in Python sequenced data type.
- To develop python programs using advanced constructs like dictionaries and files.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Logical and Algorithmic Thinking: Logical Thinking – Algorithmic Thinking; Problem Solving and Decomposition: Defining the Problem – Devising the Solution – Decomposition; Effective building blocks: Basic Algorithmic Constructs (pseudo code, flow chart, programming language) – Program State.

UNIT II DATA, EXPRESSION, STATEMENT, CONDITIONAL 9

Data and types: int, float, boolean, string, list; variables, expressions, statements, simultaneous assignment, precedence of operators; comments; in-built modules and functions; Conditional: boolean values and operators, conditional (if), alternative (if-else), case analysis (if-elif-else).

UNIT III ITERATION, FUNCTION, STRINGS 9

Iteration: while, for, break, continue, pass; Functions: function definition, function call, flow of execution, parameters and arguments, return values, local and global scope, recursion; Strings: string slices, immutability, string functions and methods, string module.

UNIT IV LISTS, TUPLES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, nested lists, list comprehension; Tuples: tuple assignment, tuple as return value, tuple operations.

UNIT V DICTIONARIES, FILES 9

Dictionaries: operations and methods, looping and dictionaries, reverse lookup, dictionaries and lists; Files: Text files, reading and writing files, format operator, file names and paths; command line arguments.

TOTAL HOURS:45

COURSE OUTCOMES:

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

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.

TEXT BOOKS:

1. Karl Beecher, ``Computational Thinking – A beginner's Guide to Problem Solving and Programming", British Computer Society (BCS), 2017.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist", 2nd edition, Green Tea Press, Shroff/O'Reilly Publishers, 2015 (http://greenteapress.com/wp/think-python/)

REFERENCES:

1. John V Guttag, ``Introduction to Computation and Programming Using Python", 3rd edition, MIT Press, 2021.
2. Ashok Namdev Kamthane, Amit Ashok Kamthane, ``Programming and Problem Solving with Python", McGraw Hill Education (India) Private Limited, 2018.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, ``Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, ``Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, ``Fundamentals of Python: First Programs", 2nd Edition, CENGAGE Learning, 2018.

CO-PO Mapping:

UGE 2176 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	-	-	-	-	-	-	-	-	-	-
CO2	Develop simple programs using basic constructs	2	2	-	--	-	-	-	-	-	-	-	-
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
UGE 2177	ENGINEERING GRAPHICS (Common to all B.E./B. Tech degree Programs)	1	0	4	3

OBJECTIVES:

- To develop the graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATIONS):

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING 10

Basic Geometrical constructions, Curves used in engineering practices: Conics –Construction of ellipse, parabola and hyperbola by eccentricity method – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 15

Orthographic projection principles - Principal planes - First angle projection - Layout of views - Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 15

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 20

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of truncated solids (simple position only) – Prisms, pyramids, cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Perspective projection of simple solids- Prisms, pyramids and cylinders by visual ray method.

TOTALHOURS:75

TEXTBOOKS:

1. Natarajan, K.V., A Textbook of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 33rd Edition, 2020. [ISBN:9788190414089]
2. Venugopal, K. and Prabhu Raja, V., Engineering Graphics, New Age International (P) Limited, 15th Edition, 2018. [ISBN :9789386649249]

REFERENCES:

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House, 53rd Edition, 2014. [ISBN: 9789380358963]
2. Basant Agarwal, and Agarwal, C.M., Engineering Drawing, McGraw Hill, 3rd Edition, 2019. [ISBN: 9789353167448]
3. Gopalakrishna, K.R., Engineering Drawing (Vol. I & II Combined), Subhas Publications, 27th Edition, 2017. [ISBN: 9789383214235]

4. Luzzader J Warren, and Jon M Duff, Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Pearson Education, 11th Edition, 2005. [ISBN :9789332549982]

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
1. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to End Semester Examinations on Engineering Graphics:

1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

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: **UGE2177ENGINEERING 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
UGE 2197	PROGRAMMING IN PYTHON LAB (Common to all B.E./B. Tech degree Programs)	3	0	0	1.5

OBJECTIVES:

- To write, test, and debug simple Python programs.
- To apply conditions and loops to solve problems using python.
- To implement programs using functions
- To write programs using different data types such as strings, lists tuples and dictionaries
- To perform read and write operations into the files.

SUGGESTIVE EXERCISES:

1. Use Linux shell commands, use Python in interactive mode, and an editor
2. Write simple programs (area of a geometric shape, simple interest, solve quadratic equation, net salary).
3. Write programs using conditional statements (leap year, maximum of 2 numbers, maximum of 3 numbers, simple calculator, grade of the total mark).
4. Develop programs using loops and nested loops (gcd, prime number, integer division, sum of digits of an integer, multiplication table, sum of a series, print patterns, square root using Newton's method).
5. Develop programs using functions (sine and cosine series, Pythagorean triplets).
6. Develop programs using recursion (efficient power of a number, factorial, Fibonacci number).
7. Develop programs using strings (palindrome, finding substring) without using in-built functions.
8. Develop programs using lists and tuples (linear search, binary search, selection sort, insertion sort, quicksort).
9. Develop programs using nested lists (matrix manipulations).
10. Develop simple programs using dictionaries (frequency histogram, nested dictionary).
11. Develop programs using Files (read and write files).
12. Develop programs to perform any task by reading arguments from command line.
13. Implement a simple application using appropriate datatypes and files

TOTAL HOURS: 45

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: UGE 2197 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	-	-	-	-	-	1	-	-	-	-
CO2	Build Python programs with conditionals and loops.	3	3	-	1	-	-	-	1	-	-	-	-
CO3	Solve a problem using functions in python programming.	3	3	-	1	-	-	-	1	-	-	-	-
CO4	Construct python programs using compound data like lists, tuples, and dictionaries.	3	3	-	1	-	-	-	1	-	-	-	-
CO5	Build a simple application in teams using files and appropriate datatypes by applying the best programming practices.	3	3	-	2	-	-	-	1	3	2	-	-

COURSECODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
UGS 2197	**PHYSICS AND CHEMISTRY LABORATORY**	**3**	**0**	**0**	**1.5**

A. PHYSICS LABORATORY

COURSE OBJECTIVE:

The objective of this course is to enable the students to

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

LIST OF EXPERIMENTS

(A minimum of 5 experiments to be performed from the given list)

1. Determination of the Young's modulus of the material of the given beam by Non-uniform bending method.
2. Determination of the rigidity modulus of the material of the given wire using torsion pendulum.
3. Determination of the wavelength of the mercury spectra using Spectrometer and grating.
4. Determination of the dispersive power of a prism using Spectrometer.
5. Determination of the grating element/wavelength, and particle size/ wavelength using a laser.
6. Determination of the Numerical and the acceptance angle of an optical fiber.
7. Determination of the thickness of a thin wire using interference fringes.
8. Determination of the coefficient of viscosity of the given liquid using Poiseuille's method.
9. Determination of the band gap energy of a semiconductor.
10. Determination of the coefficient of thermal conductivity of the given bad conductor using Lee's disc.

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/PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3			2	1										

B. CHEMISTRY LABORATORY

OBJECTIVE:

To impart hands on training for all the possible concepts learned in Engineering Chemistry Course

List of Experiments
(A minimum of 6 experiments to be performed from the given list)

1.Estimation of ferrous ion by potentiometric titration
2. Estimation of strong acid using pH meter.
3. Estimation of strong acid by conductometric titration
4. Estimation of mixture of strong and weak acids using conductometer
5. Estimation of $BaCl_2$ by conductometric titration
6. Determination of degree of polymerization of a water-soluble polymer by Viscosity method
7. Determination of equivalent conductance of a strong electrolyte at infinite dilution
8. Determination of weak acid using weak base by conductometric titration.
9. Determination of rate of corrosion by weight loss method

Total Hours: 45

TEXTBOOK:
Manual Prepared by Faculty of Chemistry Department, SSNCE

REFERENCE:
1. Practical Physical Chemistry, B.Viswanath and P.S.Raghavan, ViVa Books Pvt. Ltd., New Delhi, 2012.

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: UGS 2197 **A.** CHEMISTRY LABORATORY		**POs**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	Analyse ions like Fe2+, Fe3+, 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

OBJECTIVES:

The objective of this course is to enable the student to

- Applying C-R equations in the construction of Analytic Functions.
- Study the methods of Complex Integration, finding Taylor's and Laurent's Series expansions.
- Find the Laplace Transforms and inverse transforms for standard functions.
- Solve Differential Equations using different techniques.
- Evaluate Line, Surface and Volume integrals.

UNIT I ANALYTIC FUNCTIONS 12

Analytic functions – necessary and sufficient conditions, Cauchy-Riemann equations in Cartesian and polar form (with proof) – Properties - harmonic functions, Construction of analytic function, conformal mapping - some standard transformations – $w = z + c, cz, \frac{1}{z}, z^2$, bilinear transformation.

UNIT II COMPLEX INTEGRATION 12

Line integral - Cauchy's integral theorem – Cauchy's integral formula, Taylor's and Laurent's series, Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour (except the poles on the real axis).

UNIT III LAPLACE TRANSFORMS 12

Definition, properties, existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function, shifting theorems, Transforms of derivatives and integrals, Initial and final value theorems, Periodic functions, Inverse transforms – Convolution theorem.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

Solution of second and higher order linear differential equation with constant coefficients $(f(x) = e^{mx}, sinmx, cosmx, x^n, f(x)e^{mx}, f(x)sinmx)$, Method of variation of parameters, Simultaneous linear equations with constant coefficients of first order, Solving linear second order ordinary differential equations with constant coefficients using Laplace transforms.

UNIT V VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and curl – Vector identities – Irrotational and Solenoidal vector fields, Line integral over a plane curve, Surface integral - Area of a curved surface, Volume integral, Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

TOTAL HOURS: 60

TEXT BOOKS:

1. Grewal, B.S., Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2018.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, Inc., 2016.

REFERENCE BOOKS:

1. Bali, N.P., Goyal, M., Watkins, C., Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.
2. Boyce, W.E., and DiPrima, R.C., Elementary Differential Equations and Boundary Value Problems, 11th Edition, Global Edition, Wiley, 2017.

3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' Calculus: Early Transcendental, 13th Edition, Pearson Education, 2014.
4. O'Neil. P. V., Advanced Engineering Mathematics, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2012.
5. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus Early Transcendentals, 11th Edition, Global Edition, John Wiley & Sons, Inc., 2017.
6. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 2015.
7. Srivastava, A.C., and Srivastava, P.K., Engineering Mathematics Volume I and II, PHI learning Pvt. Ltd, 2011.

COURSE OUTCOMES:

On successful completion of this course, the student 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 Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	3	2										
CO4	3	2										
CO5	3	2										
CO6	3	2										1

COURSE CODE	COURSE TITLE	L	T	P	C
UEE2276	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To learn the basic concepts of electric circuits.
- To know the operation of various electrical machines.
- To study the concepts of utilization of electrical power.
- To comprehend the working principle of electronic devices and its applications.
- To grasp the working principle of various sensors and transducers.

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Ohm's Law- Kirchhoff's laws - Mesh current and Node voltage methods (Analysis with only independent source). Network theorems - Superposition theorem, Thevenins theorem and Norton theorem. AC circuit: Waveforms and RMS value, Phasor diagram, Power, Power factor. Three phase supply – Star connection, Delta connection –Balanced Loads - Power in three-phase systems.

UNIT II ELECTRICAL MACHINES 9

Construction, Principle of Operation, Basic Equations and Applications - DC Generators, DC Motors, Single Phase Transformer, Single phase Induction Motor, Three phase Induction Motor, Three phase Alternator, Stepper and BLDC motors.

UNIT III UTILIZATION OF ELECTRICAL POWER 9

Renewable energy sources- wind and Solar panels. Illumination by lamps- Sodium Vapour, Mercury vapour, Fluorescent tube. Batteries-NiCd, Pb Acid and Li ion Charge and Discharge Characteristics. Protection-Earthing, Fuses. Energy Tariff calculation for domestic loads.

UNIT IV ELECTRONIC DEVICES AND APPLICATIONS 9

Operation of PN junction diodes, VI characteristics, Zener diode, BJT- CB, CE, CC configurations, input and output characteristics, MOSFET. Half wave and full wave rectifier, capacitive filters, zener voltage regulator, Operational amplifiers, Ideal Op-Amp characteristics, Inverting and Non-inverting amplifier.

UNIT V SENSORS AND TRANSDUCERS 9

Sensors: Capacitive and resistive sensors, magnetic sensors, Hall effect sensors, Piezo-resistive sensors, viscosity, optical sensors, Ultrasonic sensors, Nuclear and microsensors. Transducers: Classification of transducers, strain gauges, RTD, thermocouples, Piezo-electric, LVDT and Thermo electric transducers

TOTAL HOURS: 45

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, McGraw Hill Education,2014
2. Alan S. Moris, Principles of Measurements and Instruments, Prentice Hall of India Pvt. Ltd., New Delhi,1999.
3. S.Salivahanan, R.Rengaraj and G.R.Venkatakrishnan, Basic Electrical, Electronics and Measurement Engineering, McGrawHill, 2017.

REFERENCES:

1. S.B. Lal Seksena and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016.
2. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronic Engineering, Oxford, 2016.
3. S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015.
4. Edward Hughes, John Hiley, Keith Brown and Ian McKenzie Smith "Electrical And Electronic Technology" Pearson Education Ltd, 10 th Edition, 2008
5. H.Cotton, "Electrical Technology" 7th Edition,CBS; 2005

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

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UIT2201	PROGRAMMING AND DATA STRUCTURES	3	0	2	0	4

OBJECTIVES:

The objective of this course is to enable the students to

- understand the concepts of ADTs and implement them using Python
- design and implement linear data structures – lists, stacks, and queues
- design, analyze, and implement sorting, searching, and hashing algorithms
- formulate problems using tree and graph structures and solve them using Python

UNIT I ABSTRACT DATA TYPES 9

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying. Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms.

UNIT II LINEAR STRUCTURES 9

List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – applications of lists – Stack ADT – Queue ADT – double ended queues.

UNIT III SORTING AND SEARCHING 9

Bubble sort – selection sort – insertion sort – merge sort – quick sort – linear search – binary search – hashing – hash functions – collision handling – load factors and efficiency – rehashing

UNIT IV TREE STRUCTURES 9

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multi-way search trees

UNIT V GRAPH STRUCTURES 9

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – shortest paths – minimum spanning trees – disjoint sets

LECTURE HOURS: 45

TEXTBOOK:

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures & Algorithms in Python”, John Wiley & Sons Inc., 2013

REFERENCES:

1. Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithms with Python” Springer Edition 2015
2. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011
3. Aho, Hopcroft, and Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
5. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition, Pearson Education, 2014

LAB COMPONENT:

1. Implement simple ADTs as Python classes.
2. Implement recursive algorithms in Python.

3. Implement List ADT using Python arrays.
4. Linked list implementations of List.
5. Implementation of Stack and Queue ADTs.
6. Applications of List, Stack and Queue ADTs.
7. Implementation of sorting and searching algorithms.
8. Implementation of Hash tables.
9. Tree representation and traversal algorithms.
10. Implementation of Binary Search Trees.
11. Implementation of Heaps.
12. Graph representation and Traversal algorithms.
13. Implementation of single source shortest path algorithm.
14. Implementation of minimum spanning tree algorithms.

LAB HOURS: 30
TOTAL HOURS: 75

COURSE OUTCOMES:

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

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 applications.
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.

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

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**EL**	**C**
UIT2211	**SOFTWARE DEVELOPMENT PROJECT – I**	**0**	**0**	**3**	**0**	**1.5**

Students will be divided into teams of size not exceeding seven. Each team will be given a project as a context. Teams will be mentored to follow best software engineering practices to develop data-structure-intensive software. The grading rubrics are as outlined below:

1. Processes: PSP, Scrum, DevOps : 5%
2. Management: Estimation, WBS, Planning, Tracking : 5%
3. Risk Management : 5%
4. Coding, Testing, and Configuration Management : 25%
5. Automation of routine tasks : 5%
6. Meetings: “Customer” meetings, review meetings, brain-storming : 5%
7. Presentations : 25%
8. Documentations : 25%

TOTAL HOURS: 45

REFERENCES:

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", John Wiley & Sons Inc., 2013.
2. Watts S. Humphrey, "PSP: A self-improvement process of software engineers", Pearson Education, 2005.
3. Roger S. Pressman, "Software Engineering – A practitioner's Approach", Seventh Edition, McGraw-Hill International Edition, 2017.
4. Ian Sommerville, "Software Engineering", Tenth Edition, Pearson Education Asia, 2017.
5. Alan D. Moore, "Python GUI programming with Tkinter", Second Edition, Packt Publishing Ltd., 2021.
6. Joshua M. Willman, "Beginning PyQt: A hands-on approach to GUI programming with PyQt6", Second Edition, APress, 2022.

COURSE OUTCOMES:

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

CO1: Design and develop data structure intensive software systems by applying best practices for IT project management.

CO2: Communicate efficiently in team meetings & presentations and prepare documents for data structure intensive software systems.

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

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

OBJECTIVES:

The students of Engineering undergoing this Course would develop a

- Better understanding of human relationships, perceptions and policies towards the environment
- Focus on design and technology for improving environmental quality

UNIT I ENVIRONMENT, ECOSYSTEMSANDBIODIVERSITY 9

Definition, scope and importance of environment– concept, structure and function of an ecosystem – energy flow- food chains, food webs and ecological pyramids – ecological succession. Introduction to biodiversity definition and types– values of biodiversity- India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity-endangered and endemic species of India -conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II NATURAL RESOURCES 9

Uses, over-exploitation of natural resources: Forest, Water, Mineral, Food, Energy and Land. Case studies on over exploitation of natural resources -Role of an individual in conservation of natural resources- Equitable use of resources for sustainable life styles.

UNIT III CURRENT ENVIRONMENTAL ISSUES 9

Environmental issues– causes, effects and control measures of Pollution of (a) Air (Smog, acid rain, climate change and global warming, ozone layer depletion) (b) Water (rain water harvesting, watershed management and waste water treatment) (c) Soil (solid waste management, wasteland reclamation) (d)Electronic waste. Population explosion, Resettlement and rehabilitation of people and Disaster management.

UNIT IV ENGINEERING INTERVENTIONS TO REDUCE ENVIRONMENTAL STRESSES 9

Role of information technology in environment- Remote Sensing- satellites and sensors- Geographical Information Systems(GIS)-Applications. Environment data base management system. Green chemistry-Principles - Green buildings-Advantages of green buildings over conventional buildings-Electric and Hybrid Electric Vehicles (HEV).

UNIT V ENVIRONMENTALREGULATIONS 9

Environmental Ethics for sustainable development- Human rights- Environmental Impact Assessment– Ecomark-role of NGO- Central and state pollution control boards- Air (Prevention and Control of Pollution) act 1981– Water (Prevention and control of Pollution) act 1974– Wildlife protection act 1972 – Forest conservation act 1980- The National Green Tribunal Act 2010.

TOTAL HOURS: 45

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik, Environmental Science and Engineering, New Age International Publishers,14thEdition, 2014.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2006

REFERENCES:

1. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition,Pearson Education, 2004.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014

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**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	-	1									
CO2	3	2	1									
CO3	3	2	1									
CO4	3	2	1									
CO5	3	-	-									

COURSECODE	COURSETITLE	L	T	P	C
UPH2251	PHYSICS FOR INFORMATION SCIENCE AND TECHNOLOGY	3	0	0	3

OBJECTIVES:

Enable the students to

- Understandthetransportpropertiesofconductingmaterialsandtheirmodellingusingclassicaland quantum theories.
- Analyzethephysicsofsemiconductorsandrelatetheirmicroscopicpropertiestoobservablebulk phenomena.
- Understand the origin of magnetism and datastorage principles.
- Studythefundamentalsofopticalmaterialsandtheirapplicationstodisplaydevices.
- Develop an overview of Nanomaterials and their applications to Nanodevices.

UNITI SEMI CONDUCTING MATERIALS 9

Classification of solids- Conductors – classical free electron theory of metals – Electrical and thermal conductivity –Band theory of solids (qualitative), Intrinsic semiconductor – Bond and energy band diagrams–Concept of hole - carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors –

UNITII SEMI CONDUCTOR DEVICES 9

Formation of PN junction –energy band diagram –biased and unbiased conditions – BJT – Current gain and voltage gain – common emitter, common base and common collector configurations – Field effect - MOSFET – common source, common drain and common gate configurations – CMOS ICs.

UNITIII DATA STORAGE PRINCIPLES 9

Originofmagneticmoment–Bohrmagneton,atomicmagneticmoments-magneticpermeability and susceptibility – Microscopic and macroscopic classification of magnetic materials – comparison of Dia and para magnetism and Ferro magnetism – Ferromagnetism :origin and exchange interaction-saturation magnetization and Curie temperature – Domain theory – Hysteresis (based on domain theory) – soft and hard magnetic materials – Magnetic principles in computer data storage – Magnetic hard disc – GMR Sensor- Principle of GMR-Parts of a magnetic hard disc - CD-ROM-WORM- Magneto-optical storage, recording and reading systems -Holographicoptical datastorage.

UNITIV OPTICAL MATERIALS AND DISPLAYDEVICES 9

Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only)- Carrier generation and recombination in semiconductors – LED – OLED – Semiconductor Laser diodes (Homo and double heterojunction)– Photodetectors– Photo diodes and Photo conductors (concepts only) – Solar cell – Liquid crystal display - Charged Coupled Devices.

UNITV NANO DEVICES 9

Nano materials – Properties, Applications, Size effect -Density of states in quantum well, quantum wire and quantum dot structures – Quantum confinement-Quantum well and Quantum dot lasers- Franz-Keldysh effect-Quantum Confined Stark effect–Quantum Well Electro Absorption modulators-Magnetic semiconductors – Spintronics.

TOTALHOURS:45

TEXTBOOKS:

1. Adaptation by Balasubramanian,R, Callister's Material Science and Engineering, Wiley India Pvt .Ltd., 2nd Edition, 2014.
2. Kasap,S.O., Principles of Electronic Materials and Devices, (Special Indian Edition) McGraw-Hill Education, 3rd Edition, 2017.

REFERENCES:

1. Pallab Bhattacharya, Semiconductor Optoelectronic Devices,Pearson,2nd Edition,2017.

2. Umesh K Mishra & Jasprit Singh, Semiconductor Device Physics and Design, Springer, 2008.
3. Wahab,M.A.,Solid State Physics: Structure & Properties of Materials, Narosa Publishing House, 2009.
4. Gaur,R.K. & Gupta,S.L.,Engineering Physics, Dhanpat Rai Publishers,2012.
5. Salivahanan,S.,Rajalakshmi,A.,Karthie,S.,Rajesh,N.P., Physics for Electronics Engineering &Information Science, McGraw Hill (India) PrivateLimited,2018.
6. Avadhanulu,M.N.,P.G.Shirsagar,ATextBookofEngineeringPhysics,S.Chand&Co.Ltd. Ninth Revised Edition, 2012
7. Theuwissen,A.J., Solidstate imaging with Charge-Coupled Devices, Kluwer-Academic Publisher, Springer1995.

COURSE OUTCOMES:

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

CO1: Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.

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.

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3											**2**	
CO2	3	3											**2**	
CO3	3	3											**2**	
CO4	3	3											**2**	
CO5	3	3											**2**	

Course Code	**Course Title**	**L**	**T**	**P**	**C**
UGE2297	**DESIGN THINKING AND ENGINEERING PRACTICES LAB**	**0**	**0**	**3**	**1.5**

Objectives:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering
- To train the students to dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model, and to assemble the different engineering components

List of Experiments:

GROUP A (CIVIL & MECHANICAL ENGINEERING PRACTICE)

I - CIVIL ENGINEERING PRACTICE

Buildings:

Study of plumbing and carpentry components of residential and industrial buildings - Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.

(b) Preparation of plumbing line sketches for water supply and sewage works.
(c) Hands-on-exercise:
- Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components.
- Plumbing with basic connections for washing basin and sink

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.
- Fabrication of different models of pencil box and pen stand.
- Fabrication of wooden wall shelf

(c) Demonstration of wood working machinery

II - MECHANICAL ENGINEERING PRACTICE

Basic Machining:
(a) Drilling Practice (holes of various diameters - steel sheet metal, wood, hylam/plywood sheet)

Sheet Metal Work
(a) Forming & Bending
(b) Different type of joints.
- Fabrication of mobile phone metal stand
- Fabrication of electrical control panel box

Design thinking practices
To dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model, and to assemble the following components.
- Pedestal Fan head swing mechanism - Reserve mechanism (Two wheeler) - Hot Glue gun - Paper clips - Flush tank container mechanism - Hand pump – washer Mechanism

GROUP B (ELECTRICAL & ELECTRONICS ENGINEERING PRACTICE)
1. Residential house wiring, staircase wiring and tube light wiring with single phase AC two wire system.
2. Energy measurement with RLC Load.
3. Earth resistance measurement.
4. Measurement of AC parameters using CRO and half wave and Full wave rectifier.
5. Study of logic gates AND, OR, EX-OR & NOT.
6. Soldering practice – Components Devices and Circuits – Using PCB.

Design thinking practices
1. Assemble a single phase 3 wire circuit for connecting household appliances and explain through schematic diagram
2. Measure the energy consumed by the household appliances and verify it theoretically
3. Analyze the fault occurring in electrical appliances
4. Design, assemble and test a cell phone charger
5. Design, assemble and test a relay logic to control electrical appliances.
6. Design, assemble and test a dc power supply using PCB

Total Periods:45

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)

References:
1. Willis H. Wagner, Howard "Bud" Smith, and Mark W. Huth Modern Carpentry, 12th Edition, 2015

2. P.C.Sharma, Production Technology (Manufacturing Process): Manufacturing Process, S.Chand publisher, 2006
3. Robert W. Messler, Reverse Engineering: Mechanisms, Structures, Systems & Materials, McGraw-Hill Education, 2014
4. David W Rongey , A Complete Guide to Home Electrical Wiring, 2013
5. K.Jeyachandran, S.Natarajan & S, Balasubramanian, "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).

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
UMA2377	**DISCRETE MATHMATICS (Common to Third semester CSE and IT)**	**3**	**1**	**0**	**4**

OBJECTIVES

The objective of this course is to enable the student to

- study the concepts of classical logic, normal forms and its applications.
- solve problems using different counting techniques.
- learn the basic concepts in graph theory and prove simple properties.
- study the algebraic structures.
- study the concept of Boolean algebra.

UNIT I LOGIC AND PROOFS 12

Propositional Logic–Propositional equivalences–Predicates and quantifiers– Nested quantifiers– Rules of inference–Introduction to proofs–Proof methods and strategy–Normal forms– Applications to switching circuits.

UNIT II COMBINATORICS 12

Mathematical induction–Strong induction–The pigeon hole principle–Recurrence relations–Partition of Integers-Solving linear recurrence relations using generating functions –Inclusion and Exclusion Principle and its applications.

UNIV III GRAPHS 12

Graphs–Graph terminology and special types of graphs–Subgraphs–Matrix representation of graphs and graph isomorphism–Connectivity–Eulerian and Hamilton graphs.

UNIT IV ALGEBRAIC STRUCTURES 12

Algebraic systems–Semi groups and monoids–Groups–Subgroups – Homeomorphisms – Normal subgroup and coset–Lagrange's theorem–Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

Partial ordering–Posets–Lattices as Posets–Properties of lattices–Lattices as algebraic systems–Sublattices–Direct product and Homomorphism; Boolean algebra –Stone's representation Theorem.

TOTAL HOURS: 60

TEXTBOOKS

1. Kenneth H Rosen, "Discrete Mathematics and its Applications",7th Edition, Special Indian edition, Tata McGraw Hill, New Delhi, 2017.
2. Tremblay JP and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", 30th Reprint, Tata McGraw Hill, New Delhi, 2011.

REFERENCE BOOKS

1. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction",4th Edition, Pearson Education Asia, 2007.
2. Eric Lehman, F Tom Leighton, Albert R Meyer, Mathematics for Computer Science, Samurai Media Limited, 2017.
3. Thomas Koshy,"Discrete Mathematics with Applications", Elsevier Publications, 2006.
4. Seymour Lipschutz, Mark Lipson,"Discrete Mathematics", Schaum's Outlines, 3rd Edition, Tata McGraw Hill, 2010.
5. CLLiu, DP Mohapatra,"Elements of Discrete Mathematics",4th Edition, McGraw Higher Education, 2017.
6. John M Harris, Jeffry L Hirst, Michael J Mossinghoff, "Combinatorics and Graph Theory", Springer verlag New York, 2008.

OUTCOMES

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

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	3	2										
CO4	3	2										
CO5	3	2										
CO6	3	2										1

COURSE CODE	COURSE TITLE	L	T	P	C
UHS2376	**UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY**	**2**	**0**	**2**	**3**

OBJECTIVES:

- To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
- To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
- To help students understand the meaning of happiness and prosperity for a human being.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.

- To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life Course

UNIT I INTRODUCTION TO VALUE EDUCATION 9

Value Education - Need, Basic Guidelines, Content and Process, Self-Exploration - meaning, importance and process, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities - the basic requirements, Understanding Happiness and Prosperity - A critical appraisal of the current scenario, Method to fulfill the above human aspirations - understanding and living in harmony at various levels.

UNIT II HARMONY IN THE HUMAN BEING 9

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya

UNIT III HARMONY IN THE FAMILY AND SOCIETY 9

Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human to human relationship; Understanding Trust - the foundational value in relationship, Difference between intention and competence, Understanding Respect – as the right evaluation, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society - comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order - from family to world family!

UNIT IV HARMONY IN THE NATURE AND EXISTENCE 9

Understanding the harmony in the Nature, Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature- recyclability, Understanding Existence as Co- existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 9

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics - augmenting universal human order, the scope and characteristics of people-friendly and eco-friendly, Holistic Technologies, production systems and management models - Case studies, Strategy for transition from the present state to Universal Human Order - At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations.

TOTAL HOURS:45

TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2nd Revised Edition, 2019.

REFERENCES:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal

9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

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.

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1						2		3	3	2		3	1	
CO2						2		3	3	2		3	1	
CO3						2		3	3	2		3	1	
CO4						2		3	3	2		3	1	
CO5						2		3	3	2		3	1	

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**EL**	**C**
UIT2301	**PROGRAMMING AND DESIGN PATTERNS**	**3**	**0**	**0**	**0**	**3**

OBJECTIVES:

The objective of this course is to enable the students to

- understand the concepts of objects, classes, interfaces, modules and packages
- understand the concepts of inheritance, polymorphism and exceptions
- choose and apply the concepts of stings, data serialization, and different formats
- judiciously select and apply design patterns.

UNIT I OBJECTS AND CLASSES 9

Introduction to object-oriented programming – UML diagrams -- objects and classes – attributes and behaviors – abstractions – interfaces – composition – inheritance – case studies. Objects in Python – Python classes – modules and packages – managing module contents – case studies.

UNIT II INHERITANCE, POLYMORPHISM, AND EXCEPTIONS 9

Basic inheritance – multiple inheritance – polymorphism – abstract classes – case studies. Exceptions – raising exceptions – handling exceptions – exception hierarchy – user-defined exceptions – case studies.

UNIT III STRINGS AND OBJECT SERIALIZATION 9

Strings – string manipulation – string formatting – unicodes – mutable byte strings – regular expressions – object serialization – data serialization: YAML, XML, JSON formats – case studies

UNIT IV DESIGN PATTERNS I 9

Iterators – Comprehensions – generators – Coroutines – case study. Decorator pattern – observer pattern – strategy pattern – state pattern – singleton pattern – template pattern

UNIT V DESIGN PATTERNS II 9

Adaptor pattern – facade pattern – flyweight pattern – command pattern – abstract factory pattern – composite pattern. Testing object-oriented programs – test-driven development – unit testing – pytest. Concurrency – threads – multi-processing – async i/o.

TOTAL: 45 HOURS

TEXTBOOKS:

1. Dusty Phillips, "Python 3 Object-Oriented Programming: Build robust and maintainable software with object-oriented design patterns in Python 3.8", Third Edition, Packt Publishing, 2018.

REFERENCES:

1. Matt Weisfeld, "Object-Oriented Thought Process", Fifth Edition, Addison-Wesley Professional, 2019.
2. Matthias Noback, "Object Design Style Guide", Manning Publications, 2020.
3. Stephen F. Lott, "Mastering Object-oriented Python", Second Edition, Packt Publishing, 2019.
4. Mark Lutz, "Programming Python: Powerful Object-Oriented Programming", Fourth Edition, O'Reilly Media, 2011.

COURSE OUTCOMES:

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

1. Solve problems using objects, classes, interfaces, modules and packages.
2. Apply the concepts of inheritance, polymorphism and exceptions in software design
3. Employ effective object serialization and data formats to solve problems
4. Select and apply design patterns in their design and analysis

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2		1										1	
CO2	2		1										1	
CO3		1	1											
CO4	2	1	1										1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2302	DATABASE TECHNOLOGY	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students to

- Understand database development life cycle and conceptual modeling
- Learn SQL for data definition, manipulation and querying a database
- Design relational databases using conceptual mapping and normalization
- Learn transaction concepts and serializability of schedules
- Learn data model and querying in object-relational and No-SQL databases

UNIT I CONCEPTUAL DATA MODELING 8

Database environment – Database system development lifecycle – Requirements collection – Database design -- Entity-Relationship model – Enhanced-ER model – UML class diagrams.

UNIT II RELATIONAL MODEL AND SQL 10

Relational model concepts -- Integrity constraints -- SQL Data manipulation – SQL Data definition – Views -- SQL programming.

UNIT III RELATIONAL DATABASE DESIGN AND NORMALIZATION 10

ER and EER-to-Relational mapping – Update anomalies – Functional dependencies – Inference rules – Minimal cover – Properties of relational decomposition – Normalization (upto BCNF).

UNIT IV TRANSACTION MANAGEMENT 8

Transaction concepts – properties – Schedules – Serializability – Concurrency Control – Two-phase locking techniques – recovery techniques

UNIT V OBJECT RELATIONAL AND NO-SQL DATABASES 9

Mapping EER to ODB schema – Object identifier – reference types – rowtypes – UDTs – Subtypes and supertypes – user-defined routines – Collection types – Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB / FireBase data model and CRUD operations; Column-based: Hbase data model and CRUD operations.

TOTAL: 45 HOURS

TEXTBOOKS:

1. Thomas M. Connolly, Carolyn E. Begg, "Database Systems – A Practical Approach to Design, Implementation, and Management", Sixth Edition, Global Edition, Pearson Education, 2015.
2. Ramez Elmasri, Shamkant B. Navathe, "*Fundamental of Database Systems"*, Seventh Edition, Pearson, 2016.

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, "Database Modelingand Design– Logical Design", Fifth Edition, Morgan Kaufmann Publishers, 2011.
3. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012
4. C.J.Date, A.Kannan, Swaminathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2003.
5. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.
6. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, "Advanced Database Systems", Morgan Kaufmann publishers, 2006.
7. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd edition, Pearson.
8. S Sumathi, S Esakkirajan, "Fundamentals of Relational Database Management Systems ", (Studies in Computational Intelligence), Springer-Verlag, 2007.
9. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata McGraw Hill, 2010.

COURSE OUTCOMES:

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

1. Explain the database development life cycle and apply conceptual modeling
2. Apply SQL and programming in SQL to create, manipulate and query the database
3. Apply the conceptual-to-relational mapping and normalization to design relational data base
4. Determine the serializability of any non-serial schedule using concurrency techniques
5. Apply the data model and querying in Object-relational and No-SQL data bases.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1											2	
CO2	2	1											2	
CO3	2	1	1										2	
CO4	2	1	1										2	
CO5	2	1	1		1								2	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2304	DIGITAL LOGIC AND COMPUTER ORGANIZATION	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students.

- To know about the number systems, different binary arithmetic operations, and logic gates
- To design combinational and sequential circuits.
- To know about the fundamentals of computers.
- To know about the design of control units in a processor
- To know about the memory and I/O management.

UNIT I DIGITAL FUNDAMENTALS 9

Digital Systems – Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – Logic Gates – Boolean Algebra – K-Maps – Standard Forms – NAND – NOR Implementation.

UNIT II COMBINATIONAL AND SEQUENTIAL CIRCUITS 9

Combinational circuits – Adder – Subtractor – ALU Design – Decoder – Encoder – Multiplexers – Introduction to Sequential Circuits – Flip-Flops – Registers – Counters.

UNIT III COMPUTER FUNDAMENTALS 9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High-Level Language.

UNIT IV PROCESSOR 9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

UNIT V MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

TOTAL:45 HOURS

TEXTBOOKS:

1. M. Morris Mano, Michael D. Ciletti, “Digital Design”, Fifth Edition, Pearson Education, 2013.
2. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Fifth Edition, Morgan Kaufmann/Elsevier, 2013.

REFERENCES:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2008.

COURSE OUTCOMES:

On successful completion of this course, the students should be able

1. Understand the concept of number systems, logic gates and different binary arithmetic operations.
2. Design and analyse the operation of different combinational logic circuits.
3. Design and analyse the operation of different sequential logic circuits
4. Understand the design and implementation of a digital system.
5. Understand the computer functional blocks and execution of instructions.
6. Understand the design of different circuits used in ALU, memory hierarchy and different issues in parallelism

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	1	1				1				2	
CO2	3	3	2	1									3	
CO3	3	3	2	1									2	
CO4			1		1								1	
CO5	1	1											1	
CO6	1	1	1										1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2305	INTRODUCTION TO DIGITAL COMMUNICATION	3	0	0	3

OBJECTIVES:

- To learn digital communication principles
- To introduce data and pulse communication techniques
- To introduce multiuser radio communication
- To introduce information theory

UNIT I DIGITAL TRANSMISSION AND CODING 9

Introduction to Analog communication, Limitations in analog communication systems, Sampling theorem, Analog to digital conversion, quantization noise, PCM, companding.

UNIT II DIGITAL MODULATION AND DEMODULATION 9

Concept of amplitude, frequency and phase, ASK transmitter and receiver, FSK transmitter and receiver, BPSK transmitter and receiver, QPSK transmitter and receiver, 8 PSK transmitter and receiver, concept of M-ary PSK, 8QAM transmitter and receiver, 16 QAM transmitter and receiver, concept of constellation diagrams.

UNIT III INFORMATION THEORY 9

Uncertainty, Probability, PDF and PMF, Information measure, Shannon's Entropy, Mutual information, Relationship Between Entropy and Mutual Information - Chain Rules for Entropy.

UNIT IV SOURCE AND CHANNEL CODING 9

Source coding: Coding efficiency - Shannon's source coding theorem, Huffman coding, Block Huffman codingChannel coding: Shannon's channel coding theorem, Error detection - parity coding, Error correction - cyclic single error correcting Hamming code.

UNIT V MULTIPLEXING TECHNIQUES 9

TDMA, FDMA, CDMA: PN sequence generation, Frequency hopping - Time hopping.

TOTAL: 45 HOURS

TEXTBOOK:

1. B. P. Lathi and Zhi Ding, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press. 2017.

REFERENCES:

1. Thomas Cover, Joy Thomas, "Elements of Information Theory", Wiley Inderscience, 2nd Edition, 2006
2. Herbert Taub, and Donald L Schilling, "Principles of Communication Systems", 3rd Edition, McGraw Hill Publishing Company, 1998.
3. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2004

COURSE OUTCOMES:

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

1. Explain various data communication techniques.
2. Explain multiuser radio communication.
3. Use information entropy to design source and channel coding.
4. Appreciate the importance of digital communication in the physical layer of a network

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	1	1				1				2	
CO2	3	3	2	1									3	
CO3	3	3	2	1									2	
CO4	3	2	2	1	1								1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2311	DATABASE TECHNOLOGY LAB	0	0	3	1.5

OBJECTIVES:

The objective of this course is to enable the students

- To learn in creating and populating a database.
- To familiarize with a query language.
- To enforce integrity constraints on a database.
- To practice advanced SQL queries.
- To understand functions, procedures, and procedural extensions of databases.
- To design a database application with frontend tools.

LIST OF EXPERIMENTS:

1. Database Development Life cycle:
   - Problem definition and Requirement analysis
   - Scope and Constraints
2. Database design using Conceptual modeling (ER-EER) – top-down approach
   - Mapping conceptual to relational database and validate using Normalization
3. Implement the database using SQL Data definition with constraints, Views
4. Query the database using SQL Manipulation
5. Querying/Managing the database using SQL Programming

- Stored Procedures/Functions
- Constraints and security using Triggers

6. Database design using Normalization – bottom-up approach
7. Mini-project
   Flutter (Javascript) / Python Flask / Standalone application

SQL:

1. Data Definition commands, Data Manipulation commands for inserting, deleting, updating and retrieving tables and Transaction Control statements.
2. Creating a database to set various constraints.
3. Database Querying – Simple queries, Nested queries, Sub queries, Join queries, Correlated queries, Recursive queries.
4. Views, Sequences, Synonyms, Indexes.

PL/SQL:

5. Procedures and Functions.
6. Packages.
7. Implicit and Explicit Cursors.
8. Triggers.
9. Implementation of ADODB - Standalone and Web
10. Implementation of ADO - Standalone and Web
11. Database Connectivity with Front End tools.
12. Queries of MongoDB
13. Application Development using RDBMS and MongoDB.
    - Inventory control system.
    - Hospital management system.
    - Railway reservation system.
    - Web based user identification System.
    - Timetable management system.
    - Hotel management system.
    - Library information system.
    - Logistics management system.
    - Retail-shop management system.
    - Employee information system.
    - Payroll system.

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

1. Design and implement a database schema for a given problem-domain.
2. Design a database and query using SQL DML/DDL commands.
3. Create procedures using PL/SQL.
4. Design and build any GUI application.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2										2	
CO2	2	1											2	
CO3	2	1											2	
CO4	2	3	2	3	2				2	3		2	2	1

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2312	PROGRAMMING AND DESIGN PATTERNS LAB	0	0	3	1.5

OBJECTIVES:

The objective of this course is to enable the students

LIST OF EXPERIMENTS:

1. Implement simple ADTs using Python objects and classes.
2. Create Python modules and packages.
3. Programs with inheritance and polymorphism
4. Programs with abstract classes
5. Programs with exception handling
6. Object and Data Serialization
7. Programs with selected design patterns
8. Unit testing and Pytest
9. Programs using Concurrency and async i/o.
10. Mini project covering all the concepts.

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

1. Design and implement ADTs using Python modules and packages
2. Judiciously select and apply object-oriented concepts for software development
3. Implement object persistence and serialization techniques
4. Develop test cases and perform systematic testing of object-oriented software
5. Develop software systems with sub-systems running concurrently communicating and collaborating with each other

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1								2			1	
CO2	1	2	1							2			3	
CO3	1	2								1			1	
CO4	1	1	1							2			1	
CO5		2	1						2	2			2	

COURSE CODE	COURSE TITLE	L	T	P	C
UMA2476	PROBABILITY AND STATISTICS	3	1	0	4

OBJECTIVES

The objective of this course is to enable the student to

- Identify the standard distributions and apply them in solving problems.
- Solve problems in joint probabilities and to find correlation between them.
- Perform hypothesis testing using normal, t, f, chi square distribution
- Evaluate the tests of significance in analysis of variance.
- Calculate the various statistical quality control measurements.

UNIT I RANDOM VARIABLES 12

Random Variables - Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distribution – Functions of Random Variable

UNIT II TWO-DIMENSIONAL RANDOM VARIABLE 12

Joint distribution - Marginal and Conditional distributions - Covariance - Correlation and Linear regression - Transformation of random variables - Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 12

Sampling distributions - Small and large sample test - Test based on Normal and t distribution (Single and difference of mean), χ^2-Test for goodness of fit, Independence of attributes, F test for variance.

UNIT IV DESIGN OF EXPERIMENTS 12

Completely randomized design - Randomized block design - Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements ($\bar{X}$ and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits - Acceptance sampling.

TOTAL HOURS: 60

TEXT BOOKS

1. Milton, J. S. and Arnold, J.C., Introduction to Probability and Statistics, Tata McGraw Hill, New Delhi, 4th Edition, 2014.
2. Johnson, R.A. and Gupta, C.B., Miller and Freund's Probability and Statistics for Engineers, Pearson Education, Asia, 9th Edition, 2016.

REFERENCES

1. Devore, J.L., Probability and Statistics for Engineering and the Sciences, Thomson Brooks/Cole, International Student Edition, New Delhi, 8th Edition, 2012.
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., Probability and Statistics for Engineers and Scientists, Pearson Education, Asia, 9th Edition, 2012.
3. Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, New Delhi, 5th Edition, 2014.
4. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., Schaum's Outline of Theory and Problems of Probability and Statistics, Tata McGraw Hill, New Delhi, 3rd Edition, 2017.
5. Gupta, S.C and Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan and Chand Company, New Delhi, 12th Edition, 2020.

COURSE OUTCOMES

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

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

CO-PO MAPPING

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	2										
CO3	3	2										
CO4	3	2		1								
CO5	3	2										
CO6	3	2										1

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2401	**MICROPROCESSOR AND MICROCONTROLLER**	**3**	**0**	**0**	**3**

OBJECTIVES:
The objective of this course is to enable the students to

- Understand the architecture and operation of the 8086 microprocessor and ARM microcontroller.
- Learn the addressing mode and programming model of Intel X86 Processor, and ARM architecture
- Acquire Assembly language programming skills.
- Explore to basic peripherals, its programming and interfacing techniques of microprocessor and controllers
- Develop applications using Intel X86 Processors and ARM Microcontrollers

UNIT I INTEL X86 MICROPROCESSOR ARCHITECTURE 9

Introduction to Microprocessor and Computer - Evolution of Microprocessor - Computer Data Formats, Internal Microprocessor Architecture - Programming Model Addressing Mode - Data Addressing Mode - Program Memory Addressing Modes - Stack Addressing Modes - Data Movement Instructions - Arithmetic and Logical Instruction - Program Control Instruction

UNIT II THE 8086 PROCESSOR AND MEMORY INTERFACING 9

8086 Architecture -Signal descriptions of 8086, Physical memory organization, Bus Buffering and Latching - Bus Timing, Ready and Wait States - Minimum Mode Versus Maximum Mode
assembler directives, Memory Interfacing - Memory Devices, Address Decoding - X86 Memory Interfacing - 8086 Assembly language programming - Interrupts and interrupt service routines

UNIT III I/O & BUS INTERFACING 9

Programmable Peripheral Interface (8255), Programmable Interval Timer (8253), Programmable Interrupt Controller (8259) Programmable Communication Interface, Bus Interface- Peripheral Component Interconnect Bus (PCI) - The Universal Serial Bus (USB) - Accelerated Graphics Port (AGP) Controller Area Network Interface, Zigbee wireless Interface.

UNIT IV ARM MICROPROCESSOR ARCHITECTURE 9

ARM Design Philosophy, Overview of ARM architecture States [ARM, Thumb, Jazelle], ARM Processor Fundamentals - Registers, Current Program Status Register, Pipeline, Exception, Interrupt, Vector Tables, Core Extension, Arm Processor Families

UNIT V ARM PROGRAMMING AND ARM CONTROLLER 9

ARM Instruction- data processing instructions, branch instructions, load-store instructions, SWI instruction, Loading instructions, conditional Execution, Assembly Programming. Thumb Instruction- Thumb Registers, ARM Thumb interworking. ARM Microcontroller -Features of the LPC 214X - Programming LPC2148 Case Study: ARM Cortex M Microcontroller

TOTAL: 45 HOURS

TEXTBOOKS:

1. Brey, Barry B. The Intel microprocessors, Pearson Publication, 2008
2. Andrew N Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide, 2012, Morgan Kaufmann Publishers.

REFERENCES:

1. A. K. Ray, K. M. Bhurchandi, Advanced Microprocessors and Peripherals, Architecture, Programming and Interfacing, Sixth Edition Reprint, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2nd edition 2006.
2. Jochen Steve Furber, "ARM System-on-Chip Architecture", Addison Wesley Trade Computer Publications, Second Edition, 2000.
3. Doughlas V. Hall, Microprocessors and Interfacing, Programming and Hardware, TMH, 2012.
4. Mathur A. P., Introduction to Microprocessors, Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1989.

COURSE OUTCOMES:

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

1. Explain the addressing modes, assembly language programming of X86, and ARM.
2. Explain architecture of 8086.
3. Design and develop assembly language programs.
4. Interface different external memory and peripheral devices with microprocessors and micro controller
5. Analyze a problem and formulate appropriate computing solution for microprocessor-based application

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1	2								3	
CO2	3	2	2	1	2								3	
CO3	3	2	2	1	2								3	
CO4					2								3	
CO5	1												3	

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UIT2402	ADVANCED DATA STRUCTURES AND ALGORTIHM ANALYSIS	3	0	2	3	5

OBJECTIVES:

The objective of this course is to enable the students to

- Use hierarchical data structures for solving problems
- Understand and apply different algorithm design techniques
- Analyze formulations of problems and algorithms for time and space efficiency
- Understand intractability and characterize NP problems

UNIT I ADVANCED NON-LINEAR DATA STRUCTURES 9

Review of Algorithm Analysis and Asymptotic Notations – Splay trees – amortized analysis – B+-Trees and database indexing – Red-Black trees – Skew Heaps – Binomial Heaps – Fibonacci Heaps

UNIT II STATE-SPACE APPROACH AND DIVIDE-AND-CONQUER 9

State-space approach – exhaustive search: DFS, BFS, Iterative Deepening - Divide and Conquer: Merge Sort, Quick Sort, Closest Pairs Problem, Convex Hull Problem.

UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9

Dynamic programming: Computing a Binomial Coefficient – Warshall's and Floyd's algorithm– Bellman Ford Algorithm- Optimal Binary search trees – Greedy Technique: Minimum Spanning Tree –Dijkstra's Algorithm – 0/1 Knapsack problem – Huffman coding

.

UNIT IV BACKTRACKING AND ITERATIVE IMPROVEMENT 9

Backtracking – N-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem – Graph Coloring – Iterative Improvement – Stable Marriage Problem – Maximum-Flow Problem – Maximum Matching in Bipartite Graphs.

UNIT V INTRACTABILITY 9

Branch and Bound – Knapsack problem – Traveling salesman problem – Introduction to intractability – Polynomial reductions – SAT and 3-SAT – NP-complete and NP-Hard problems – Approximation algorithms: Traveling salesman problem – Knapsack problem – Introduction to randomized and parallel algorithms.

THEORY: 45 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Implementation of splay trees
2. Implementation of B+ trees
3. Implementation of state space search algorithms
4. Implementation of divide-and-conquer algorithm for closest-pairs problem
5. Implementation of Huffman coding
6. Implementation of disjoint sets and Kruskal's algorithm
7. Implementation of dynamic programming algorithms --- computing binomial coefficients, Bellman-Ford algorithm
8. Implementation of backtracking algorithms to solve n-Queens and Hamilton circuits problems
9. Implementation of iterative improvement strategy for stable marriage and maxflow problems
10. Implementation of Branch and Bound technique to solve knapsack and TSP problems
11. Implementation of approximation algorithms for knapsack and TSP problems
12. Implementation of parallel and randomized algorithms

PRACTICAL: 30 HOURS

EXPERIENCIAL LEARNING:

Students are divided into teams of size not exceeding seven.

Each team will be given a project as a context.

1. Processes: PSP, Scrum, DevOps : 15%
2. Management: Estimation, WBS, Planning, Tracking : 10%
3. Risk Management : 5%
4. Coding Standards and Configuration Management : 15%
5. Automation of routine tasks : 10%
6. Meetings: "Customer" meetings, review meetings, brain-storming : 15%
7. Presentations : 15%
8. Documentations : 15%

PROJECT: 45 HOURS

TOTAL: 120 HOURS

TEXT BOOK:

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education, 2012.

REFERENCES:

1. Jon Kleinberg and Eva Tardos, “Algorithm Design”, Pearson Education, 2006.
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education, Fourth Edition, 2014
3. S. Skiena, “The Algorithm Design Manual”, 2nd Edition, Springer, 2008.
4. Sara Baase and Allen Van Gelder, "Computer Algorithms", Third Edition, Pearson Education, 2000.
5. S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.
6. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited, 2012.

COURSE OUTCOMES:

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

1. Design and implement algorithms using hierarchical data structures
2. Judiciously select and apply algorithm design techniques for efficiently solving problems
3. Analyze the time and space complexity of algorithms and their implementations
4. Explain intractability and characterization of NP problems
5. Apply best practices for IT project management for design and development of software intensive systems
6. Communicate efficiently in team meetings & presentations and prepare documents in the context of software development projects

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1											3	
CO2	3	2	2									1	3	
CO3	3	1	1										3	
CO4	2	1	1										3	
CO5	3	3	2						3	3	2	2	3	
CO6		3	3						3	3	2	2	3	

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**EL**	**C**
UIT2403	**DATA COMMUNICATION AND NETWORKS**	**3**	**0**	**0**	**0**	**3**

OBJECTIVES:

The objective of this course is to enable the students to

- Understand the division of network functionalities into layers
- Be familiar with the components required to build distinct types of networks
- Understand the required functionality at each layer
- Develop network applications

UNIT I INTRODUCTION TO NETWORKS 8

Network Introduction: Evolution of Computer Networks, Classification of computer Networks LAN, WAN, MAN, Network Topology: BUS, STAR, RING, MESH, OSI Layered Architecture, TCP/IP architecture

UNIT II PHYSICAL LAYER AND MEDIA ACCESS 10

Basic Communication: Modulation, Sampling, Quantization - ADC – DAC – Transmission media: Wired and Wireless, Medium Access Control Techniques: Random, Round Robin, Reservation: ALOHA Pure and

Slotted, CSMA/CD-CSMA/CA- Ethernet-Token Ring-Token Bus-ARQ 3 Types, Data Link Layer design issues: Error Detection Codes, Parity Check, Checksum Error Correction Codes, Hamming codes, IEEE Standards: Bluetooth (802.15).

UNIT III NETWORK LAYER AND INTERNETWORKING 9

Network Devices: Router, Switch, HUB, Bridge, Routing: Static Routing, Introduction to dynamic routing, RIP v1 and RIP v2- OSPF-DSDV. Basic Internetworking: IP - CIDR - ARP - DHCP - ICMP.

UNIT IV TRANSPORT LAYER AND SOCKET PROGRAMMING 9

Overview of Transport layer: UDP - Reliable byte stream (TCP), Connection management: Flow control – Retransmission – TCP Congestion control, Congestion avoidance: DECbit – RED – Socket Programming: TCP, UDP.

UNIT V APPLICATION LAYER 9

Traditional applications – electronic mails (SMTP, POP3, IMAP, MIME)– HTTP – File transfer protocol – SSH – DNS – SNMP – Introduction to network security.

TOTALHOURS: 45

TEXTBOOKS:

1. Behrouz A Forouzan, "Data Communication and Networking", Fifth Edition, The McGraw Hills, 2013.

REFERENCES:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks – A systems Approach", Fifth Edition, Morgan Kaufmann, 2011.
2. James F Kurose, Keith W Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2013.
3. William Stallings, "Data and Computer Communication", 10th Edition, Pearson, 2014.
4. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", Fifth Edition, Pearson, 2013.
5. Nader F Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2014.
6. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open-Source Approach", McGraw Hill Publisher, 2011.

COURSE OUTCOMES:

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

1. Identify the components required to build different types of networks.
2. Choose the required functionality at each layer for given application.
3. Identify solution for each functionality at each layer.
4. Ability to trace and interpret information flow in the network
5. Understand the functionalities of network application services

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1				2	3	3				1	1	
CO2	2	2										1	1	
CO3	3	2										1	1	
CO4	3	2										1	1	
CO5	3	2				2	3	3				1	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2404	AUTOMATA THEORY AND COMPILER DESIGN	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students to

- Construct automata for any given pattern and find its equivalent regular expressions.
- Understand different phases of the compiler and various parsing techniques
- Learn how to generate machine codes.
- Understand Turing machines and basics of theory of computation
- Understand undecidability and semi-decidability

UNIT I FINITE AUTOMATA 9

Introduction: Basic Mathematical Notation and techniques - Finite State Systems - Basic Definitions, Finite Automaton: DFA – NDFA – with ε-moves, Regular Languages: Regular Expression Equivalence of NFA and DFA – Equivalence of finite Automaton and regular expressions – Minimization of DFA – Pushdown Automata.

UNIT II GRAMMARS 9

Grammar Introduction: Types of Grammar, Context Free Grammars and Languages, Derivations, Simplification of CFG: Elimination of Useless Symbols Simplification of CFG: Unit productions, Null productions, Chomsky normal form, Greibach Normal form – phases of a compiler – lexical analysis

UNIT III LEXICAL AND SYNTAX ANALYSIS 9

Need and Role of the Parser –Top-Down parsing: Recursive Descent Parsing – Predictive Parsing - Bottom-up parsing: Shift Reduce Parsing, Operator Precedence Parsing, LR Parsers: Canonical LR Parser – LALR Parser - Error Handling and Recovery.

UNIT IV CODE GENERATION AND TURING MACHINES 9

Intermediate Code Generation: Syntax Directed Definitions, Syntax Directed Translation Schemes – Three address code - Translation of Expressions- Code Generation: Issues in Design of a Code Generator, A Simple Code Generator Algorithm. Turing Machines: Introduction - Instantaneous descriptions, Turing Machine as Acceptors - Turing Machine for computing functions (Transducer) - Turing Machine Constructions

UNIT V UNDECIDABILITY 9

Undecidability: Basic definitions – Decidable Problems – Examples of undecidable problems – Semi-decidability – Rice's Theorem, problems about Turing Machine – Post's Correspondence Problem – Properties of Recursive and Recursively enumerable languages.

TOTAL: 45 HOURS

TEXTBOOKS:

1. John E Hopcroft and Jeffery D Ullman, Introduction to Automata Theory, Languages and Computations, Narosa Publishing House, 2002.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, Compilers – Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007.

REFERENCES:

1. Michael Sipser, "Introduction of the Theory of Computation", Second Edition, Thomson Brokecole, 2006.
2. J. Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hill, 2003.
3. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.
4. Muneeswaran. K, ―Compiler Design, Oxford University Press, 2012

5. Steven S. Muchnick, ―Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
6. Randy Allen, Ken Kennedy, ―Optimizing Compilers for Modern Architectures: A Dependence-based Approach, Morgan Kaufmann Publishers, 2002.

COURSE OUTCOMES:

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

1. Construct automata, regular expression for any pattern.
2. Write Context free grammar for any construct.
3. Build the different Phases of compiler and apply the various optimization techniques.
4. Design Turing machine for a given language
5. Explain decidability, semi-decidability, and undecidability

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1											1	
CO2	2	1											1	
CO3	2	2											2	
CO4	2	1	1									1	2	
CO5	2	1	1									1	2	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2411	NETWORK PROGRAMMING LAB	0	0	3	1.5

OBJECTIVES:

The objective of this course is to enable the students
The student should be made to:

- Learn socket programming.
- Be familiar with simulation tools.
- Have hands on experience on various networking protocols.

LIST OF EXCERCISES:

Tools: Python Twisted, Cisco Packet Tracer, Wireshark, NS2/NS3, Cooja

1. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
2. Study of Socket Programming and Client – Server model
3. Write a code simulating ARP /RARP protocols.
4. Write a code simulating PING and TRACEROUTE commands
5. Create a socket for HTTP for web page upload and download.
6. Write a program to implement RPC (Remote Procedure Call)
7. Implementation of Subnetting.
8. Applications using TCP Sockets like
    a. Echo client and echo server
    b. Chat
    c. File Transfer
9. Applications using TCP and UDP Sockets like
    a. DNS
    b. SNMP
    c. File Transfer
10. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS

11. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
    a. Link State routing
    b. Flooding
    c. Distance vector

TOTAL: 45 HOURS

REFERENCES:

1. Dr. M.O. Faruque Sarker, Sam Washington, "Learning Python Network Programming", Packt Publisher, OReilly, June 2015.
2. Brandon Rhodes, John Goerzen, "Foundations of Python Network Programming", 3rd Edition, APress, 2014
3. https://www.w3schools.in/python-tutorial/network-programming/

COURSE OUTCOMES:

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

1. Ability to study and implement network sockets
2. Study and analyze the performance of networking protocols
3. Ability to work with network simulation tools

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1											1	
CO2	2	2		2	1								1	
CO3	2	1		2	1								1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2412	DIGITAL SYSTEMS AND MICROPROCESSOR LAB	0	0	3	1.5

OBJECTIVES:

The objective of this course is to enable the students to

- Learn the functionalities of basic digital circuits
- Master the Assembly Language Programming using 8086 Processor.
- Learn the interfacing of peripheral devices with the microprocessor and microcontrollers
- Learn the features of ARM controller using ARM trainer Kit/Raspberry Pi/Arduino Boards.
- Learn about the Micro Python programming for Raspberry Pi and Arduino.

LIST OF EXPERIMENTS:

1. Study of Logic gates, flip-flops, and counters.
2. 8086 ALP Programs (Using Kit and MASM).
    a. 8 and, 16-bit Arithmetic operations (Using Kit and MASM).
    b. Sorting and searching of numbers.
    c. String manipulation operations.
    d. Implementing Digital clock.
3. Interfacing using Microprocessor and ARM Microcontroller (Using Kit)
    a. DAC for waveform generation.
    b. Interfacing to simulate Traffic Light controller signals.

c. Interfacing Stepper Motor.

4. Micro python programming using ARM Embedded Trainer Kit/ Raspberry Pi / Arduino boards.
    a. LED on/off control.
    b. Triggering Notification using sensors.
    c. Generation of PWM output.
    d. Reading analog inputs and writing analog outputs.
5. Flutter / Kotlin Multiplatform applications using ARM
6. Mini projects using any microcontroller, sensors, actuators and Zigbee/communication module

TOTAL: 45 HOURS

COURSE OUTCOMES:

On successful completion of the course, the students should be able to

1. Write ALP for 8086 processor and ARM Processor
2. Develop systems with interfacing peripheral devices with microprocessor & Controller.
3. Create ALP to solve simple problems using ARM board
4. Develop real time applications using interfacing various peripherals and processor.
5. Solve simple problems using Micro python
6. Design and develop suitable autonomous applications for the given situation using ARM Board/ARM Embedded Trainer Kit/ Raspberry Pi / Arduino board

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1					2				3	
CO2	3	2	1	1									3	
CO3	3	2	1	1					2				3	
CO4	3	2	1	1					2				3	
CO5									2					
CO6									2				1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2501	PRINCIPLES OF SOFTWARE ENGINEERING AND PRACTICES	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students

- To understand the process and its models.
- To understand fundamental concepts of Requirements Engineering and Analysis Modelling.
- To understand the design principles.
- To learn various testing and maintenance measures.

UNIT I SOFTWARE LIFE CYCLE MODELS 9

Process: Definition, Benefits of well-defined process, Generic phases, Verify and validate – Software life cycle models: Waterfall model, Prototyping model, RAD model, Spiral model, Agile methodologies.

UNIT II REQUIREMENTS ENGINEERING 9

Understanding requirements: Functional and Non-Functional, Requirement Engineering Process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management, Modelling requirements: Data Flow Diagram, Entity Relation Diagram, Data Dictionary, State Transition Diagram – Software Requirements Document

UNIT III SOFTWARE DESIGN 9

Design process and concepts – Popular design methods: Modular Decomposition, Event- oriented, Object-oriented design – Transition from Analysis to Design – Architectural Styles: Pipes & filters, Call and return systems, Object-oriented systems, Layered Systems, Data Centered systems – Structured Design: principles, strategies for converting DFD into Structure chart – How to measure the goodness of the design: coupling, cohesion, types.

UNIT IV TESTING 9

Software testing fundamentals – Testing approaches – Black Box Testing: Equivalence partitioning, Boundary Value Analysis – White box testing: basis path testing – Test coverage criteria based on Data flow mechanisms – Regression Testing – Levels of Testing: Unit Testing, Integration Testing, System Testing, Acceptance Testing.

UNIT V UMBRELLA ACTIVITIES 9

Risk Management – Identification, Projection, RMMM - Software Configuration Management: Definitions and terminology, processes and activities, Configuration audit – Software Quality Assurance: Quality Definition, Quality of Conformance, Cost and benefits of quality, Quality control and Quality assurance.

TOTAL: 45 HOURS

TEXTBOOKS:

1. Roger S. Pressman, "Software Engineering – A practitioner's Approach", Seventh Edition, McGraw-Hill International Edition, 2017.
2. Ian Sommerville, "Software Engineering", Tenth Edition, Pearson Education Asia, 2017.

REFERENCES:

1. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009
2. Kelkar S. A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007
3. Pankaj Jalote, "Software Engineering – A Precise Approach", Wiley India, 2010.
4. Ghezzi, "Fundamentals of Software Engineering", Second Edition, Pearson Education India, 2015.

COURSE OUTCOMES:

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

1. Identify the key phases and compare different process models.
2. Apply the concepts of Requirements Engineering and Analysis modelling.
3. Apply systematic procedure for software design and deployment.
4. Compare and contrast various testing strategies.
5. Apply umbrella activities from inception till maintenance.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1			3				1	1		3	
CO2	1	1	1	1					1	2			3	
CO3	1	2	1	1		3				2	1		2	
CO4	1	1	1	1		3							2	
CO5	1	2	1	1						1	2		2	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2502	DATA ANALYTICS & VISUALIZATION	3	0	2	4

OBJECTIVES:

- Understand the challenges and processes in data analytics
- Apply descriptive data analytics and visualization techniques
- Apply inferential data analytics
- Build and evaluate models for predictive analytics

UNIT I INTRODUCTION TO DATA SCIENCE 8

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications.

UNIT II DESCRIPTIVE ANALYTICS AND VISUALIZATION 10

Frequency distributions – Outliers –interpreting distributions – graphs – averages - describing variability – interquartile range – variability for qualitative and ranked data - Normal distributions – z scores –correlation – scatter plots – regression – regression line – least squares regression line – standard error of estimate – interpretation of r^2 – multiple regression equations – regression toward the mean.

UNIT III INFERENTIAL STATISTICS 9

Populations – samples – random sampling – Sampling distribution- standard error of the mean - Hypothesis testing – z-test – z-test procedure –decision rule – calculations – decisions – interpretations - one-tailed and two-tailed tests – Estimation – point estimate – confidence interval – level of confidence – effect of sample size.

UNIT IV ANALYSIS OF VARIANCE 9

t-test for one sample – sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – statistical significance – t-test for two related samples. F-test – ANOVA – Two-factor experiments – three f-tests – two-factor ANOVA –Introduction to chi-square tests.

UNIT V PREDICTIVE ANALYTICS 9

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling. Regression using StatsModels – multiple regression – nonlinear relationships – logistic regression – estimating parameters – Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis.

THEORY: 45HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

1. Working with Numpy arrays
2. Working with Pandas data frames
3. Basic plots using Matplotlib
4. Frequency distributions, Averages, Variability
5. Normal curves, Correlation and scatter plots, Correlation coefficient
6. Regression
7. Z-test
8. T-test
9. ANOVA
10. Building and validating linear models
11. Building and validating logistic models
12. Time series analysis

PRACTICAL: 30HOURS

TOTAL: 75HOURS

TEXTBOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I).
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

REFERENCES:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

COURSE OUTCOMES:

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

1. Explain end-to-end data analytics pipeline
2. Use appropriate tools to describe and visualize data
3. Perform various statistical analysis to make statistical inferences
4. Build, validate and communicate data analytical models for complex engineering problems

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1											
CO2	3	2	2		3									
CO3	3	2	2	3									3	3
CO4	3	3	3		1				1	3		3	3	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2503	PRINCIPLES OF OPERATING SYSTEMS	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students to

- Understand the basic concepts and functions of operating systems.
- Learn about processes, threads, and scheduling algorithms.
- Understand the principles of concurrency and deadlocks.
- Learn various memory management schemes.
- Understand I/O systems basics and various file systems.

UNIT I INTRODUCTION TO OPERATING SYSTEMS 9

Introduction: Defining Operating Systems - Operating System objectives and functions - The evolution of Operating Systems - Operating System operations, Operating System structures: Operating System Services - System calls - System programs - Operating System structure - Developments leading to modern Operating Systems - Virtual machines- OS design considerations for multiprocessor and multicore - Operating System generation - System boot.

UNIT II PROCESSES AND THREADS 9

Processes: Process concept - Process scheduling - Operations on processes – Inter-process communication, Threads: Multi core programming - Multithreading models - Threading issues, CPU Scheduling: Basic concepts - Scheduling criteria - Scheduling algorithms - Thread scheduling.

UNIT III CONCURRENCY 9

Process Synchronization: Background - The Critical Section problem - Peterson's solution - Synchronization hardware - Mutex Locks - Semaphores - Classic problems of synchronization, Deadlocks: System model - Deadlock characterization - Methods for handling deadlocks: Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT IV MEMORY MANAGEMENT 9

Main Memory: Background – Swapping - Contiguous Memory Allocation – Segmentation – Paging - Structure of the Page Table – Virtual Memory: Background - Demand Paging - Copy-on-Write - Page Replacement - Allocation of Frames – Thrashing.

UNIT V STORAGE MANAGEMENT 9

Mass-Storage Structure: Disk Structure - Disk Scheduling - Disk Management - Swap-Space Management - I/O Systems Basics - File-System Interface: File concept - Access methods - Directory and Disk Structure - File-System Implementation: File-System Structure - File-System implementation - Directory implementation - Allocation methods - Free-Space management - Case studies: FAT, NTFS File Systems.

THEORY: 45 HOURS

TEXTBOOK:

1. Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, "Operating System Concepts", Tenth Edition, John Wiley and Sons Inc., 2018.

REFERENCES:

1. William Stallings, "Operating Systems – Internals and Design Principles", Ninth Edition, Pearson, 2018.
2. Andrew S. Tanenbaum, Albert S. Woodhull, "Operating Systems Design and Implementation", Third Edition, Prentice Hall, 2006.
3. Brian L. Stuart, "Principles of Operating Systems: Design & Applications", First Edition, Thomson Learning, 2009.
4. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
5. Harvey M. Deitel, Paul J. Deitel, and David R. Choffnes, "Operating Systems", Third Edition, Pearson Education, 2004.
6. Achyut S. Godbole, Atul Kahate, "Operating Systems", Third Edition, McGraw Hill Education, 2017.

COURSE OUTCOMES:

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

1. Explain operating system services and operations.
2. Implement various scheduling algorithms.
3. Apply the principles of concurrency.
4. Compare and contrast various memory management schemes.
5. Analyze the various disk scheduling algorithms
6. Design and implement prototype file systems.

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3											1		
CO2	3	2	1									1	1	
CO3	3	2	1									1	1	
CO4	3	2	1									1	1	
CO5	3	2	1									1	1	
CO6	3	2	1									1	1	

COURSECODE	COURSETITLE	L	T	P	C
UIT2504	ARTIFICIAL INTELLIGENCE	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students to

- Understand the basic concepts of intelligent agents
- Develop general-purpose problem-solving agents, logical reasoning agents, and agents that reason under uncertainty
- Employ AI techniques to solve some of today's real-world problems.

UNITI INTELLIGENT AGENTS 9

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

UNITII PROBLEM SOLVING 9

Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments

UNITIII GAME PLAYING AND CSP 9

Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.

UNITIV LOGICAL AGENTS 9

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.

UNITV PROBABILISTIC REASONING 9

Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

THEORY: 45 HOURS

TEXTBOOK:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.

REFERENCES:

1. Dan W. Patterson, "Introduction to AI and ES", Pearson Education,2007
2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013 (http://nptel.ac.in/)

COURSE OUTCOMES:

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

1. Understand the foundations of artificial intelligence (AI) and autonomous agents that make effective decisions in various environmental settings, their scope and limitations.
2. Apply basic principles of AI in solutions that require problem solving, inference under certainty and uncertainty, perception, knowledge representation, and learning
3. Define complex problems in AI terms, and solve them by analyzing appropriate AI agents.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1										2	2
CO2	3	2	2										3	2
CO3	2	3	2										3	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2511	SOFTWARE DEVELOPMENT PROJECT – II	0	0	3	1.5

OBJECTIVES:

The objective of this course is to enable the students to

- Apply the software engineering principles and practices in developing software systems that use artificial intelligence techniques
- Manage software projects using enduring principles
- Judiciously select and use modern tools for software development

Carry out team project to solve a real-world problem that requires significant ideas from Artificial Intelligence. Each team should follow the best principles and practices for software development, and demonstrate their abilities to:

1. Choose and follow a team process
2. Identify and manage risks
3. Prepare Statement of Work (SoW)
4. Identify and document the functional and quality attributes of the product
5. Perform high-level and low-level design activities
6. Estimate and track the cost
7. Perform work break-down (WBS)
8. Prepare macro and micro plans and track them
9. Develop and test the software in iterations
10. Carry out configuration management and quality assurance activities
11. Conduct and contribute in different types of meetings
12. Prepare necessary documents and make effective presentations

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

1. Apply systematic approach to software development using enduring principles and best practices
2. Design, implement, and evaluate software to meet business requirements of users
3. Judiciously select and apply artificial intelligence techniques in their computing solutions
4. Apply best practices for IT project management
5. Communicate efficiently in team meetings & presentations and prepare documents

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	1				1		1		3	1
CO2	1	3	3	3					2	2	1		3	1
CO3	2	1	1		1						1		3	3
CO4			1	2	1						2	3	2	1
CO5			1	1					2	3				1

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2512	OPERATING SYSTEMS PRACTICES LAB	0	0	3	1.5

OBJECTIVES:

The objective of this course is to enable the students to

- Install and configure operating systems
- Develop software using operating system services
- Learn to create and manage processes and threads
- Understand CPU scheduling algorithms, memory allocation algorithms, and page replacement algorithms
- Understand disk scheduling, file allocation methods, and file organization techniques.

LIST OF EXCERCISES:

1. Install and configure operating systems in bare metal and virtual machines
2. Implement selected operating system services
3. Develop software using operating system services
4. Develop software using processes and threads
5. Implement selected CPU scheduling algorithms
6. Implement selected memory management algorithms
7. Implementselected storage management algorithms
8. Mini-project

TOTAL: 45 HOURS

REFERENCES:

1. The Linux Knowledge Base and Tutorial:http://www.linux-tutorial.info/
2. http://nptel.ac.in/

COURSE OUTCOMES:

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

1. Install and configure operating systems
2. Implement operating system services
3. Automate routine operating system maintenance tasks
4. Develop software using operating system services
5. Analyze the performance of the various scheduling, memory management, and storage management algorithms

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1							3		2		
CO2	3	3	2									1	3	
CO3	3	3	2						2	2		2	3	
CO4	3	3	2						2	2		2	3	
CO5	3	3	2						2	2		2	3	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2601	PATTERN RECOGNITION AND MACHINE LEARNING	3	0	2	4

OBJECTIVES:

The objective of this course is to enable the students to

- Understand the basic concepts and techniques of Machine Learning.
- design and implement machine learning solutions for classification, regression, and clustering problems.
- design and analyse machine learning experiments

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Review of Linear Algebra for machine learning (delivery through asynchronous mode video lectures); What is machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II SUPERVISED LEARNING: REGRESSION AND CLASSIFICATION 11

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Case study with California Housing dataset.

UNIT III NEURAL NETWORKS 8

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout. Case study with UCI heart disease/ CIFAR10 dataset.

UNIT IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 8

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization, Case study with breast cancer dataset.

UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 9

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – *t* test, McNemar's test, K-fold CV paired *t* test, Case study using CIFAR10/MNIST/Airline Sentiment datasets.

LECTURE HOURS: 45

LAB COMPONENT:

1. Predicting the age of Abalone (type of snail) using linear regression
2. Detecting spam mails using Naïve Bayes
3. Sentiment classification of movies using decision tress and random forest
4. Recognizing digits using multilayer perceptron
5. Deep neural networks for CIFAR-10
6. Ensemble algorithms
7. Clustering MNIST handwritten dataset using K-means algorithm
8. Model validation and selection using statistical tests
9. Mini-project: students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance.

LAB HOURS: 30
TOTALHOURS: 75

TEXTBOOK:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

REFERENCES:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition,1997.
3. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014
4. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
5. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
6. Sebastain Raschka, "Python Machine Learning", Packt publishing (open source).

COURSE OUTCOMES:

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

1. Explain and appreciate the underlying mathematics and paradigms of Machine Learning algorithms.
2. Select the appropriate machine learning approach and suitable model parameters for a given problem.
3. Design machine learning experiments, and implement machine learning solutions for regression, classification and clustering problems, and interpret the results.
4. Implement various machine learning algorithms for real-world applications.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1										2	2
CO2	3	2	2										3	2
CO3	3	3	2										3	2
CO4	3	2	2	1	1				3	3		2	3	3

COURSE CODE	COURSE TITLE6	L	T	P	EL	C
UIT2602	WEB PROGRAMMING	3	0	2	3	5

OBJECTIVES:

The objective of this course is to enable the students to

- understand the basics of web technology and software-as-a-service
- fully comprehend a selected platform for web software development
- understand service-oriented architecture and develop micro-services and RESTful APIs
- understand SaaS abstractions and develop client-side code using Javascript ecosystem
- employ software engineering best practices for web programming

UNIT I INTRODUCTION 9

Introduction to web technology – Software-as-a-service – software development processes – quality assurance – SaaS and service-oriented architecture – cloud computing – HTTP, HTML, and the web – mobile clients – fallacies and pitfalls. How to learn a new language – learning to learn languages and frameworks – pair programming – programming using Ruby – Ruby idioms – library management in Ruby – fallacies and pitfalls

UNIT II SAAS ARCHITECTURE AND FRAMEWORKS 9

Client-server architecture – HTTP routes – service-oriented architecture – micro-services – RESTful APIs – RESTful URIs, API calls, and JSON – fallacies and pitfalls. Model-view-controller architecture – Rails models (databases and active records) – routes, controllers, and views – Forms – debugging web applications – fallacies and pitfalls.

UNIT III SAAS ABSTRACTIONS AND CLIENTS 9

DRYing out MVC – single-sign-on and third party authentication – associations and foreign keys – through associations – RESTful routes for associations – fallacies and pitfalls. Mobile and desktop SaaS clients – javascript – ECMA script – classes, functions, and constructors – document object model and jQuery – DOM and accessibility – events and callbacks – AJAX – testing javascript and AJAX – single-page apps and JSON APIs – fallacies and pitfalls.

UNIT IV REQUIREMENTS AND TESTING 9

Behavior-driven design – user stories – SMART user stories – Lo-Fi user interface sketches and story boards – points and velocity – agile cost estimation – fallacies and pitfalls. Test-driven development – FIRST, TDD, and Red-Green refactor – test cases – isolating code – stubbing the Internet – fixtures and factories – coverage concepts and types of tests – other testing approaches – fallacies and pitfalls.

UNIT V MAINTENANCE AND DESIGN PATTERNS 9

Exploring legacy code base – characterization tests – documenting code – metrics, code smells, and SOFA – method-level refactoring – fallacies and pitfalls. Patterns, anti-patterns, and SOLID class – single responsibility principle – Open/Closed principle – Liskov substitution principle – Dependency injection principle – demeter principle – fallacies and pitfalls.

LECTURE HOURS: 45

LAB COMPONENT:

Selected CHIPS from the text book

LAB HOURS: 30

EXPERIENCIAL LEARNING:

Students are divided into teams; About 7--10 members in a team

Each team will be given a web programming project (using Ruby on Rails) as a context

1. Processes: PSP, Scrum, DevOps : 15%
2. Management: Estimation, WBS, Planning, Tracking : 10%
3. Risk Management : 15%
4. Coding Standards and Configuration Management : 15%
5. Automation of routine tasks : 15%
6. Meetings: “Customer” meetings, review meetings, brain-storming : 10%
7. Presentations : 10%
8. Documentations : 10%

PROJECT HOURS: 45
TOTALHOURS: 120

TEXTBOOK:

1. Armando Fox and David Patterson, “Engineering Software as a Service: An agile approach using cloud computing”, Second Edition, Pogo Press, 2021.

REFERENCES:

1. Mark Pilgrim, “HTML5: Up and Running”, O’Reilly, 2010.
2. Brad Dayley, Brendan Dayley, Caleb Dayley, “Learning Angular: A Hands-On Guide to Angular 2 and Angular 4”, Second Edition, Addison-Wesley Professional, 2018.
3. Evan Hahn, “Express in Action: Node applications with Express and its companion tools”, First Edition, Manning Publications, 2015.
4. Kristina Chodorow, Shroff, “Mongodb: The Definitive Guide – Powerful and Scalable Data Storage”, Second Edition, O’Reilly, 2013.
5. Subbu Allamaraju, RESTful Web Services Cookbook, First Edition, O′Reilly, 2010.

COURSE OUTCOMES:

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

1. Explain the basics of web technology and software-as-a-service
2. Employ ruby-on-rails platform for web software development
3. Develop and test micro-services and restful apis
4. Develop client-side code using javascript ecosystem
5. Judiciously select and employ design patterns in web programming
6. Employ software engineering best practices for web programming
7. Apply best practices for IT project management
8. Communicate efficiently in team meetings & presentations and prepare documents

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2					3						1	1	
CO2	2		1						1			1	2	2
CO3	2	2	1		1	3						1	2	2
CO4	2	2	1		1	3						1	2	
CO5	2	2	1									1	1	
CO6		2	1									1		
CO7		1	1									1		1
CO8	1								1					1

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2603	INTERNET OF THINGS AND C PROGRAMMING	3	0	2	4

OBJECTIVES:

The objective of this course is to enable the students

- To develop C Programs using basic programming constructs
- To develop C programs using arrays, strings and functions
- To develop applications in C using pointers, structures and files
- To introduce the IoT terminology, technology, and applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices.

UNIT I INTRODUCTION TO INTERNET OF THINGS 9

Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT II IoT AND M2M 9

Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.

UNIT III IoT PHYSICAL DEVICES AND ENDPOINTS 9

Introduction to Arduino and Raspberry Pi – Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

UNIT IV BASIC C PROGRAMMING 9

Introduction to programming paradigms - Structure of C program - C programming: Data Types, Operators: Precedence and Associativity - Expressions - Input/output statements, Assignment statements – Decision making statements, Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays –- String operations, Functions: Function prototype, function definition, function call, Built-in functions – Recursion – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers

UNIT V POINTERS, STRUCTURES AND FILES 9

Structure – Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Self-referential structures – Dynamic memory allocation. Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments – cross compilation for ARM

LECTURE HOURS: 45

LABORATORY COMPONENT:

1. Mini-project using the C programming language
2. Hands-on Tutorials on Arduino programming
3. Developing simple applications using open platform (like Raspberry Pi)
4. Mini-project using IoT

LAB HOURS: 30

TOTALHOURS: 75

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things – A Hands-on Approach”, Universities Press, 2015.
2. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
3. Kernighan, B.W and Ritchie, D.M., “The C Programming language”, Second Edition, Pearson Education, 2006
4. Matt Richardson & Shawn Wallace, “Getting Started with Raspberry Pi”, O'Reilly(SPD), 2014.
5. Simon Monk, “Raspberry Pi Cookbook: Software and Hardware Problems and solutions”, O'Reilly (SPD), 2016.

REFERENCES:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors OvidiuVermesan
2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment',River Publishers, 2014
3. Juneja, B. L and Anita Seth, ―Programming in C‖, CENGAGE Learning India Pvt. Ltd., 2011
4. Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment, River Publishers, 2014
5. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

COURSE OUTCOMES:

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

1. Develop software solutions using C
2. Explain the IoT value chain structure (device, data cloud), application areas and technologies involved
3. Explain IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules
4. Perform market forecast for IoT devices with a focus on sensors
5. Develop smart solutions using IoT

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1											1	
CO2	1	3	1										2	3
CO3	2	1	1		1								2	3
CO4		1										2	1	3
CO5	3	2	1		2	2			2	2			3	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2611	MOBILE APPLICATION DEVELOPMENT LAB	0	0	4	2

OBJECTIVES:

The objective of this course is to enable the students to

- Use Flutter/Kotlin multi-platform environment for building cross-platform mobile applications.
- Demonstrate the knowledge of different programming techniques and patterns for mobile application development.
- Identify the components and structure of mobile application development frameworks.
- Understand the capabilities and limitations of different platforms.
- Design and develop real-time mobile applications.

LIST OF EXPERIMENTS:

- Study and installation of Flutter/Kotlin multi-platform environment
- Develop an application that uses Widgets, GUI components, Font and Colors.
- Develop a native calculator application.
- Develop a gaming application that uses 2-D animations and gestures.
- Develop a movie rating application (similar to IMDB)
- Develop an application to connect to a web service and to retrieve data with HTTP.
- Develop a simple shopping application.
- Design a web server supporting push notifications.
- Develop an application by integrating Google maps
- Mini Projects involving Flutter/Kotlin multi-platform

TOTAL: 60 HOURS

TEXTBOOKS:

1. Simone Alessandria, Flutter Projects: A practical project-based guide to building real-world cross-platform mobile applications and games,publisher: packt publishing, www.packt.com.
2. Carmine Zaccagnino, Programming Flutter: Native, Cross-Platform Apps the Easy Way (The Pragmatic Programmers), publisher: packt publishing, www.packt.com.
3. Gergely Orosz, Building Mobile Applications at Scale:39 Engineering Challenges, amazon.in
4. Souvik Biswas & Codemagic, Flutter Libraries we love, pub.green.
5. ED Freitas, Daniel Jebaraj, Flutter Succinctly, Syncfusion, Inc.
6. Flutter Basics, www.tutorialpoints.com.
7. Learn Google Flutter Fast
8. Antonio Leiva, Kotlin for Android Developers Learn Kotlin the easy way while developing an Android Applications

PREREQUISITES IN TERMS OF KNOWLEDGE, SKILLS AND OTHER COMPETENCIES:

1. Basic knowledge of modern operating systems (Windows and Linux in particular).
2. Fundamentals of Kotlin.
3. Fundamentals of Flutter.

4. Basic knowledge of the anatomy of Android Application Development using Android Studio.
5. Basic knowledge of mobile technologies.

COURSE OUTCOMES:
On successful completion of this course, the student should be able to

1. Design and build simple mobile applications supporting multiple platforms.
2. Apply various programming techniques and patterns to build mobile applications.
3. Build real-time/gaming/multimedia/AI-based mobile applications for society/environment following ethical practices

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1										2	
CO2	3	3	1										2	
CO3	3	3	3		3			2		1		1	3	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2701	NETWORK AND COMMUNICATION SECURITY	3	0	0	3

OBJECTIVES:
The objective of this course is to enable the students to

- understand the fundamentals of Cryptography.
- acquire knowledge on standard algorithms used to provide confidentiality, integrity, and authenticity.
- understand the various key distribution and management schemes.
- understand how to deploy encryption techniques to secure data in transit across data networks.
- design security applications in the field of Information technology.

UNIT I MATHEMATICS OF CRYPTOGRAPHY 9
Security threats – Attacks and services – Basic Number theory – Congruences – Chinese Remainder theorem – Modular exponentiation – Fermat and Euler's theorem – Finite fields – Classical crypto systems – Different types of ciphers – Steganography -LFSR sequences.

UNIT II ENCRYPTION TECHNIQUES 9
Symmetric Key Encryption- Simple DES, Linear and Differential cryptanalysis, DES, Modes of operation, Triple DES, AES – Public Key Cryptography - Factorization problem and RSA, Discrete Log problem and Diffie Hellman Key Exchange, Elliptic curve cryptography.

UNIT III HASH FUNCTION AND MESSAGE AUTHENTICATION 9
Requirements and Security of Cryptographic Hash Functions, SHA 256, Message Authentication Requirements – Message Authentication Functions – Message Authentication Codes – HMAC, Digital Signatures – Digital Signature Algorithm, Key Management and Distribution.

UNIT IV NETWORK LEVEL SECURITY 9
Remote User Authentication Principles, Kerberos- X.509 Certificate –Electronic Mail Security–PGP–S/MIME-IP Security – Transport Layer Security, Network Security Concepts and policies, Offences covered in ITAct 2000.

UNIT V SYSTEM LEVEL SECURITY 9
Intruders, Intrusion Detection, Password Management, Malicious Software: Types, Viruses and Worms, Countermeasures for Viruses and Worms, DDoS Attacks, Firewalls: Need, Characteristics, Types, Basing, Location and Configuration of Firewalls.

TOTAL: 45 HOURS

TEXT BOOK:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education; Seventh edition, 2017

REFERENCES:

1. Wade Trappe and Lawrence C. Washington, Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007
2. Atul Kahate, Cryptography and Network Security, 2nd Edition, Tata McGraw Hill, 2008
3. Bruce Schneier, Applied Cryptography, John Wiley& Sons Inc, 2001.
4. Charles P Fleeger and Shari Lawrence P Fleeger, Security in Computing, Fourth edition, Pearson Education,2015.
5. William Stallings, Network Security Essentials: Applications and Standards, Pearson Education India; 4 edition (2011)
6. Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography and Network Security (SIE), Tata McGraw-Hill Education,2nd edition.2010
7. Catherine Paquet, "Implementing Cisco IOS Network Security (IINS 640-554) Foundation Learning Guide", 2nd Edition.

COURSE OUTCOMES:

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

1. Build basic security algorithms required by any computing system.
2. Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
3. Analyze the possible security attacks in complex real time systems and their effective countermeasures.
4. Classify the security issues in the network and resolve it.
5. Evaluate security mechanisms using rigorous approaches, including theoretical derivation, modeling, and simulations.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	1										3	
CO2	2	3	1			3		3					3	2
CO3	1	3	1										2	2
CO4	2	3	1			3		3					3	
CO5	1	3	2										2	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2702	CLOUD AND DISTRIBUTED COMPUTING	2	0	2	3

OBJECTIVES:

The objective of this course is to enable the students to

- Explain about distributed system and cloud models.
- Apply distributed computational model and understand the need for cloud computing.
- Learnabout cloud recovery and storage.

UNIT I INDRODUCTION TO DISTRIBUTED SYSTEM 6

Characterization of Distributed System: Introduction-Examples of distributed system, Trends in distributed system, focus on resource sharing, Challenges – System models – Inter Process Communication – Remote Invocation – Indirect Communication – Case study: World Wide Web.

UNIT II DISTRIBUTED ALGORITHMS 6

Message Passing, Leader Election, Distributed Models, Causality and Logical Time, Global State & Snapshot and Distributed Mutual Exclusion- Token based approaches, Consensus & Agreement, Checkpointing &

Rollback Recovery - Introduction classical distributed algorithms - Algorithm for Recording Global State and Snapshot - Time and Clock Synchronization in Cloud Data Center - Key Challenges.

UNIT III CLOUD VIRTUALIZATION 6

Features of Today's Cloud-Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture: public, private, hybrid. Service provider interfaces: SaaS, PaaS, IaaS – Virtualization Technology - Hardware Independence, Server Consolidation, Resource Replication, Operating System-Based Virtualization, Hardware-Based Virtualization, Virtualization management and considerations – Use case and Example.

UNIT IV CLOUD STORAGE AND RECOVERY 6

Fundamental cloud architectures - workload distribution, resource pooling, dynamic scalability, elastic resource capacity, service load balancing, cloud bursting, elastic disk provisioning, redundant storage, Case Study Example - Advanced Cloud Architectures, Hypervisor clustering, Load balanced virtual server instances, Non-Disruptive service relocation, Zero-downtime, Cloud balancing, Resource reservation, Dynamic failure detection and recovery, Bare-metal provisioning, Rapid provisioning, Storage workload management, Case Study Example.

UNIT V CLOUD PLATFORMS AND APPLICATIONS 6

Cloud platform: Microsoft Azure, Amazon Web Services, Google Cloud, IBM Cloud and CloudLinux– APIs - Microservices - Docker - Kubernetes - Applications and Use Cases.

Lectures: 30 HOURS

LAB SESSIONS:

1. Inter-process communication
2. Remote Method Invocation
3. Message passing and distributed mutual exclusion
4. Clock and Time synchronization
5. Virtual instances and server consolidation with fault-tolerance
6. Task scheduling and load balancing
7. Hypervisor clustering
8. Hosting microservices on cloud platforms
9. Dockerization and Kubernetes
10. Mini project

Lab: 30 HOURS

TOTAL: 60 HOURS

TEXTBOOK:

1. Rajiv Misra, Yashwant Singh Patel, Cloud and Distributed Computing: Algorithms and Systems, Wiley India.
2. Coulouris George, Dollimore Jean, Kindberg Tim, Blair Gordon, Distributed Systems Concepts and Design, Pearson Education, 5th Edidtion

REFERENCES:

1. Danielle Ruest, Nelson Ruest, Virtualization: A Beginner's Guide, McGraw-Hill Osborne Media, 2009.
2. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, First Edition, Pearson Education 2013.
3. John W.Rittinghouse and James F.Ransome, Cloud Computing: Implementation, Management, and Security, CRC Press, 2010.
4. Michael J.Kavis, "Architecting the Cloud". Wiley India, 2014.

COURSE OUTCOMES:

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

1. Understand how distributed system concepts apply inside cloud.
2. Apply the distributed algorithms for effective scheduling.
3. Analyze the need for virtualization and apply it in a cloud environment.

4. Understand the architecture, infrastructure, and delivery models of cloud computing.
5. Explore cloud tools and build applications.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1											
CO2	2	2		1	2									2
CO3		2	1	1	1								1	2
CO4		2												2
CO5		2	1	1	2							1	1	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2716	INDUSTRIAL TRAINING /INTERNSHIP	0	0	0	2

COURSE OUTCOMES:
Student should be able to

1. Integrate theory and practice, and identify curriculum gap
2. Develop work competencies for a specific profession or occupation.
3. Communicate and collaborate effectively and appropriately with different professionals in the work environment through written and oral means.
4. Exhibit critical thinking and problem solving skills in building real time applications.
5. Present a report on work experience and skill sets acquired.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	1									3	3	3
CO2	2	3	1		2							2	3	3
CO3									1	3				1
CO4	2	3	3	3	2	3	3				3	3	3	3
CO5									1	3				1

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2718	PROJECT WORK-PHASE-I	0	0	6	3

COURSE OUTCOMES:
Student should be able to

1. To propose solution to the problem by applying the acquired knowledge
2. To understand and apply the different advancements happened in their selected area
3. To understand and apply the different techniques used in project management.
4. To apply the different efficient and modern tools for designing their project modules.
5. To analyze and categorize the executable project modules after identifying the risks to assess the health, societal, safety and legal issues.
6. To select the best alternative design techniques used for designing solutions to the complex problems by following ethical principles.

7. To integrate different modules together through team work after undergoing efficient testing, elaborate the completed task and compile the project work efficiently

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

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2818	PROJECT WORK-PHASE-II	0	0	16	8

COURSE OUTCOMES:
Student should be able to

1. To propose solution to the problem by applying the acquired knowledge
2. To understand and apply the different advancements happened in their selected area
3. To understand and apply the different techniques used in project management.
4. To apply the different efficient and modern tools for designing their project modules.
5. To analyze and categorize the executable project modules after identifying the risks to assess the health, societal, safety and legal issues.
6. To select the best alternative design techniques used for designing solutions to the complex problems by following ethical principles.
7. To integrate different modules together through team work after undergoing efficient testing, elaborate the completed task and compile the project work efficiently
8. To present their project work effectively by using the modern media tools.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3					2				3	
CO2	3	3	3	3					1				3	
CO3	3	2	2	3					2	3	3		3	
CO4	3	2	2	3	3				2		3	3	3	3
CO5			1			3	3		2			3		3
CO6								3	2			3	1	3
CO7			1	1					1	3	3	3		3
CO8										3		3		

HSMC – ELECTIVES – HUMANITIES I (II SEMESTER)

Course Code	Course Title	L	T	P	C
UEN2241	LANGUAGE AND COMMUNICATION	2	0	2	3

OBJECTIVES:

- To enhance communicative competence in general.
- To improve the ability of the students to negotiate with meaning in context.
- To develop speaking skills of the students for career needs.
- To develop sensitivity to gender, human rights, politeness and other aspects
- To enhance the skills in being persuasive in writing and speech

UNIT I APPROACHES TO COMMUNICATION: 9

The information Processing school, Shannon and Weaver; A Mathematical Theory of Communication, Formal Signal Processing approach. Semiotic approach; information, communication and significance. Chomskyan distinction between language structure and language use; form and function. Towards a theory of performance; acceptability and grammaticality.

Communicative Competency; Possibility, appropriacy, feasibility.

UNIT II MEANING IN LANGUAGE USE 9

Speech Act Theory; communicative activity, elocutionary act, directives, commissives, expressive, declarations and representatives. Grice's theory of conversational meaning; the cooperative principle, quantity maxim, quality maxim, relational maxim, manner maxim. Ancient Indian theory of meaning; lexical, compositional, extended. Speaker intention in communication. Discourse meaning; context and situation.

UNIT III STRUCTURE OF DISCOURSE/CONVERSATION 9

Coherence, Cohesion, Initiating and closing conversations, Intervention, Turn-taking

UNIT IV POWER STRUCTURE AND LANGUAGE USE 9

Gender and language use, Politeness expressions and their use, Ethical dimensions of language use Language rights as part of human rights.

UNIT V MEDIA AND PERSUASIVE COMMUNICATION 9

Power of media, Orwell's problem(Chomsky), Manufacturing of opinion and hidden agendas.

Fundamentals of persuasive communication. Persuasive quotient. Politics and communication barrier.

TOTAL HOURS: 45

TEXT BOOKS:

1. Stephen. C. Levenson, 1983, Pragmatics, Cambridge University press.

REFERENCES:

1.Austin, J.L., How to do things with word, Oxford Clarendon Press. Grice, P. 1989.
2. Studies in the way of words. Cambridge, M.A: Harvard University Press.
3. Chomsky, N.1966. Aspects of the theory of syntax, The MIT press, Cambridge.
4. Chomsky, N.2006. Language and Mind, Cambridge University Press.
5. Hymes. D.N. 1972, On communication competence in J.B. Pride and J. Holmes (ed), Sociolinguistics, pp 269-293, London Penguin.
6. Gilbert, H. Harman, 1976. Psychological aspect of the theory of syntax in Journal of Philosophy, page75-87.
7. Stangley, J. 2007. Language inContext. Clarendon press, Oxford.
8. Shannon, 1942. A Mathematical Theory of Communication.
9. Searle, J.R. 1969. Speech acts: An essay in the philosophy of language. Cambridge: Cambridge University Press.

COURSE OUTCOMES:

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

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

COs	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		2
CO2									2	3		2
CO3									2	3		2
CO4									2	3		2
CO5									2	3		2

Course Code	Course Title	L	T	P	C
UEN2242	FUNDAMENTALS OF LINGUISTICS	2	0	2	3

OBJECTIVES:

- To introduce the students to Linguistics (the scientific study of language).
- To explore some basic issues and questions related to language such as what do we know when we know a language, the relation between language and brain, language and society, how does a child learn a language, how the languages of the world are similar as well as different, how can we analyze language as a structure etc.
- To provide students to a brief outline of language studies in Indian and western tradition and many applications of linguistics in different fields

UNIT I DEFINING LANGUAGE 9

- What is language and where is language?
- Language is a means of communication, a social product
- Language is a cognitive ability, relation between language and brain
- Study of Language in Indian and western traditions

UNIT II AN INSIGHT INTO LINGUISTICS 9

- What is Linguistics and what is not Linguistics?
- Linguistics is not prescriptive grammar learnt in the school
- Linguistics is not learning of many languages
- Linguistics provides tools to analyze language structure scientifically

UNIT III FORM AND FUNCTION 9

- Levels of Language Analysis: Form and content
- Sound
- Word
- Sentence
- Meaning
- Similarities and differences of languages

UNIT IV APPLICATIONS 9

- Applications of Linguistics

- Natural Language Processing
- Clinical Linguistics
- Psycholinguistics etc.

UNIT V IMPACT ON CAREER 9

- Impact of linguistics on one's career
- An understanding of Linguistics for better use of language
- Language and personality development
- Linguistic features specific to Engineers.

TOTAL HOURS: 45

TEXT BOOKS:

1. Raj Kumar Sharma, 'Fundamentals of Linguistics', Atlantic Publishers, Chennai:2019.

REFERENCES:

1. Thomas Herbst, 'English Linguistics: A coursebook for students of English', De Gruyter Mouton Publication, Germany: 2010.
2. Victoria A. Fromkin (ed.), Linguistics: An introduction to linguistic theory, Blackwell Publishers, USA: 2001.
3. Jeff Connor - Linto and Ralph W Fasold, 'An Introduction to Language and Linguistics', Cambridge University Press, 2014.

COURSE OUTCOMES:

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

CO1: understand what is linguistics

CO2: explore some basic issues and questions related to language

CO3: understand the subtle difference between the use of English in Indian and western tradition.

CO4: Familiarize themselves with the unique features of language in technology

CO5: Understand the basics of how children acquire languages

COs	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		2
CO2									2	3		2
CO3									2	3		2
CO4									2	3		2
CO5									2	3		2

Course Code	Course Title	L	T	P	C
UHS2243	FILM APPRECIATION	2	0	2	3

OBJECTIVES:

- To introduce students to the development of film as an art and entertainment form.
- To discuss the language of cinema as it evolved over a century.
- To enable the students to read a film and appreciate the various nuances of a film as a text.
- To guide the students to study films joyfully.

UNIT 1 THE COMPONENT OF FILMS 9

- The material and equipment

- The story, screenplay and script
- The actors, crew members, and the director
- The process of film making

UNIT II EVOLUTION OF FILM LANGUAGE 9

- Film language, form, movement etc.
- Early cinema… silent film (Particularly French)
- The emergence of feature films: Birth of a Nation Talkies
- Films and their influence on the language of people

UNIT III FILM APPRECIATION 9

- Realist theory; Auteurists
- Psychoanalytic, Ideological, Feminists
- How to read films?
- Film Criticism / Appreciation

UNIT IV DEVELOPMENT OF FILMS 9

- Representative Soviet films
- Representative Japanese films
- Representative Italian films
- Representative Hollywood film and the studio system

UNIT V INDIAN FILMS 9

- The early era
- The important films made by the directors E-3: The regional films
- The documentaries in India
- The Indian Film Industry and the Hollywood
- The impact of Films on students in India.

TOTAL HOURS:45

TEXT BOOKS:

1. Jim Piper, 'The Film Appreciation Book': The Film Course You Always Wanted to Take, Allworth Press, New York: 2014.

REFERENCES:

1. Stanley Cavell, 'The World Viewed: Reflections on the Ontology of Film, Enlarged Edition', Harvard University Press, 1979.
2. Joseph M. Boggs, Dennis W. Petrie, 'The Art of Watching Films', McGraw – Hill, 2006.
3. Bernard F. Dick, 'Anatomy of Film', St. Martins Press, 1990.
4. Understanding the Film: An Introduction to Film Appreciation by Jan Bone and Ron Johnson

COURSE OUTCOMES:

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

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.

COs	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		2
CO2									2	3		2
CO3									2	3		2
CO4									2	3		2
CO5									2	3		2

Course Code	Course Title	L	T	P	C
UHS2241	HUMAN RELATIONS AT WORK	2	0	2	3

OBJECTIVES:

The objectives of this course are to make students:

- aware of human relations at work its relationship with self.
- aware about the processes involved in interaction with people at work.
- understand the importance of psychological and physical health in maintaining human relations at work and progressing in career.
- Understand the ways and means to improve human relations at work.
- Realize the importance of safeguarding themselves from any exploitation.

UNIT I HUMAN RELATIONS 9

- Understanding and Managing Yourself
- Human Relations and You
- Self-Esteem and Self Confidence
- Self-Motivation and Goal Setting
- Emotional Intelligence
- Attitudes and Happiness
- Values and Ethics and Problem Solving and Creativity.

UNIT II INTERPERSONAL RELATIONSHIP 9

- Dealing Effectively with People
- Communication in the Workplace
- Specialized Tactics for Getting Along with Others in the Workplace
- Managing Conflict; Becoming an Effective Leader
- Motivating Others and Developing Teamwork
- Diversity and Cross-Cultural Competence

UNIT III HEALTHY LIVING 9

- Staying Physically Healthy
- Yoga, Pranayam
- Exercise: Aerobic and anaerobic

UNIT IV MENTAL WELL BEING 9

- Staying Psychologically Healthy

- Managing Stress and Personal Problems
- Meditation

UNIT V CAREER READINESS 9

- Developing Career Thrust
- Getting Ahead in Your Career
- Learning Strategies
- Perception
- Life Span Changes
- Developing Good Work Habits

TOTAL HOURS:45

TEXT BOOKS:

1. Dubrien, A. J. (2017). Human Relations for Career and Personal Success: Concepts,Applications,andSkills,11thEd.UpperSaddleRiver,NJ:Pearson.

REFERENCES:

1. Greenberg, J. S. (2017). Comprehensive stress management (14th edition). New York: McGraw Hill.
2. Udai, Y. (2015). Yogasanaurpranayam. New Delhi: N.S. Publications.

COURSE OUTCOMES:

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

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: 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.

COs	Program Outcomes											
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						2		2	3	2		2
CO2						2		2	3	2		2
CO3						2		2	3	2		2
CO4						2		2	3	2		2
CO5						2		2	3	2		2

Course Code	Course Title	L	T	P	C
UHS2242	APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE	2	0	2	3

OBJECTIVES:

The objectives of this course are to make students:

- aware of the different applications of psychology to everyday issues of life,
- aware of the different social issues, workplace issues, and behavioural issues, and
- understand how the knowledge gained from this course can be used in their own personal and professional work life.

- Understand the psychological principles relevant to human development.
- Understand the impact of Psychology on human life

UNIT I PSYCHOLOGY OF AN INDIVIDUAL 9

- Introduction: Nature and fields.
- The individual human being and his or her experiences, mental processes and behaviors.

UNIT II DIFFERENT TYPES OF PSYCHOLOGY 9

- Psychology in industries and organizations: Job analysis; fatigue and accidents; consumer behavior.
- Different types of psychology: cognitive, forensic, social, and developmental psychology

UNIT III PSYCHOLOGY AND MENTAL HEALTH 9

Psychology and mental health: Abnormality, symptoms and causes psychological disorders. Psychology for better decision making, stress management and behavior.

UNIT IV COUNSELING 9

Psychology and Counseling: Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling.

UNIT V SOCIAL BEHAVIOR 9

Psychology and social behavior: Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation

TOTAL HOURS:45

TEXT BOOKS:

1. Schultz, D. & Schultz, S.E. (2009). Psychology and Work Today (10th ed.). New Jersey:Pearson/Prentice Hall.

REFERENCES:

1. Butcher, J. N., Mineka, S., & Hooley, J. M. (2010). Abnormal psychology (14th ed.). New York: Pearson
2. Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: Pearson Education
3. Aronson, E., Wilson, T. D., &Akert, R. M. (2010). Social Psychology (7th Ed.). Upper Saddle River, NJ: Prentice Hall.

COURSE OUTCOMES:

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

CO1: raise their awareness on applications of psychology to every day issues of life
CO2: deal more efficiently with different issues in society, work place 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

COs	Program Outcomes											
	PO 1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO12
CO1						2		2	3	2		2
CO2						2		2	3	2		2
CO3						2		2	3	2		2
CO4						2		2	3	2		2
CO5						2		2	3	2		2

Course Code	Course Title	L	T	P	C
UEN2243	UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE	2	0	2	3

OBJECTIVES:

- To acquire skills not only the ones necessary for one's "trade", but also the ones to acquire knowledge and become a better human being, as a means towards the end of creating a better society.
- To facilitate understanding a society, its people, their mind, prevalent traditions and culture with a view to developing a holistic worldview, which is essential for a sustainable society.
- To introduce students to literary works of various countries/ regions / societies and attempt to understand the respective traditions to which the works belong.
- To understand the relationship between life and literature

UNIT I LITERATURE AND LIFE 9

Traditional Knowledge.

- what is Literature?
- Significance of studying literature,
- Studying society and culture through literature,
- Understanding morality through literature.
- Reading of Literary texts –The literary piece will be given to students before hand so that they read it and become familiar with the texts before coming to the class. In the class, the text will be read once again, where doubts if any will be cleared.
- First Discussion – The reading will be followed by a discussion where the text will be analyzed in detail. The students will been couraged to share their interpretation of the text.

UNIT II RESOLVING DILEMMA 9

- Definition and Description of 'Dilemma'
- Choice of literary texts to confront situations where one is faced with a dilemma (differentiating what is right and wrong? and develop a deeper insight into the various realities of life.
- Presentation of analysis of the literary text (The students will keep in mind the author's background and the socio-historical and cultural backgrounds while preparing this presentation)
- Q&A Session on the Presentation (the students will be encouraged to ask questions to their respective classmates regarding the presentation/analysis initiating a second discussion on the text.

UNIT III GENDER STUDIES 9

- Literary pieces that question the current notions of gender, and raises uncomfortable questions,
- Literature that challenges the status quo, forcing us to think about the real meaning of equality and emancipation
- Second Discussion–(Having made their presentation, and heard the presentations made by their classmates, the students would now have a fairly good idea of the various nuances of the text, making it aripe moment to have the second detailed discussion on the text. Here the teacher may refer to those points which may have been missed by the students.)

UNIT IV READING LITERATURE 9

- Reading of select Literary works
- The author's Background, Historical and Social Background for a better understanding of the literary work
- Study of other significant study material as required for an overall understanding of the literary work.

UNIT V READINGS 9

Submission of a report–Having faced questions from their classmates, and after having a second discussion on the text, the student would come across new ideas which will be in corporated in to the

analysis and submitted in the form of a report.

TOTAL HOURS: 45

TEXT BOOKS:

1. Literary works will be provided by the teacher. Author's Background,
2. Historical and Social Background which are significant for a better understanding of the work will be provided by the teacher.

REFERENCE:

Reference materials or other significant study material as required for an overall understanding of the literary work will be sourced out by the students in consultation with the teacher

COURSE OUTCOMES:

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

CO1:Improve their awareness of various traditions.

CO2: Not only understand the diversity found between various traditions but also celebrate them.

CO3:Strengthen their analytical capability.

CO4: Improve their language skills and ability of expressing complex ideas.

CO5: understand the relationship between life and literature

COs	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1									2	3		2
CO2									2	3		2
CO3									2	3		2
CO4									2	3		2
CO5									2	3		2

MANAGEMENT ELECTIVES

COURSE CODE	COURSE TITLE	L	T	P	C
UBA2541	**PRINCIPLES OF MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge about the following topics:

- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers managerial roles and skills – Evolution of Management –Scientific, human relations , system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting

TOTAL HOURS: 45

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich "Essentials of Management", Tata McGraw Hill, 1998.
2. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Robert Kreitner and Mamata Mohapatra, " Management", Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management", Pearson Education, 7th Edition, 2011.
3. Tripathy PC and Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

COURSE OUTCOMES:

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

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.

Course Outcomes	Program Outcomes											
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1											2	1
CO2									2		3	1
CO3									2		2	1
CO4					3					2	2	1
CO5											1	1

COURSE CODE	COURSE TITLE	L	T	P	C
UBA2542	TOTAL QUALITY MANAGEMENT	3	0	0	3

OBJECTIVES:

To impart knowledge about the following topics:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction)-- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six-sigma Process Capability Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM –Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards -AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation-InternalAudits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL HOURS: 45

TEXT BOOKS:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. Joel.E. Ross, “Total Quality Management – Text and Cases”,Routledge.,2017.

2. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth –Heinemann Ltd, 2016.
3. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition,2003.
4. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006

COURSE OUTCOMES:

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

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.

Course Outcomes	Program Outcomes											
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1						3		2	1		1	1
CO2						3			2		1	1
CO3					2	3			1		1	1
CO4						3	1		1		1	1
CO5						3	2		1		1	1

COURSE CODE	COURSE TITLE	L	T	P	C
UBA2543	WORK ETHICS, CORPORATE SOCIAL RESPONSIBILITY AND GOVERNANCE	3	0	0	3

OBJECTIVES:

To impart knowledge about the following topics:

- To impart the value of professional practices with code of conduct and ethical values
- Discuss the various outlooks of roles and responsibilities with work ethics.
- Introduce the Indian constitutional statutes for ethical practices by citizens
- Analyze the ethical commitments to be hold by industry with protecting environment
- Insist on corporate and social responsibilities through Governance practices and regulation

UNIT I INTRODUCTION 9

Ethics - Definition & nature, Characteristics, Attributes of Ethics - Business Ethics; Ethical theories; Causes of unethical behavior; Ethical abuses; Work ethics; Code of conduct; Public good.

UNIT II ETHICS THEORY AND BEYOND 9

Management of Ethics - Ethics analysis [Hosmer model]; Ethical dilemma; Ethics in practice – ethics for managers; Role and function of ethical managers- Comparative ethical behaviour of managers; Code of ethics; Competitiveness, organizational size, profitability and ethics; Cost of ethics in Corporate ethics evaluation.

UNIT III LEGAL ASPECTS OF ETHICS 9

Political – legal environment; Provisions of the Indian constitution pertaining to Business; Political setup – major characteristics and their implications for business; Prominent features of MRTP &FERA. Social – cultural environment and their impact on business operations, Salient features of Indian culture and values.

UNIT IV ENVIRONMENTAL ETHICS 9

Economic Environment; Philosophy of economic grow and its implications for business, Main features of Economic Planning with respect to business; Industrial policy and framework of government contract over Business; Role of chamber of commerce and confederation of Indian Industries.

UNIT V CORPORATE SOCIAL RESPONSIBILITY AND GOVERNANCE 9

Definition- Evolution- Need for CSR; Theoretical perspectives; Corporate citizenship; Business practices; Strategies for CSR; Challenges and implementation; Evolution of corporate governance; Governance practices and regulation; Structure and development of boards; Role of capital market and government; Governance ratings; Future of governance- innovative practices; Case studies with lessons learnt.

TOTAL HOURS: 45

TEXT BOOKS:

1. S.A. Sherlekar, Ethics in Management, Himalaya Publishing House, 2009.
2. William B. Werther and David B. Chandler, Strategic corporate social responsibility, SagePublications Inc., 2011
3. VVRobert A.G. Monks and Nell Minow, Corporate governance, John Wiley and Sons, 2011.

REFERENCES:

1. VW.H. Shaw, Business Ethics, Cengage Learning, 2007.
2. Beeslory, Michel and Evens, Corporate Social Responsibility, Taylor and Francis, 1978.
3. Philip Kotler and Nancy Lee, Corporate social responsibility: doing the most good for company and your cause, Wiley, 2005.
4. Subhabrata Bobby Banerjee, Corporate social responsibility: the good, the bad and the ugly, Edward Elgar Publishing, 2007.
5. Satheesh kumar, Corporate governance, Oxford University, Press, 2010.
6. Bob Tricker, Corporate governance- Principles, policies and practices, Oxford University Press, 2009
7. Larue Tone Hosmer and Richard D., The Ethics of Management, Irwin Inc., 1995.
8. Joseph A. Petrick and John F. Quinn, Management Ethics - integrity at work, Sage, 1997.

COURSE OUTCOMES:

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

CO1: Understand ethical issues in workplace and have good practices in professional duties.
CO2: Learn roles and responsibilities in professional career as a team worker
CO3: Understand the legal aspects in Indian constitutional for protection of societal values
CO4:Analyze the economical development by industry with importance to environment protection.
CO5: Understand need of good Governance in a corporate with ethical organizational behavior.

Course Outcomes	Program Outcomes											
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1								3	1	1		2
CO2								3	1	1		2
CO3						3	2	3	1	1		2
CO4							2	3	1	1	3	2
CO5								3	1	1	2	2

PROFESSIONAL ELECTIVES

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2521	INFORMATION THEORY AND APPLICATIONS	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students

- To learn fundamentals of random variables
- To learn Shannon and Renyi entropy
- To understand error control coding
- To apply information theory in the fields of coding, image processing, and machine learning

UNIT I REVIEW OF PROBABILITY THEORY 9

Set theory fundamentals, Review of Probability theory: Probability measure - Conditional Probability, Random variable, Probability Distribution, discrete and continuous, density estimation - histogram - Parzen window using Gaussian Kernel.

UNIT II INFORMATION THEORY FUNDAMENTALS 9

Information Theory: Uncertainty, Shannon's Entropy, Relative Entropy: Kullback-Leibler Divergence - Mutual Information - Relationship Between Entropy and Mutual Information - Chain Rules for Entropy

UNIT III SOURCE AND CHANNEL CODING 9

Source coding: Coding efficiency - Shannon's source coding theorem, Lossless compression: Shannon-Fado binary coding - Huffman coding - Run length coding. Channel coding: Shannon's channel coding theorem, Error detection - parity coding, Error correction - cyclic single error correcting Hamming code

UNIT IV INFORMATION THEORETIC IMAGE PROCESSING 9

Digital image: representation, Distance between two images based on pixels - mean square error Image histogram - normalization, Image entropy, Distance between two images based on probability - mean square error - Kullback-Leibler divergence; Image classification.

UNIT V INFORMATION THEORETIC CLASSIFICATION 9

Adaptive system, Cost function - Mean square error – Least mean square error - Problems of LMS, Entropy as cost function - Minimum error entropy, Decision tree algorithm.

TOTAL: 45 HOURS

TEXTBOOKS:

1. Thomas Cover, Joy Thomas, Elements of Information Theory, Wiley Inderscience, 2nd Edition, 2006.

REFERENCES:

1. David J C MacKay Information theory, Inference and Learning Algorithms, Cambridge University Press, 2005.
2. Christopher M Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
3. Monica Borda, Fundamentals in Information Theory and Coding, Springer, 2011.
4. R C Gonzalez, and R E Woods, Digital Image Processing, Pearson, 2018.
5. Mark Nelson, “Data Compression Book”, BPB Publication 1992

COURSE OUTCOMES:

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

1. Explain and estimate information theory metrics, entropy, and cross entropy.
2. Design an application with error control.
3. Apply entropy as a cost function in image processing and machine learning algorithms.
4. Make use of MEE in small applications.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1											1	3
CO2	3	1											2	3
CO3	3	1											2	3
CO4	3	2		1									3	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2522	OPTIMIZATION TECHNIQUES FOR MACHINE LEARNING	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students

- Apply basic concepts of mathematics to formulate an optimization problem
- To find the optimal solution of an optimization problem.
- To understand the importance of optimization for a defined process management.
- Analyse the of performance measures for various optimization problems
- To graphically display interdependent relationships between groups' steps and tasks as they all impact a project.

UNIT I FORMATION OF OPTIMIZATION PROBLEMS 9

Introduction – formulation of linear programming model-Linear Programming Applications Classification of Non-Linear programming- Objective function; Constraints and Constraint surface; Formulation of design problems mathematical programming problems, Classification of optimization problem.

UNIT II CONSTRAINED AND UNCONSTRAINED OPTIMIZATION 9

Constrained Optimization: Lagrange theorem - Unconstrained optimization: Conjugate direction and Quasi-Newton methods - Gradient-based methods, One-dimensional search methods.

UNIT III DYNAMIC PROGRAMMING 9

Sequential optimization- Representation of multistage decision process- Types of multistage decision problems - Concept of sub optimization and the principle of optimality.

UNIT IV MODERN METHODS OF OPTIMIZATION 9

Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, Multi-level optimization Evolutionary algorithms for optimization.

UNIT V PRACTICAL ASPECTS OF OPTIMIZATION 9

Genetic Algorithms, Optimization of Fuzzy Systems, Multi-objective Optimization.

TOTAL: 45HOURS

TEXT BOOKS:

1. Edwin P K Chong, Stainslaw Zak, An introduction to Optimization, Wiley Inter Science Publication, Second Edition, 2001

REFERENCES:

1. Dimitri Bertsekas, "Nonlinear Programming" Athena Scientific, Second Edition, 1999.
2. Dimitri Bertsekas, "Introduction to linear optimization" Athena Scientific, Second Edition, 1997.
3. Philip E Gill, "Practical optimization", Emerald Group Publishing Limited, 1982.
4. Ravindran A and Reklaits G V, "Engineering optimization methods and applications", Second

Edition, Wiley, 2006.
5. Daniel N Wilke and Jan Snyman, “Practical Mathematical Optimization: Basic Optimization Theory and Gradient-Based Algorithms”, Second Edition, Springer, 2018

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

1. Explain efficient computational procedures to solve optimization problems.
2. Apply engineering minima/maxima problems into optimization framework.
3. Apply the concept of Dynamic programming and its applications to project implementation.
4. Formulate optimization problems for bio inspired algorithm.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1										2	2
CO2	3	1	1										2	2
CO3	2	2	1	1									2	2
CO4	3	2	1	1									2	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2523	DATA WAREHOUSING AND DATA MINING	3	0	0	3

OBJECTIVES:
The objective of this course is to enable the students

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) 9

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT II DATA MINING – INTRODUCTION 9

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Pre-processing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III DATA MINING - FREQUENT PATTERN ANALYSIS 9

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns - Mining associations in real time data sets using WEKA / R.

UNIT IV CLASSIFICATION 9

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy - Classification of real time data sets using WEKA / R.

UNIT V CLUSTERING 9

Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods - Clustering real time data sets using WEKA / R.

TOTAL: 45 HOURS

TEXTBOOK:

1. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

REFERENCES:

1. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

COURSE OUTCOMES:

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

1. Design a Data warehouse system and perform business analysis with OLAP tools.
2. Apply suitable pre-processing and visualization techniques for data analysis.
3. Apply frequent pattern and association rule mining techniques for data analysis.
4. Apply appropriate classification and clustering techniques for data analysis.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2		1								2	2
CO2	2	2	3		2								3	2
CO3	2	3	3		3								3	2
CO4	2	3	3		3								3	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2524	CYBER SECURITY	3	0	0	3

OBJECTIVES:

The primary objective of the course is to understand

- the security basics and how it is applied to the Cyber landscape
- the cause of various attacks and possible ways available to mitigate them
- the different ways of injecting malicious code
- the functioning of different tools
- the concepts of intrusion detection and prevention system.

UNIT I CYBER SECURITY FUNDAMENTALS 9

Threats, attacks, vulnerability, CIA triad, Authentication, Authorization, Non-repudiation, Privacy, Basic Cryptography, Symmetric Encryption, Public key Encryption, Attacker Techniques: How attackers cover their tracks, Tunneling Techniques, Phishing, Smishing, Vishing, and Mobile Malicious Code, Rogue Antivirus, Click Fraud, Case study- Cyber Crimes

UNIT II EXPLOITATIONTECHNIQUES 9

Shellcode, Integer Overflow Vulnerabilities, Stack-Based Buffer Overflows, Stacks upon Stacks, Buffer Overflows, Protecting against overflows, Format String Vulnerabilities, SQL Injection, Protecting against SQL Injection, Malicious PDF Files, PDF File Format, Creating Malicious PDF Files, Reducing the Risks of Malicious PDF Files, Race Conditions, Detecting and Preventing Race conditions, Web Exploit Tools, Updates, Statistics, and Administration, Proliferation of Web Exploit Tools, DoS Conditions, Brute Force and Dictionary Attacks, Misdirection, Reconnaissance, and Disruption, Cross-Site Scripting (XSS) Social Engineering, DNS Amplification Attacks.

UNIT III ATTACKS USING MALICIOUS CODE 9

Self-Replicating Malicious Code- worms and viruses, Evading Detection and Elevating Privileges-Obfuscation, Virtual Machine Obfuscation, Persistent Software Techniques, Rootkits, Spyware, Attacks against Privileged User Accounts and Escalation of Privileges, Token Kidnapping, Virtual Machine Detection, Stealing Information and Exploitation- Form Grabbing, Man-in-the-Middle Attacks, DLL Injection, Browser helper objects, Case Study – prevention technique.

UNIT IV SECURITY TECHNOLOGY 9

Intrusion Detection and Prevention Systems, Scanning and Analysis tool: port scanners, Firewall analysis tool, Operating System Detection tool, Vulnerability Scanners, Packet Sniffer, Wireless Security tools, Case Study of tools.

UNIT V DEFENSE AND ANALYSIS TECHNIQUES 9

Memory Forensics, Honeypots, Malicious code naming, Automated Malicious Code Analysis Systems-Ethics and information Security, Case Study: implementing information security, Information Security Maintenance.

TOTAL: 45 HOURS

TEXT BOOKS:

1. James Graham, Richard Howard and Ryan Olson, Cyber Security Essentials, CRC Press, USA, 2011.
2. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Sixth Edition, Cengage Learning, 2017.

REFERENCES:

1. Charles P. Pfleeger and Shari Lawrence Pfleeger, Analyzing Computer Security – A threat/vulnerability / Counter measure approach, Pearson, New Delhi, 2014.
2. The Art of Deception by Kevin Mitnick. (Mitnick, Kevin D. and William L. Simon; The Art of Deception. 2002. © Wiley–VCH Verlag GmbH & Co. KGaA.
3. Cyber Security and Its Ten domain : https://www.coursera.org/learn/cyber-security-domain
4. Introduction to cybersecurity tools & cyber attacks: https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks
5. The Foundations of Cybersecurity:https://www.coursera.org/learn/foundations-cybersecurity
6. The GRC Approach to Managing Cybersecurity: https://www.coursera.org/learn/grc-approach-to-managing-cybersecurity
7. Managing Cybersecurity Incidents and Disasters: https://www.coursera.org/learn/managing-
8. cybersecurity-incidents-and-disasters Road to the CISO – Culminating Project Course: https://www.coursera.org/learn/road-to-ciso#syllabus
9. Managing cybersecurity specialization: https://www.coursera.org/specializations/managing-cybersecurity

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

1. Understand and apply the basics of cyber security
2. Recognize different exploitation techniques
3. Identify various security attacks and select appropriate security mechanisms
4. Explore various defense and vulnerability analysis tools

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	1										1	2
CO2	1	1	1											2
CO3	1	3	1									1	1	2
CO4	1	2	1		2							1		2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2525	SENSORS AND ACTUATORS	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students

- To be familiar with the fundamentals of various sensors, and actuators.
- To introduce MEMS Sensors and Actuators.
- To learn interfacing methods and circuits
- To learn interfacing of sensors and actuators with microprocessor

UNIT I PERFORMANCE METRICS 9

Classification of sensors and actuators, Interfacing requirement, Transfer function, impedance matching, range, resolution, dynamic range, accuracy, error, repeatability, sensitivity, Hysteresis, non-linearity, response time, calibration, excitation, dead band, reliability

UNIT II PRINCIPLES OF SENSORS AND ACTUATORS-I 9

Temperature Sensors and Thermal Actuators - Thermosensitive Sensors - Thermoelectric Sensors, Optical Sensors and Actuators - Photoelectric Effect - Photo conducting Sensors – Photodiodes –Passive IR sensors – Optical actuators, Mechanical Sensors and Actuators - Force Sensors – Accelerometers – Pressure sensors – velocity sensors - Gyroscope.

UNIT III PRINCIPLES OF SENSORS AND ACTUATORS-II 9

Electric field Sensors and Actuators - Capacitive Sensors and Actuators, magnetic field sensors -Inductive Sensors - Hall Effect Sensors - Magnetic Actuators - Voice Coil Actuators – Motors, Voltage and Current Sensors, Acoustic Sensors and Actuators – Microphones - Piezoelectric Sensors – Loudspeakers and buzzers – ultrasonic sensors and actuators, Electrochemical Sensors - Humidity and Moisture Sensors – Airbag, Ionization Sensors - Microwave Sensors

UNIT IV MEMS AND SMART SENSORS 9

MEMS Sensors - Pressure Sensors - Mass Air Flow Sensors - Inertial Sensors Angular Rate Sensors, MEMS Actuators -Thermal and Piezoelectric Actuation - Electrostatic Actuation, Wireless Sensors and Actuators – sensor networks

UNIT V INTERFACING 9

Amplifiers, Power Amplifiers, A/D and D/A Converters, Bridge Circuits, Data Transmission, Excitation Methods and Circuits, Interfacing to microprocessor – signal level – impedance – signal conditioning – errors

TOTAL: 45 HOURS

TEXT BOOKS:

1. Nathan Ida, "Sensors, Actuators and Their Interfaces", Scitech Publishing, 2014

REFERENCES:

1. Hiroto Yasuura, Chong-Min Kyung, Yongpan Liu, Youn-Long Lin, "Smart Sensors at the IoTFrontier", Springer, 2017.
2. Clarence W de Silva, "Sensors And Actuators", CRC press, 2016.

COURSE OUTCOMES:

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

1. Understand a given sensor
2. Choose an appropriate sensor and actuator for the given requirement.
3. Make use of interfacing circuits to interface with the sensors and actuators.
4. Demonstrate a full stack development using various sensors, actuators, interfacing circuits and microcontrollers.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2		1						2		1	2	
CO2	2	3	1	1						2		1	2	
CO3	2	2	1	1						2		1	1	
CO4	2	2	1	1						2		1	1	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2526	SOFTWARE ARCHITECTURE AND PRINCIPLES	3	0	0	3

OBJECTIVES:

- Understand software architectural requirements and drivers.
- Be exposed to architectural styles and views.
- Be familiar with architectures with emerging technologies.

UNIT I INTRODUCTION AND ARCHITECTURAL DRIVERS 9

Introduction – What is software architecture? – Standard Definitions – Architectural structures – Influence of software architecture on organization-both business and technical – Architecture Business Cycle- Introduction – Functional requirements – Technical constraints – Quality attributes.

UNIT II QUALITY ATTRIBUTE WORKSHOP 9

Quality Attribute Workshop – Documenting Quality Attributes – Six-part scenarios – Case studies.

UNIT III ARCHITECTURAL VIEWS 9

Introduction – Standard Definitions for views – Structures and views - Representing views-available notations – Standard views – 4+1 view of RUP, Siemens 4 views, SEI's perspectives and views – Case studies.

UNIT IV ARCHITECTURAL STYLES 9

Introduction – Data flow Styles – Call-return styles – Shared information styles – Event styles – Case studies for each style.

UNIT V DOCUMENTING THE ARCHITECTURE 9

Good practices – Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages - Architectural Description Languages – ACME – Case studies. Special topics: SOA and Web services – Cloud Computing – Adaptive structures.

TOTAL: 45 HOURS

TEXTBOOKS:

1. Len Bass, Paul Clements & Rick Kazman, "Software Architecture and Principles", 2nd Edition, Addison – Wesley, 2003.
2. Anthony J Lattanze, "Architecting Software Intensive System, A Practitioner's guide", Auerbach Publications, 2010.

REFERENCES:

1. Paul Clements, Rick Kazman and Mark Klein, "Evaluating Software architectures: Methods and case studies, Addison-Weseley, 2001.

2. Paul Clements, Felix Bachmann, Len Bass, Paulo Merson, "Documenting Software Architectures, Views and Beyond", 2nd Edition, Addison-Weseley, 2010.

COURSE OUTCOMES:

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

1. Explain influence of software architecture on business and technical activities.
2. Identify key architectural styles.
3. Use styles and views to specify architecture.
4. Design document for a given architecture.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	1			2		2	1	1			
CO2	1	3	2				2				2		1	
CO3	2	1	2				2		1		1	3	1	
CO4		1								2	1	1		

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2527	COMPUTER GRAPHICS AND MULTIMEDIA	2	0	2	3

OBJECTIVES:

- To understand the two-dimensional graphics and their transformations.
- To understand the three-dimensional graphics and their transformations.
- To appreciate illumination, color models and animation.
- To learn projection and clipping techniques.
- To study the concepts of multimedia computing.

UNIT I OUTPUT PRIMITIVES 6

Basic − Line − Circle and Ellipse drawing algorithms − Applications – Attributes of Output primitives – Two-dimensional geometric transformations – Two-dimensional viewing and clipping – Input techniques.

UNIT II THREE-DIMENSIONAL CONCEPTS 6

Three dimensional concepts; Three-dimensional object representations –Polygon surfaces; Curved Lines and surfaces; Quadric surfaces; Spline representations – Cubic Spline Interpolation Methods – Bezier curves and surfaces - B-Spline curves and surfaces - Fractals; Three dimensional geometric and modelling transformations.

UNIT III THREE-DIMENSIONAL VIEWING AND VISIBLE SURFACE DETECTION 6

Viewing - Viewing Coordinates, Projections, Projection Transformations, Clipping; Classification of visible surface detection algorithms - Back-Face detection, Depth-Buffer method, A-Buffer method, Scan-Line Method, Depth-Sorting method, BSP-Tree method, Octree Methods.

UNIT IV COLOUR MODELS AND ANIMATION 6

Illumination– Light sources, Basic illumination models, Halftone patterns and dithering techniques; Color models - Properties of light - Chromaticity diagram - RGB color model -YIQ color model-CMY color model - HSV color model - HLS color model - Applications; Computer Animation.

UNIT V MULTIMEDIA SYSTEM 6

Multimedia basics − Multimedia applications − Multimedia system architecture - Defining objects for multimedia systems - Compression and Decompression − Data and file format standards; Multimedia authoring and user interface- Hypermedia Messaging.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Study of Fundamental Graphics Functions.
2. Implementation of Line drawing algorithms: DDA Algorithm, Bradenham's Algorithm.
3. Implementation of Circle drawing algorithms: Bradenham's Algorithm, Mid-Point Algorithm.
4. Programs on 2D and 3D transformations.
5. Write a program to implement Cohen Sutherland line clipping algorithm.
6. Using Flash/Maya perform different operations (rotation, scaling move etc..) on objects.
7. Create a Bouncing Ball using Key frame animation and Path animation

PRACTICAL: 30HOURS

TOTAL: 60 HOURS

TEXT BOOK:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C Version", Second Edition, Pearson, 2003.

REFERENCES:

1. Andleigh, P. K and Kiran Thakrar, Multimedia Systems and Design, PHI, 2003.
2. Judith Jeffcoate, Multimedia in practice: Technology and Applications, PHI, 1998.
3. Foley, Vandam, Feiner and Huges, Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.
4. Xiant, Computer Graphics, Schaum Outline Series, Mc-Graw Hill Education, 2017.
5. Steve Marschner,Peter Shirley ,Fourth edition, Taylor & Francis Group, 2015.

COURSE OUTCOMES:

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

1. Apply two dimensional transformations.
2. Apply three dimensional transformations.
3. Apply illumination and color models.
4. Apply clipping and projection techniques.
5. Design animation sequences.
6. Describe the characteristics and representations of various multimedia data.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1		1	2					1			1	
CO2	2	1		1	2					1			1	
CO3					1					1			1	
CO4	2	1		1	2					1			1	
CO5		1		1	2					1			1	
CO6		1		1	2					1			1	

COURSE CODE	COURSE TITLE	L	T	P	C
UEE2303	ELECTRONIC DEVICES AND CIRCUITS	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students to:

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

UNIT I PN JUNCTION DEVICES 9

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier, – Display devices- LED, Laser diodes, Zener diode characteristics- Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS AND THYRISTORS 9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

TOTAL: 45 HOURS

TEXTBOOKS:

1. David A. Bell, "Electronic devices and circuits", Oxford University higher education, 5thEdition 2008.
2. Sedra and smith, "Microelectronic circuits", 7th Ed., Oxford University Press.

REFERENCES:

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10thEdition, 2017.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.

COURSE OUTCOMES:

Upon Successful Completion of this course, the students should be able to:

1. Explain the structure and working operation of basic electronic devices.
2. Able to identify and differentiate both active and passive elements.
3. Analyse the characteristics of different amplifiers in high frequency.
4. Choose and adapt the required components to construct an amplifier circuit.
5. Employ the acquired knowledge in design and analysis of oscillators.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2		1						2		1	1	
CO2	2	2	1	1						2		1	1	
CO3	2	2	1	1						2		1	1	
CO4	2	2	1	1						2		1	1	
CO5	3	2	1	1						2		1	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2621	SIGNALS, SYSTEMS, AND APPLICATIONS	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students:

- To understand signals and linear systems
- To learn Fourier and wavelet analysis
- To understand integral transforms
- To apply transforms to solve the problems related to IT

UNIT I INTRODUCTION TO SIGNALS AND SYSTEMS 9

Continuous time signals, Discrete time Signals, Analog and Digital Signals, Periodic and Aperiodic Signals, Energy and Power Signals, Detenninistic and Random Signals, Unit step function, Unit impulse, Linear and Nonlinear Systems, Time-Invariant and Time-Varying Systems, Instantaneous and Dynamic Systems, Causal and Noncausal Systems, Continuous-Time and Discrete-Time Systems, Analog and Digital Systems, System model

UNIT II BASIC OPERATIONS WITH SIGNALS 9

Time shifting, Time scaling, Time Reversal, Energy, Impulse response, correlation and convolution in continuous and discrete time domains, Autocorrelation and auto convolution, Concept of frequency in continuous and discrete-time signals, the sampling theorem,

UNIT III FOURIER TRASNFORM AND APPLICATIONS 9

Continuous time Fourier series, Discrete time Fourier series, Continuous time Fourier transform, Discrete-time Fourier transform, Discrete Fourier transform,

Applications: Data cleaning using Fourier analysis, Tempo and beat tracking in music

UNIT IV WAVELET TRANSFORM AND APPLICATIONS 9

Introduction to wavelets, Continuous wavelet transform, Discrete wavelet transforms

Applications: Edge detection, Data Compression,

UNIT V INTEGRAL TRANSFORMS 9

Introduction to integral transforms, Mellin Transform, Hilbert transform, Radon transform, Hermite transform

TOTAL: 45 HOURS

TEXT BOOK:

1. B P Lathi, Principles of Linear Systems and Signals, 2nd edition, Oxford University Press, 2009.
2. The Illustrated Wavelet Handbook, CRC Press, Taylor and Francis Group, 2nd edition, 2017.
3. Lokenath Debnath, and Dambaru Bhatta, Integral Transform and their applications, Chapmann & Hall/CRC, Taylor and Francis Group, 2nd edition, 2007

REFERENCES:

1. Meinard Muller, Fundamentals of Music Processing, Springer, 2015
2. Richard G. Lyons, Understanding Digital Signal Processing, Second Edition, Pearson Education, 2005

COURSE OUTCOMES:
At the end of the course, the students should be able to

1. Define various types of continuous and discrete-time signals and systems, and to perform the basic operations on the given signal
2. Estimate the frequency content of a given signal using Fourier transform
3. Apply wavelet transform to perform compression
4. Understand a given new transform using the integral transform generalization

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1							2		1	1	
CO2	3	1	1							2		1	1	
CO3	3	1	1	1						2		1	2	
CO4	3	1	1							2		1	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2622	ADVANCED ARTIFICIAL INTELLIGENCE TECHNIQUES	2	0	2	3

OBJECTIVES:
The objective of this course is to enable the students to

- Learn the features of some of the advanced artificial intelligence techniques.
- Understand the fundamental concepts, strengths, weaknesses and appropriateness of advanced AI techniques.
- Know about the ideas of advanced AI techniques in solving real world problems.

UNIT I PLANNING 6
Classic planning, planning as state-space search, planning graphs, hierarchical planning, planning and acting in non-deterministic domains, multiagent planning

UNIT II DECISION MAKING 6
Making simple decisions –combining beliefs and desires under uncertainty, Utility functions, Decision networks; Making complex decisions – sequential decision problems, Value iteration, Policy iteration, Partially observable MDPs

UNIT III PROBABILISTIC MODELS AND REINFORCEMENT LEARNING 6
Statistical learning, learning with complex data, learning with hidden variables – EM algorithm; Reinforcement Learning (RL) – passive RL, active RL, generalization in RL, policy search

UNIT IV NATURAL LANGUAGE PROCESSING ANDCOMMUNICATION 6
Language models, text classification, information retrieval and extraction; Phrase structure grammars, syntactic analysis, sematic interpretation, machine translation, speech recognition

UNIT V PERCEPTION 6
Image formation, image processing operations, object recognition by appearance, reconstructing the 3D world, object recognition from structural information

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Implementation of Object recognition.
2. Implementation of text classification.
3. Implementation of language models.
4. Implementation of machine translation.
5. Implementation of different image processing operations.
6. Implementation of sequential decision problem.

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOKS

1. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach." Pearson Education Limited, 2016.

REFERENCE BOOKS

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", MIT Press, 2nd edition, 2018.

COURSE OUTCOMES:

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

1. Describe the features of some of the advanced artificial intelligence techniques.
2. Understand the fundamental concepts, strengths, weaknesses and appropriateness of advanced AI techniques.
3. Understand about the NLP and language models.
4. Learn about the different concepts related to perception.
5. Apply ideas of advanced AI techniques in solving real world problems

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	1	1								2	2
CO2	3	2	1	2	2								2	2
CO3	3	1	1	3	2								1	2
CO4	2	1	1	1									1	2
CO5	3	2	1	2	2								2	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2623	BUSINESS ANALYTICS	2	0	2	3

OBJECTIVES:

The student should be made to:

- Be exposed with the basic rudiments of business analytics.
- Understand the modelling aspects behind Business Intelligence.
- Understand about the business forecasting.
- Learn about the HR and supply chain analytics.
- Learn about the marketing and sales analytics.

UNIT I INTRODUCTION TO BUSSINESS ANALYTICS 6

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration.

UNIT II BUSSINESS INTELLIGENCE 6

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP –, Analytic functions.

UNIT III BUSSINESS FORECASTING 6

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.

UNIT IV HR AND SUPPLY CHAIN ANALYTICS 6

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain.

UNIT V MARKETING AND SALES ANALYTICS 6

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales.

THEORY: 30 HOURS

LAB COMPONET:

LIST OF EXPERIMENTS:

1. Introduction to SPSS, Sorting File, Split File, Compute File, Recode File and Select Cases.
2. Chi- Square Test (Parametric and Non-Parametric Test).
3. Exploratory Factor Analysis.
4. Cluster analysis
5. Logical regression.
6. Discriminant analysis.

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOKS:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 2013.
2. R. Evans James, Business Analytics, 2017.
3. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2016.
4. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
5. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
6. Mahadevan B, "Operations Management -Theory and Practice", 3rd Edition, Pearson Education,2018.

REFERENCES:

1. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.
2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager"s Guide", Second Edition, 2012.
4. Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw-Hill, 2007.
5. Ralph Kimball, Margy Ross, Warren Thornthwaite, Joy Mundy, Bob Becker, "The Data Warehouse Lifecycle Toolkit", Wiley Publication Inc.,2007

COURSE OUTCOMES:

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

1. Explain the fundamentals of business intelligence.
2. Apply various modelling techniques in business intelligence.
3. Explain the data analysis and knowledge delivery stages.
4. Perform business forecasting.
5. Apply business intelligence tools appropriate for various situations.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	2
CO2	2	2	1	2	2								1	2
CO3	2												1	2
CO4	2	2	1	2	2		2	2		2		1	2	2
CO5	2	2	1	2	2		2	2		2		1	2	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2624	SOFTWARE QUALITY ASSURANCE	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students

- Understand the basic tenets of software quality and quality factors.
- Understand of how the SQA components can be integrated into the project life cycle.
- Be familiar with the software quality infrastructure and management.
- To learn the software quality assurance, metrics, defect prevention techniques
- To learn the techniques for quality assurance and applying for applications.

UNIT I INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE 9

Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall‟s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

UNIT II SQA COMPONENTS AND TESTING 9

Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality.

UNIT III SOFTWARE QUALITY INFRASTRUCTURE 9

Procedures and work instructions – Templates – Checklists – 3S development – Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.

UNIT IV SOFTWARE QUALITY ASSURANCE TECHNIQUES 9

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.

UNIT V SOFTWARE QUALITY STANDARDS 9

Software quality – People’s Quality Expectations, Frameworks and ISO-9126, McCall‘s Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model.

TOTAL: 45 HOURS

REFERENCES:

1. Software Testing and Quality Assurance-Theory and Practice, Kshirasagar Nak Priyadarshi Tripathy, John Wiley & Sons Inc,2008
2. Daniel Galin, “Software Quality Assurance”, Pearson Publication, 2009.

3. Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.
4. Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004
5. Software Quality Assurance, Milind Limaye, TMH, New Delhi, 2011

COURSE OUTCOMES:

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

1. Understand the elements of Software Quality Assurance.
2. Demonstrate their capability to adopt quality standards.
3. Apply the concepts in preparing the quality plan & documents.
4. Identify defect prevention techniques and software quality assurance metrics.
5. Apply techniques of quality assurance for typical applications.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	1	2								1	1
CO2	1	1	1	1	1								1	
CO3	1	1	1	1	1								1	1
CO4		1	1	1	1								1	
CO5		2	1	1										

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2625	BLOCKCHAIN TECHNOLOGIES	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students to

- Understand the basics of blockchain technology.
- Study the technologies behind cryptocurrencies.
- Learn how consensus algorithms are used in blockchain technology.
- Understand the Ethereum based blockchain networks.
- Acquire knowledge on trends and different applications of blockchain technology.

UNIT I INTRODUCTION 9

Basic Cryptographic primitives used in Blockchain - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography Secure, Collision-resistant hash functions, public key cryptosystems, zero-knowledge proof systems. Need for Distributed Record Keeping, Modelling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Why Nakamoto Came up with Blockchain based cryptocurrency?

UNIT II CRYPTOCURRENCY (BITCOIN) 9

Bitcoin blockchain - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin - Bitcoin scripting language and their use - Bitcoin, the challenges, and solutions

UNIT III CONSENSUS ALGORITHMS 9

Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains – Proof of burn, POET, RBFT Hybrid models.

UNIT IV ETHEREUM 9

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - The Turing Completeness of Smart Contract Languages and verification challenges, using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts. Some attacks on smart contracts

UNIT V BLOCKCHAIN TRENDS AND APPLICATIONS 9

Beyond Cryptocurrency – applications of blockchain in cyber security, integrity of information, E-Governance and other contract enforcement mechanisms. Limitations of blockchain as a technology, and myths vs. reality of blockchain technology. Applications: Internet of Things, Medical Record Management System, Supply chain management and future of Blockchain.

TOTAL: 45 HOURS

TEXT BOOKS:

1. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Blockchain Technology: Cryptocurrency and Applications, Oxford University Press 2019.

REFERENCES:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Gold Feder, Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
2. Joseph Bonneau et.al, Research perspectives and challenges for Bitcoin and cryptocurrency IEEE Symposium on security and Privacy, 2015
3. J.A. Garay et al, The bitcoin backbone protocol -analysis and applications EUROCRYPT, LNCS Vol. 9057, (Vol II), pp 281-310,2015
4. R. Pass et al, Analysis of Blockchain protocol in Asynchronous networks, EUROCRYPT 2017
5. Josh Thompson Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017

COURSE OUTCOMES:

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

1. Define and explain the fundamentals of Blockchain.
2. Illustrate the technologies of blockchain.
3. Describe the models of blockchain.
4. Analyse and demonstrate the Ethereum.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												1	2
CO2	3				2								1	2
CO3	3	2		1	2								3	3
CO4		3	2	2	3		2	2		2		1	3	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2626	CONTROL SYSTEMS	3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control system-Terminology and Basic Structure-Feed forward and Feedback control theoryElectrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system.

UNIT II TIME RESPONSE ANALYSIS 9

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems.

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist Plots-Design of compensators using Bode Plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation.

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative Stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL: 45 HOURS

TEXTBOOKS:

1. M. Gopal, Control System – Principles and Design‖, Tata McGraw Hill, 4th Edition, 2012.

REFERENCES

1. J. Nagrath and M. Gopal, Control System Engineering‖, New Age International Publishers, 5 th Edition, 2007.
2. K. Ogata, Modern Control Engineering, 5th edition, PHI, 2012.
3. S. K. Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
4. Benjamin C. Kuo, Automatic control systems‖, Prentice Hall of India, 7th Edition,1995.

COURSE OUTCOMES:

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

1. Identify the various control system components and their representations.
2. Analyze the various time domain parameters and different types of control systems..
3. Analysis the various frequency response plots for analyzing the system.
4. Apply the concepts of various system stability criterions.
5. Design various

6. s transfer functions of digital control system using state variable models.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1						2		1	1	
CO2	3	2	1	1						2		1	1	
CO3	3	2	1	1						2		1	1	
CO4	3	2	1	1						2		1	1	
CO5	3	2	1	1						2		1	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2627	INTRODUCTION TO AR/VR/MR/XR	3	0	0	3

OBJECTIVES:

- To understand the concept of virtual reality and augmented reality
- To study visual computation in virtual reality
- To provide an opportunity to explore the research issues in Augmented Reality and Virtual Reality (AR &VR).
- To know the basic concepts and framework of virtual reality.

UNIT I INTRODUCTION OF VIRTUAL REALITY 9

Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Multiple Models of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices.

UNIT II VISUAL COMPUTATION IN VIRTUAL REALITY 9

Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large-Scale Environments & Real Time Rendering. Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.

UNIT III DEVELOPMENT TOOLS AND FRAMEWORKS IN VIRTUAL REALITY9

Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools

UNIT IV APPLICATION OF VR IN DIGITAL ENTERTAINMENT 9

VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

UNIT V AUGMENTED AND MIXED REALITY 9

Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems. 4.

TOTAL: 45 HOURS

TEXTBOOK:

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.
2. Alan B. Crai`g, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

REFERENCES:

1. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.

COURSE OUTCOMES:

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

1. Describe the concept of virtual reality and augmented reality.
2. Have an idea of VR and AR tools
3. Apply VR and AR concepts in real world applications.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1			1								2	
CO2	3	2	1	1	2								2	
CO3	3	2	2	3	2	2						2	3	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2721	DEEP LEARNING CONCEPTS AND ARCHITECTURES	2	0	2	3

OBJECTIVES:

The objective of this course is to enable the students

- To provide the mathematical and computational demands of building neural networks.
- To study the concepts of deep learning.
- To introduce dimensionality reduction techniques.
- To apply deep learning techniques for real time applications.

UNIT I MATHEMATICAL PRELIMINARIES 6

Probability, continuous and discrete distributions; Gradient descent, Stochastic gradient descent, maximum likelihood estimation, cost functions: maximum likelihood based cost, cross entropy, MSE cost, hypotheses and tasks: regression - classification - clustering.

UNIT II LEARNING IN NEURAL NETWORKS 6

Feed-forward networks: MLP, sigmoid units; output vs hidden layers; linear vs nonlinear networks; recursive chain rule (backpropagation); bias-variance tradeoff, regularization; output units: linear, softmax; hidden units: tanh, RELU, Case study.

UNIT III CONVOLUTIONAL NEURAL NETWORKS 6

Convolution, Pooling and fully connected layers, complete CNN architecture: AlexNet - VGG - Inception - ResNet, Training a Convnet: weights initialization - batch normalization - hyper parameter optimization, Case Study – Image Classification using CNNs.

UNIT IV SEQUENCE MODELING USING RECURRENT NETS 6

Recurrent Neural Networks (RNN), Bidirectional RNN, Long Short-Term Memory (LSTM), GRU; Case Study - Language Modelling, Image Captioning using RNNs.

UNIT V UNSUPERVISED AND DEEP REINFORCEMENT LEARNING 6

Autoencoder, Generative Adversarial Networks, Deep Reinforcement Learning -Policy gradients, hard attention, Q-Learning, Actor-Critic, Case Study – Text-to-Image Synthesis using GAN.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Image caption Generator using CNN and LSTM.

2. Text to image synthesis using GAN.
3. Visualization of filters and feature maps in Convolution Neural Network.
4. Image classification using CNN.
5. Pre-trained CNN models for feature extraction.
6. Pre-trained CNN models for feature extraction.

PRACTICAL: 30 HOURS
TOTAL: 60HOURS

TEXT BOOK:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

REFERENCES:

1. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition,1997.
3. Francois Chollet, "Deep Learning with Python", Manning, 2018.
4. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer, 2018.
5. Umberto Michelucci, Applied Deep Learning: A Case-Based Approach to Understanding Deep Neural Networks, Apress, 2018.

COURSE OUTCOMES:
After completing this course, the student should be able to

1. Explain Deep Learning algorithms and their limitations
2. Apply Deep Learning algorithms in practice.
3. Apply CNN for different applications.
4. Perform sequence modelling using recurrent nets.
5. Apply unsupervised and deep reinforcement learning

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	2
CO2	2	2	1	2	1	2							1	2
CO3	1		1	2	1	2				2			1	2
CO4	2		1	2	1	2							1	2
CO5	2		1	2	1	2						1	1	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2722	BIO-INSPIRED OPTIMIZATION TECHNIQUES	2	0	2	3

OBJECTIVES:
The objective of this course is to enable the students to

- Learn the natural phenomena that motivate the bio-inspired algorithms.
- Understand the fundamental concepts, strengths, weaknesses and appropriateness of nature-inspired algorithms.
- Study nature-inspired algorithms to optimization, design and learning problems.

UNIT I INTRODUCTION 6
Nature-based computing – three branches; General concepts – individuals, entities and agents, parallelism and distributivity, adaptation, self-organization, bottom-up vs. top-down, determinism, chaos and fractals.

UNIT II EVOLUTIONARY COMPUTING 6
Evolutionary biology – evolution, genetics; Genetic algorithm – Roulette wheel selection, crossover,

mutation, applications – pattern recognition, numerical functional optimization.

UNIT III NEUROCOMPUTING 6

Nervous system – neurons, synapses, networks, maps; Artificial neural networks – types of neurons, architectures and learning; Hebbian learning, single and multilayer perceptron, self-organizing maps, Hopfield networks.

UNIT IV SWARM INTELLIGENCE 9

Ant colonies – organization and foraging; Ant Colony Optimization (ACO) – simple and general ACO; Ant clustering algorithm; Swarm robotics; Particle swarm optimization.

UNIT V IMMUNOCOMPUTING 9

Immune system – physiology, components, adaptive immune response; Artificial immune response – immune algorithms; Bone marrow models; Negative selection algorithms; Artificial immune networks.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Implement classical optimization algorithms
2. Application of genetic algorithm - e.g., route navigation
3. Application of ant colony optimization - e.g., scheduling
4. Application of particle swarm optimization - e.g., prediction of pollution level

PRACTICAL: 30 HOURS

TOTAL: 60 HOURS

TEXT BOOK

1. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

REFERENCE BOOKS

1. M. Wahde, “Biologically Inspired Optimization Methods: An Introduction”, WIT Press, 2008
2. Xin She-Yang, “Nature Inspired Optimization Algorithms”, Elsevier, 2014

COURSE OUTCOMES:

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

1. Describe the natural phenomena that motivate the bio-inspired algorithms.
2. Understand the fundamental concepts, strengths, weaknesses and appropriateness of nature-inspired algorithms.
3. Apply nature-inspired algorithms to optimization, design and learning problems.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1												2	3
CO2	1				1					3			2	3
CO3	3			1	1					3		2	2	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2723	BIG DATA MANAGEMENT	2	0	2	3

OBJECTIVES:

- To understand about big data.
- To learn and use NoSQL big data management.
- To learn map-reduce analytics using Hadoop and related tools.
- To understand the usage of Hadoop related tools for Big Data Analytics.

UNIT I UNDERSTANDING BIG DATA 6

What is big data – why big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT II NOSQL DATA MANAGEMENT 6

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema-less databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication – consistency – relaxing consistency – version stamps – map-reduce – partitioning and combining – composing map-reduce calculations.

UNIT III BASICS OF HADOOP 6

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.

UNIT IV MAPREDUCE APPLICATIONS 6

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT V HADOOP RELATED TOOLS 6

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Installation of Hadoop.
2. File Management tasks in Hadoop.
3. Word Count Map program.
4. Program to analyse Time-Temperature statistics and generate report with maximum/minimum temperature.
5. Implementation of matrix multiplication with Hadoop Map Reduce.
6. Pig Latin scripts to sort, group, join, project and filter the data.
7. Hive databases, tables, views, functions and Indexes.

PRACTICAL: 30 HOURS

TOTAL: 60 HOURS

TEXT BOOK:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.

REFERENCES:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. 4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
4. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
5. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
6. Alan Gates, "Programming Pig", O'Reilley, 2011.

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

1. Describe big data and use cases from selected business domains.
2. Explain NoSQL big data management.
3. Install, configure, and run Hadoop and HDFS to perform map-reduce analytics using Hadoop.
4. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	1								2	2
CO2	2	1	1	1	1								2	2
CO3	2	2	1	1	2					1		1	2	2
CO4	2	2	1	1	2					1		1	2	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2724	SOFTWARE PROJECT MANAGEMENT	3	0	0	3

OBJECTIVES:

- To outline the need for Software Project Management
- To highlight different techniques for software cost estimation and activity planning.

UNIT I PROJECT PLANNING 9

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT TOOLS 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

UNIT IV PROJECT CONTROL AND MANAGEMENT 9

Framework for control and Management– Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans – Management case studies.

TOTAL: 45 HOURS

TEXTBOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2011.
2. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education (India), Fourteenth Reprint 2013.

COURSE OUTCOMES:

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

1. Understand Project Management principles while developing software.
2. Gain extensive knowledge about the basic project management concepts, framework and the process models.
3. Obtain adequate knowledge about software process models and software effort estimation techniques.
4. Estimate the risks involved in various project activities.
5. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
6. Learn staff selection process and the issues related to people management

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2		1	1	1								1	2
CO2	2	2	1	2	1								1	2
CO3	1		1	2	1								1	2
CO4	2	1	1	2	1								1	2
CO5	2		1	2	1							1	1	2
CO6		1		1	1									

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
UIT2725	**INFORMATION PRIVACY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To introduce the basics of Information Privacy
- To make the learner aware of the globally used privacy principles and guidelines
- To make the learner understand various privacy risk, threats, violation and adopt privacy by designing IT solutions
- To understand and apply privacy enhancing technologies.

UNIT I PRIVACY IN DIGITAL AGE 7

What is privacy?Nissenbaum's Contextual Integrity, AlanWestin's privacy states, Ryan Calo's Harm Dimensions, Sloove's taxonomy-Privacy, security and data governance – The data life cycle- Online issues in privacy- case study: Technology challenges for privacy.

UNIT II PRIVACY PRINCIPLES, STANDARDS AND REGULATIONS 7

The Fair Information Practice Principles (FIPPs), OECD's Guidelines on the Protection of Privacy and Transborder Flows of Personal Data (1980), The Privacy Framework (2005), Generally Accepted Privacy Principles, NIST/NICE frameworks. Standards-ISO/IEC 27701- Regulations: PIPEDA, EU DPD, GDPR, Hongkong's Personal Data Ordinance- India's Privacy Data protection bill- Based on domain: HIPPA, Principles of Interactive advertisement Bureau-PCIDSS- CALOPPA-COPPA- e Privacy Directive

UNIT III PRIVACY RISK, THREAT AND VIOLATION 11

Privacy threats and violations: Information collection, Information processing, Information dissemination, Invasions, Decisional inference through dark patterns - Privacy harms: subjective and objective- Risk analysis: FAIR method, organizational risk, domain redux- Quantifying risk: computing the risk of exposure.

UNIT IV ADOPTING PRIVACY BY DESIGN 11

Foundational principles – Challenges of principles - The Privacy by Design Process: requirements engineering for privacy, understanding quality attributes, identify information needs, High level design, Low Level Design and Implementation, imposing controls, Testing and validation - Integrating Privacy by Design into the Business.

UNIT V PRIVACY ENHANCING TECHNOLOGIES 9

Data Oriented Strategies: Separate, minimize, abstract, hide – Techniques: Aggregation, De-identification, Encryption, Identity and access management, Authentication - Process Oriented Strategies: Informing the Individual, User Control, Policy and Process Enforcement, Demonstrate Compliance.

TOTAL: 45HOURS

TEXTBOOKS:

1. An Introduction to Privacy for Technology Professionals,Executive EditorTravis D. Breaux
2. Strategic Privacy by Design R. Jason Cronk, CIPP/US, CIPM, CIPT, FIP

REFERENCES:

1. Privacy in Technology Standards and Practices for Engineers and Security and IT Professionals by JC Cannon
2. Alessandro Acquisti, Leslie John, and George Loewenstein, "What Is Privacy Worth?" Carnegie Mellon University- Heinz College, Heinz CMU, 2010, accessed July 5, 2018, www.heinz.cmu.edu/~acquisti/papers/acquisti-ISRworth.pdf

COURSE OUTCOMES:

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

1. Understand and apply the basics of cyber security
2. Recognize different exploitation techniques
3. Identify various security attacks and select appropriate security mechanisms
4. Explore various defense and vulnerability analysis tools

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	1	1											2
CO2		1	1			3		3						
CO3	2	2	1				2						2	2
CO4	1	2	2		1								1	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2726	SOFTWARE DEFINED NETWORKS	3	0	0	3

OBJECTIVES:

- To learn the fundamentals of software defined networks.
- To understand the separation of the data plane and the control plane.
- To study about the SDN Programming.
- To study about the various applications of SDN

UNIT I INTRODUCTION 9

Introduction to Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Data Planes: SDN Data plane, Control Plane, Application Plane.

UNIT II OPEN FLOW AND SDN CONTROLLERS 9

Open Flow: Open Flow Specification, FloodLight, Mininet – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – Overlay model and network model for cloud computing.

UNIT III DATA CENTERS AND NETWORK VIRTUALIZATION 9

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE - Network Virtualization: Concepts, Benefits, requirements, Reference architecture, Management, Functionality and Infrastructure

UNIT IV SDN PROGRAMMING 9

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications, Network functions Virtualization:Virtual LAN, Virtual Private Networks: IPSEC, MPLS, Network Virtualization Architecture and Benefits

UNIT V SDN AND IMPLICATIONS OF QOS AND QOE 9

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration, Network Design Implications of QoS and QoE: QoS Architectural Framework, SLA, IP Performance metrics, QoE: Strategies, Measurements, QoE/QoS Mapping models.

TOTAL: 45 HOURS

TEXT BOOKS:

1. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks, O'Reilly Media, 2013.

REFERENCES:

1. Siamak Azodolmolky, ―Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. Vivek Tiwari, ―SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, ―Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

COURSE OUTCOMES:

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

1. Analyze the evolution of software defined networks

2. Express the various components of SDN and their uses
3. Explain the use of SDN in the current networking scenario
4. Design and develop various applications of SDN

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1	1	1							1	1	2
CO2	1	1		1								1		2
CO3		1			1								1	
CO4			1	1	1							1	1	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2727	VIDEO: EDITING, PRODUCTION, AND CINEMATOGRAPHY	2	0	2	3

OBJECIVES:

The objective of this course is to enable the students

- To learn about the fundamentals of camera engineering and cinematography.
- To understand the postproduction video editing.
- To know about audio mixing and engineering.
- To learn about animation and special effects.
- To learn about the different tools used for video editing.

UNIT I FUNDAMENTALS OF CAMERA ENGINEERING ANDINEMATOGRAPHY 6

Principles of camera : History of camera, architecture, shutter, aperture; Single Lens Reflection system (SLR), Digital Cameras, Digital Single Lens Reflection System (DSLR), Video cameras, Motion cameras, IMAX systems - Video format and Aspect ratios: Scanning; Progressive and Interlaced, PAL, NTSE, SECAM, Aspect ratios, HD, Full-HD, 2K, 4K, 8K, Anamorphic, IMAX video format, 3D Normal Frame Rate (3D-NFR), 3D High Frame Rate (3D-HFR), HDR and Dolby Vision - Principles of cinematography and photography: Lighting methods, outdoor, indoor, ISO, Shutter and Aperture control, Subject and background composition

UNIT II POST PRODUCTION VIDEO EDITING 6

Image file formats: BMP, GIF, JPEG, JPEG 2000, PNG, RAW, Web P - Video file formats: Video containers; 3GPP, MPEG -4, MPEG – 4 TS, Matroska, Web M, Video encoders; avi, H.263, H 264 AVC Baseline Profile, H264 AVC Main profile, H265 HEVC – Introduction to video editing tools: Adobe Premier Pro, Final Cut Pro X

UNIT III AUDIO MIXING AND ENGINEERING 6

Evolution of audio: History of audio, Analog and digital audio - Standard audio types: Mono and Stereo – Audio formats: Lossy format; MP3, AAC, OggVorbis, Lossless formats; FLAC, ALAC, Uncompressed Formats; WAV, AIFF, DSD, PCM – Advanced audio types: Muti-Channel audio: Types, Audio Panning, Discrete Tracks, Dolby and DTS systems – Object based audio systems: DTS-X - Introduction to audio editing tools: Adobe Audition CC

UNIT IV ANIMATION AND SPECIAL EFFECTS 6

Evolution of animation in movies – Concept of Visual effects (VFX) – Special effects and animation tools: flash, flash 3D, Blender, Adobe after effects – VR and AR: Unity; Creation of virtual environment, 360-degree video, immersive experience, Augmented reality.

UNIT V LABORATORY 6

Manual mode photography: indoor and outdoor – Analyze and create videos for different platforms, video production using multi-channel audio - Video editing: Adobe Premier Pro, Final Cut Pro X – Audio editing: Sound processing with Adobe Audition CC, mono, stereo and multi-track audio – Unity: making of 360-degree video, interactive 360-degree video, Introducing immersion, augmented reality.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Study of different software tools used for post production video editing.
2. Study of different tools used in audio mixing.
3. Study of different tools used in animation and special effects.
4. Study of different video editing tools.
5. Study of different audio editing tools.
6. Experiments using Augmented Reality.

PRACTICAL: 30 HOURS
TOTAL 60HOURS

TEXT BOOKS:

1. Fundamentals of multimedia, Ze-Nian Li, Springer-Verlag New York, 2nd Edition, 2014
2. Introduction to digital audio coding standards, Marina Bosi, Richard E. Goldberg, Springer International Series in Engineering and Computer Science, 2003 edition

REFERENCES:

1. Adobe Premier Pro CC Classroom in a book, MaxinJago, Adobe Press, 1st Edition
2. Adobe Audition CC Classroom in a book, Maxim Jago, Adobe Press, 2nd Edition
3. Unity in Action: Multiplatform Game Development in C# with Unity 5, Joseph Hocking, Hanning, June 2015

COURSE OUTCOMES:

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

1. To learn about the fundamentals of camera engineering and cinematography.
2. To understand about the post production video editing.
3. To know about audio mixing and engineering.
4. To learn about animation and special effects.
5. To learn about the different tools used for video editing.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2		1								1	1	
CO2	1	2		1								1	1	
CO3	1	1	2	2	3	3			2			1	1	
CO4	1	1	2	2	3	3			2			1	1	
CO5		1	2	2	3	3			2			1	1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2728	NATURAL LANGUAGE PROCESSING	2	0	2	3

OBJECTIVES:

The primary objective of this course is to make the student

- Understand the language models
- Analyze semantic embeddings
- Understand sequence labelling and word senses
- Implement different parsing techniques
- Understand logical representations of text
- Perform semantic role labelling

UNIT I OVERVIEW ANDLANGUAGEMODELING 6

Origins and challenges of NLP – Knowledge in Language Processing – NLP tasks – NLP Applications – Regular expressions, text normalization, edit distance – tokenization – stemmer – Language Modeling: Language and Grammar – Grammar-based Language Models – Statistical Language Models – N-gram Models, Smoothing Techniques

UNIT II SEMANTIC EMBEDDINGS 6

Semantic Analysis: Meaning Structure of Language, Slot-filler Representation, Lexical Semantics – Vector semantics – words and vectors – similarity measures – TF-IDF and PMI – word2vec – visualizing embeddings – analysis of embeddings

UNIT III SEQUENCE LABELLING AND WORD SENSES 6

Word classes – PoS tagging – named entities – named entities tagging – HMM-based PoS tagging – conditional random fields (CRF) – evaluation of NER – word senses – wordnet – word sense disambiguation – improved embeddings – word sense induction

UNIT IV PARSING TECHNIQUES 6

Constituency grammars – context-free grammars – Tree banks– normal forms – lexicalized grammars – constituency parsing – ambiguity – CKY parsing – span-based neural constituency parsing – evaluating parsers – CCG parsing – dependency parsing – dependency relations and formalisms – dependency treebanks – transition-based dependency parsing – graph-based dependency parsing

UNIT V LOGICAL REPRESENTATIONS AND SEMANTIC ROLE LABELLING 6

Computational Desiderata for Representations – model-theoretic semantics – first-order logic – event and state representations – description logics – Semantic roles – diathesis alternations – problems with thematic roles – proposition bank – frame net – SRL task – selectional restrictions – decomposition of predicates

THEORY: 30 HOURS

LAB EXERCISES:

1. Regular expressions and n-grams
2. Naïve Bayes classification
3. Logistic Regression
4. Vector embeddings for NLP tasks
5. Word2vec
6. PoS tagging
7. Named Entity Recognition
8. Constituency parsing
9. Dependency parsing
10. Logical representations of text
11. Proposition bank and frame nets
12. Semantic Role Labelling

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOK:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

REFERENCES:

1. Christopher D. Manning and HinrichSchutze, Foundations of Statistical Natural Language Processing, MIT Press,1999.
2. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, CRC Press,2010.
3. Tanveer Siddiqui and Tiwary U S, Natural Language Processing and Information Retrieval, OxfordUniversity Press,2008.
4. NLTK – Natural Language Tool Kit -http://www.nltk.org/

5. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O’RREILLY.
6. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress.

COURSE OUTCOMES:

After completing this course, students should be able to

1. Build and apply languagemodels for NLP tasks
2. Build and apply word embeddings for NLP tasks
3. Implement basic NLP tasks such as PoS tagging, named entity recognition, and word sense disambiguation
4. Implement and use different parsing techniques for natural languages
5. Build logical representations for text
6. Perform semantic role labelling

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	3	2					2		3	2	2
CO2	2	2	2	3	2					2		3	2	2
CO3	2	2	2	3	2					2			2	2
CO4	2	2	2	3	2					2			2	2
CO5	2	2	2	3	2					2			2	2
CO6	2	2	2	3	2					2			2	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2729	IMAGE PROCESSING AND COMPUTER VISION	2	0	2	3

OBJECTIVES:

The objective of this course is to enable the students to

- Learn about the different techniques used for feature detection and matching.
- Learn about the different techniques used for image segmentation.
- Know about the depth estimation and 3-D reconstruction.
- Study about the different types of recognition used in computer vision.
- Study about the different deep learning models and networks used in computer vision.

UNIT I FEATURE DETECTION AND MATCHING 6

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

UNIT II IMAGE SEGMENTATION 6

Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection. Application: Medical image segmentation

UNIT III DEPTH ESTIMATION AND 3D RECONSTRUCTION 6

Feature-based alignment: 2D and 3D feature-based alignment, pose estimation, Geometric intrinsic calibration. Structure from Motion: Triangulation, Two-frame structure from Motion, Factorization, Bundle adjustment. Stereo Correspondence: Epipolar geometry,3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations

UNIT IV OBJECT RECOGNITION 6

Face recognition, instance recognition, category recognition, Context and scene understanding

UNIT V DEEP LEARNING TECHNIQUES 6

Introduction to CNNs; Visualization of Kernels; Backprop-to-image/Deconvolution Methods; CNNs for Detection: Background of Object Detection, R-CNN, Fast R-CNN, Faster R-CNN.CNNs for Segmentation: FCN, SegNet, U-Net, Mask-RCNN, Recurrent Neural Networks (RNNs): CNN + RNN Models for Video Understanding: Spatio-temporal Models, Action/Activity Recognition

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Implementation of Edge detection algorithms.
2. Implementation of image segmentation algorithms.
3. Implementation of feature extraction techniques.
4. Implementation of object detection.
5. Implementation of object recognition using different deep learning models.
6. Implementation of Activity recognition.

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

REFERENCES:

1. Rick Szelisk, “Computer Vision: Algorithms and Applications”, Springer 2011.

COURSE OUTCOMES:

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

1. Use the different techniques used for feature detection and matching.
2. Apply the different techniques used for image segmentation.
3. Understand depth estimation and 3-D reconstruction.
4. Apply the different types of recognition used in computer vision.
5. Apply the different deep learning models and networks used in computer vision.

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	3	3								2	2
CO2	3	3	2	3	3								2	2
CO3	3	3	2	3	3								2	2
CO4	3	3	2	3	3								3	2
CO5	3	3	2	3	3								3	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2731	HEALTHCARE ANALYTICS	2	0	2	3

OBJECTIVES:

- To explore the various forms of electronic health care information.
- To learn the techniques adopted to analyse health care data.
- To understand the predictive models for clinical data

UNIT I INTRODUCTION 6

Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting EHRChallenges- Phenotyping Algorithms.

UNIT II BIOMEDICAL IMAGE ANALYSIS 6

Biomedical Image Analysis- Mining of Sensor Data in Healthcare- Biomedical Signal Analysis- Genomic Data Analysis for Personalized Medicine.

UNIT III ANALYTICS 6

Natural Language Processing and Data Mining for Clinical Text- Mining the Biomedical- Social Media Analytics for Healthcare.

UNIT IV ADVANCED ANALYTICS 6

Advanced Data Analytics for Healthcare– Review of Clinical Prediction Models- Temporal Data Mining for Healthcare Data- Visual Analytics for Healthcare- Predictive Models for Integrating Clinical and Genomic Data.

UNIT V APPLICATIONS 6

Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer-Assisted Medical Image Analysis Systems.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Implementation of prediction model for Diabetic retinopathy
2. Implementation of prediction model for covid-19.
3. Implementation of prediction model for cancer.
4. Implementation of fraud detection in healthcare.
5. Implementation of caption generator for generating the symptoms of diabetic retinopathy.
6. Implementation of feature extractor from medical images
7. Implementation of visualization in medical images.

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOK:

1. Chandan K. Reddy and Charu C Aggarwal, “Healthcare data analytics”, Taylor & Francis, 2015.

REFERENCES:

1. Hui Yang and Eva K. Lee, “Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016.
2. Trevor L. Strome, "Healthcare Analytics for Quality and Performance Improvement" John Wiley & Sons, Inc, 2013.

COURSE OUTCOMES:

Students will be able to:

1. Analyse health care data using appropriate analytical techniques.

2. Apply analytics for decision making in healthcare services.
3. Apply data mining to integrate health data from multiple sources and develop efficient clinical decision support systems.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1			2								1	2
CO2	2	2	2	1	2							1	1	2
CO3	2	2	2	3	2							1	2	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2732	MICRO SERVICES AND DEVOPS	2	0	2	3

OBJECTIVES:

The primary objective of this course is to

- Understand the fundamentals of microservices
- Create microservices using Java
- Understand microservice for devops
- Understand microservices with kubernetes
- Create Spring boot and angular microservices using JHipster

UNIT I INTRODUCTION 6

Introduction: Evolution, Cloud native. Building Blocks: Communications, Services, bounded contexts and domains, API layer, logging, tracing.

UNIT II DESIGN PATTERNS 6

Strangler pattern, Sidecar pattern, Edge pattern, Gateway pattern, Process aggregator pattern, Log aggregation patterns, Tracing patterns, External configuration, Service discovery, Metrics aggregation patterns, single and shared service database, command query responsibility segregation, asynchronous eventing.

UNIT III ASYNCHRONOUS COMMUNICATIONS 6

Introduction: Definition, The need, Issues, Message Brokers. Interservice communications: Introduction, point-2-point, syndication. Event driven: Introduction, choreography, orchestration, hybrid. Streaming data: Introduction, Log aggregation, system analytics, event detection. Data: flows, eventual consistency, CQRS, migration, synchronization.

UNIT IV SECURITY 6

Introduction: basics, challenges. IAM: platforms, patterns, Reverse proxies, Gateway API, access scenarios. Tokens: Introduction, OAuth2, OIDC, validation, maintenance. Inter microservices security: mTLS, certificate rotation, East/West traffic, shared access token anti-pattern, token relay, token switch, Logging, service mesh. Container and Application Security: Throttling, rate limiting, image security, container runtime security, secure pipelines.

UNIT V APPLIED MICROSERVICES 6

Java: Micronaut, Helidon, Spring, Quarkus. RabbitMQ: Introduction, AMQP, Publish, Consume, Filter, Authentication, Authorization, Validation. Express: service registry, service registration and deregistration, circuit breaker, queues

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Introduction to Azure DevOps Build.
2. Working with pull requests.

3. Package management with Azure artifacts.
4. Web application load and performance testing.
5. Managing Delivery Plans with Azure DevOps
6. Wiki collaboration with Azure DevOps.
7. Managing Test Plans, Suites and Cases

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOK:

1. Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, Mike Amundsen. Shroff, Microservice Architecture: Aligning Principles, Practices, and Culture, O'Reilly, 2016.

REFERENCES:

1. Stephen Fleming, Devops and Microservices Handbook: Non-Programmer's Guide to Devops and Microservices. 2018.
2. Gigi Sayfan, Hands-On Microservices with Kubernetes: Build, deploy and manage scalable microservices on Kubernetes, Packt Publishing Limited, 2019.
3. Deepu K Sasidharan, Sendil Kumar N, Full Stack Development with JHipster: Build modern web applications and microservices with Spring and Angular, Packt Publishing Limited, 2018.
4. Sourabh Sharma, Mastering Microservices with Java 9, Packt Publishing Limited; 2nd Revised edition, 2017.
5. Vinicius Feitosa Pacheco, Microservice Patterns and Best Practices: Explore Patterns Like CQRS and Event Sourcing to Create Scalable, Maintainable, and Testable Microservices, Packt Publishing Limited, 2018.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Explain the core concepts and benefits of microservices
2. Develop microservices using Java
3. Make use of microservices for devops
4. Build microservices with kubernetes
5. Create angular and spring boot microservices using JHipster

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	1	1	3						2			2
CO2	1	3	2	1	2						2	3		2
CO3	1	2	2	1	1						1	1		2
CO4	1	2	2	1	1						1	1		2
CO5	1	2	2	1	1						1	1		2

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
UIT2733	**CYBER FORENSICS AND INFORMATION SECURITY**	**2**	**0**	**2**	**3**

OBJECTIVES:

- To learn the security issues network layer and transport layer.
- To get exposed to security issues of the application layer.
- To learn computer forensics.
- To be familiar with forensics tools.
- To learn to model and interpret forensics data.

UNIT I NETWORK LAYER AND TRANSPORT LAYER SECURITY 6

Introduction, Network layer security: IPSec protocol – Authentication header – Key management protocol, Transport layer security: SSL and TLS, Introduction to E-mail security, Introduction to firewalls: Terminology – Types of firewalls.

UNIT II UNDERSTANDING DIGITAL FORENSICS AND INVESTIGATION 6

Overview of digital forensics, Preparation for digital investigation, Professional conduct, preparing digital forensics investigation, Conducting an investigation, Procedures for private sector investigations.

UNIT III DATA ACQUISITION AND PROCESSING 6

Understanding storage formats, determining acquisition methods, Contingency planning, using acquisition tools and validating, Identifying and collecting digital evidence, preparing for a search, Storing digital evidence.

UNIT IV DIGITAL FORENSICS ANALYSIS AND VALIDATION 6

Determining the data to collect and analyze, validating forensics data, addressing data hiding techniques, Performing live acquisition.

UNIT V E-MAIL AND SOCIAL MEDIA INVESTIGATION 6

Intoduction, Role of client and server in E-Mail, Investigating E-mail crimes: Understanding forensics linguistics – Examining E-mail headers and messages – Tracing E-mail files, Social media forensics on mobile devices: Forensics tools for social media investigations.

THEORY: 30 HOURS

LAB COMPONENT:
LIST OF EXPERIMENTS:

1. Study of Computer Forensics and different tools used for forensic investigation.
2. How to recover deleted files using foresenics tools.
3. Study the steps for hiding and extract any text file behind an image file/ Audio file using Command Prompt.
4. Program to Extract Exchangeable image file format (EXIF) Data from Image Files using Exif reader Software.
5. Program to make the forensic image of the hard drive using EnCase Forensics.
6. Program to Restore the Evidence Image using EnCase Forensics.
7. Program to Collect Email Evidence in Victim PC.
8. Program to Extract Browser Artifacts.
9. Program to View Last Activity of Your PC.
10. Program to Find Last Connected USB on your system (USB Forensics).
11. Comparison of two Files for forensics investigation by Compare IT software.
12. Live Forensics Case Investigation using Autopsy

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOKS:

1. Nelson, Phillips, Enfinger, Steuart, Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.
2. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003.

REFERENCES:

1. John R.Vacca, Computer Forensics, Cengage Learning, 2005.
2. Richard E.Smith, Internet Cryptography, 3rd Edition Pearson Education, 2008.
3. Marjie T.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
4. Peterson, Gilbert, and Sujeet Shenoi,Advances in Digital ForensicsIX, Vol. 410, Springer, 2013.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Explain the security issues with network layer and transport layer.
2. Understand computer forensics.
3. Make use of forensics tools to collect and store evidences.
4. Analyze and validate forensics data.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2					3				2				2
CO2	2	1	1		3	3				2				2
CO3	2	1	1		3	3				2		1		2
CO4	2	1	1		3	3				2		1		2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2734	IOT ARCHITECTURES AND APPLICATIONS	2	0	2	3

OBJECTIVES:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I FUNDAMENTALS OF IoT 6

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II IoT PROTOCOLS 6

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRa WAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III DESIGN AND DEVELOPMENT 6

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 6

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG.

UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS 6

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – Grid Blocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Study of Raspberry Pi board.
2. Study of Arduino board.
3. Build an IoT system using Raspberry Pi board.
4. Build an IoT system using Arduino board.
5. Build an IoT system for weather monitoring.
6. Build an IoT system for Home Automation.
7. Build an IoT system for controlling different environmental parameters.

PRACTICAL: 30 HOURS

TOTAL: 60 HOURS

TEXTBOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012 (for Unit 2).
3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.
6. https://www.arduino.cc/
7. https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Explain the concept of IoT.
2. Analyze various protocols for IoT.
3. Design a PoC of an IoT system using Raspberry Pi/Arduino
4. Apply data analytics and use cloud offerings related to IoT.
5. Analyze applications of IoT in real time scenario

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2		1						2		1	1	
CO2	2	3	1	2	3				1	3		1	1	3
CO3	2	2	1	1						2		1	1	3
CO4	2	2	1	3	3					2		1	3	3
CO5	3	3	1	3	3					2		1	3	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2735	3D MODELING, RENDERING, ANIMATION, AND MOTION GRAPHICS	2	0	2	3

OBJECTIVES:

- Understand the definition of Computer Based Modeling techniques.
- Understand 3D modeling in simple objects with lines and connect with compound objects.
- Learn different types of lighting, camera and rendering.
- Understand the Animation and motion graphics techniques.

UNIT I THE MAYA USER INTERFACE 6

Introduction -The Maya interface Creating, manipulating, and viewing objects Creating a new scene, Primitive objects, Transformation tools. Viewing the Maya 3D scene - Workflow overview, viewing objects in shaded mode, Grouping objects, The Hypergraph Selection modes and masks, Pivot points Components and attributes Template display Components, The Attribute Editor Surface materials.

UNIT II NURBS MODELING 6

Revolving a curve to create a surface Creating a profile curve, Creating a revolve surface Editing a revolve surface Sculpting a NURBS surface Preparing a surface for sculpting, Basic sculpting techniques, Additional sculpting techniques. Sculpting a nose, Sculpting eye sockets, Sculpting eyebrows, Sculpting a mouth Sculpting other facial features.

UNIT III 3D STUDIO MAX 6

Introduction to 3D Studio Max: Exploring the Max Interface, Creating & Editing Standard Primitive Objects, Creating & Editing Extended Primitive Objects, Working with Files, Importing & Exporting, Understanding 2D Splines & Shape, Convert 2D to 3D object using extrude, bevel, loft, terrain. Using Morph, Scatter, conform, connect compound objects, Using Boolean, Pro boolean&Procutter.

UNIT IV LIGHTING AND RENDERING 6

Lighting & Camera Configuring & Aiming Cameras, Using Camera Motion Blur & Depth of Field, Using Basic lights, Using Light tracing, radiosity, Video Post, Mental Ray Lighting. Rendering with V-Ray - Introduction to Scene, Preparing the Scene, Basic Settings for Texturing, Create & Assign Textures, Light Setup, V-Ray Rendering Settings, Fine-Tuning.

UNIT V ANIMATION AND MOTION GRAPHICS 6

Introduction to Animation: Creating keyframes & Auto Key/Set Key, Animating with simple controllers, Function curves in track view, motion mixer and Animation techniques. Motion Graphics: Cinema 4D, Nuke - Professional pixel-perfect visual effects and Blender.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Study of 3D Studio Max.
2. Study of different tools used in Animation and Motion graphics.
3. Program or tool to create and edit a surface.
4. Implementation of different sculpting operations.
5. Study of Cinema4D.
6. Program or tool to create a scene and edit using different operations.

PRACTICAL: 30 HOURS

TOTAL: 60 HOURS

TEXT BOOKS:

1. Mortenson, Michael E, 3D Modeling, Animation, and Rendering: An Illustrated LexiconBlack and White Edition, 2010.
2. Boris Kulagin, “3ds Max 8 from Modeling to Animation, BPB,2006.
3. Michael G., 3D Modeling and Animation, IRM Publishing,2005
4. Lance Flavell, Beginning Blender: Open Source 3D Modeling, Animation, and Game Design, Apress, 2010.

REFERENCES:

1. TedBoardman, 3d'sMax5Fundamentals, Techmedia"2004.
2. Lance Flavell Beginning Blender: Open Source 3D Modeling,Animation, and Game Design Apress, 2008.

COURSE OUTCOMES:

Upon Successful Completion of this course, the students should be able to:

1. Design 3D modeling with 3d objects and scene.
2. Apply different types of lighting effects in real word scene.
3. Design a real-world application using rendering concepts.
4. Apply the Animation and motion graphics techniques.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2		2	2								1	
CO2	1	2		2	2								1	
CO3	1	2		2	2								1	
CO4	1	2		2	2								1	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2736	TEXT ANALYSIS	2	0	2	3

OBJECTIVES:

The objective of this course is to enable the students to

- Understand neural language models
- Apply encoder-decoder and transformer models
- Understand conference and coherence
- Build question answering systems
- Build chatbots and dialogue systems

UNIT I NEURAL LANGUAGE MODELS 6

Review of foundations of natural language processing – introduction to neural networks and deep learning – language models based on neural networks – review of semantic embeddings using neural networks – Recurrent neural networks – RNN language models – RNN for NLP tasks – stacked and bi-directional RNN – LSTM – transformers – transformers as language models

UNIT II ENCODER-DECODER AND TRANSFORMER MODELS 6

Language divergence and typology – machine translation – the encoder-decoder model – encoder-decoder with RNN – attention – beam search – encoder-decoder with transformers – practical MT systems – evaluation of MT systems – bias and ethical issues – bidirectional transformer encoders – training bidirectional encoders – transfer learning through fine tuning – transfer learning via prompting

UNIT III COREFERENCE AND COHERENCE 6

Coreference phenomena – coreference tasks and datasets – mention detection – coreference algorithms – neural mention-ranking algorithm – evaluation of coreference – gender bias in coreference – coherence relations – discourse structure parsing – centering and entity based coherence – local coherence – global coherence

UNIT IV QUESTION ANSWERING 6

Information retrieval – relation extraction – extraction of time – extracting events – template filling – review of SRL – lexicons – IR-based factoid question answering – entity linking – knowledge-based question answering – language models for QA – classic QA models – evaluation of factoid answers

UNIT V CHATBOTS AND DIALOUGE SYSTEMS 6

Properties of human conversation – chatbots – GUS a frame-based dialogue system – dialogue-state architecture – evaluating dialogue systems – design of dialogue systems – other text processing applications – recent advancements in deep learning architectures for text processing

THEORY: 30 HOURS

PRACTICAL COMPONENTS:

LIST OF EXPERIMENTS:

1. Build language models using neural networks
2. Build language models using RNN
3. Simple NLP tasks using RNN
4. Build language modes using transformers
5. Implement encoder-decoder model for NLP tasks
6. Transfer learning using BERT
7. Implement machine translation systems
8. Implement coreference algorithms
9. Implement information extraction tasks
10. Implement QA systems
11. Implement a chatbot system
12. Implement dialogue systems

PRACTICAL: 30 HOURS

TOTAL: 60 HOURS

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.

REFERENCES:

1. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'RREILLY.
2. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress.

COURSE OUTCOMES:

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

1. Build language models based on neural networks, RNN, LSTM, and transformers
2. Apply encoder-decoder and transformer models for NLP tasks such as machine translation
3. Explain coreference and coherence
4. Build question answering systems
5. Build chatbots and dialogue systems
6. Learn emerging deep learning architectures for text processing

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	3	2								3	2
CO2	3	3	3	3	2								3	2
CO3	3	1											1	2
CO4	2	3	3	3	2	2				2		3	3	2
CO5	2	3	3	3	2	2				2		3	3	2
CO6	3											3	1	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2737	IMAGE AND VIDEO ANALYSIS	2	0	2	3

OBJECTIVES:
The primary objective of this course is to enable the students

- To review the image processing techniques
- To understand shape and region analysis
- To study the different techniques for motion analysis.
- To learn about object detection in images and video
- To study some applications of computer vision algorithms

UNIT I IMAGES IN DIFFERENT DOMAINS AND OPERATORS 6
Images in the Spatial Domain, Images in the Frequency Domain, Operators: Point - Local - Global, Three Procedural Components, Classes of Local Operators, Advanced Edge Detectors.

UNIT II IMAGE AND MOTION ANALYSIS 6
Basic Image Topology, Geometric 2D Shape Analysis, Image Value Analysis, Detection of Lines and Circles, 3D-Motion and 2D-OpticalFlow, Algorithms: Horn–Schunck - Lucas–Kanade - BBPW, Performance Evaluation of Optical Flow Results.

UNIT III IMAGE AND VIDEO SEGMENTATION 6
Image Segmentation: Mean-Shift, Image Segmentations as an Optimization Problem, Video Segmentation and Segment Tracking.

UNIT IV OBJECT DETECTION IN IMAGES AND VIDEO 6
Post Processing methods, multi-frame methods using 3-D convolution, multi-frame methods using recurrent neural networks, Sparse feature propagation, multi-frame feature aggregation.

UNIT V APPLICATIONS OF MACHINE LEARNING FOR IMAGE AND VIDEO ANALYSIS 6
Face recognition using eigen faces, Face recognition using LBP, Face detection with Haar Cascades in real-time video, Object detection with YOLO. Tracking moving object in video.

THEORY: 30 HOURS

LAB COMPONENTS:
LIST OF EXPERIMENTS:

1. Implementation of different filters for edge detection.
2. Implementation of different filters for image smoothening.
3. Implementation of optical flow algorithm using openCV.
4. Implementation of object recognition using python and OpenCV.
5. Implementation of object detection using YOLO.
6. Implementation of face recognition in real time video
7. Design and implementation of video game bots.

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXTBOOK:

1. Reinhard Klette, Concise Computer Vision: An Introduction into Theory and Algorithms, Springer, 2014

REFERENCES:

1. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.
2. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, Pearson Education, 2003.

COURSE OUTCOMES:
Upon completion of the course, the student should be able to

1. To apply the different image processing techniques
2. To perform shape analysis
3. To perform image and video segmentation.
4. To apply object detection in images and video.
5. To develop applications using computer vision techniques

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	3	3								2	2
CO2	3	3	2	3	3								2	2
CO3	3	3	2	3	3								2	2
CO4	3	3	2	3	3								3	2
CO5	3	3	2	3	3								3	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2738	SOCIAL NETWORK ANALYSIS	2	0	2	3

OBJECTIVES:

The primary objective of this course is to

- Model social network
- Mine the communities for knowledge
- Understand the links in social network
- Understand privacy preservation in Online Social Network
- Learn visualization of social networks.

UNIT I INTRODUCTION 6

Introduction, Statistical properties of social networks: Static and dynamic properties, Random walk and their applications: Random walk on graphs - Algorithms for Computing Personalized Pagerank and Simrank.

UNIT II COMMUNITY DISCOVERY AND NODE CLASSIFICATION 6

Introduction, Communities in context, Core methods: KL algorithm– Agglomerative & divisive algorithm – Markov clustering, Node classification: Introduction- Node classification problem – Random walk based methods.

UNIT III EVOLUTION AND LINK PREDICTION IN SOCIAL NETWORKS 6

Evolution: Introduction – Modeling a network actor across time frame – Challenges – Laws of evolution – Incremental mining, Link prediction: Introduction – Feature based linked prediction – Bayesian and Probabilistic relational models.

UNIT IV PRIVACY IN SOCIAL NETWORKS 6

Introduction, Privacy breaches: Disclosure of identity, social links and attribute, Privacy definition for publishing data: k-anonymity, l-diversity & t-closeness – Differential privacy, Privacy preserving mechanisms for social networks.

UNIT V VISUALIZING SOCIAL NETWORKS 6

Introduction, Taxonomy of visualization: structural- semantic – temporal, Visualization and analytics: Centrality-based Visual Discovery and Exploration.

THEORY: 30 HOURS

LAB COMPONENTS:

LIST OF EXPERIMENTS:

1. Study of different tools used in social network analysis.
2. Experiment to build social network graphs.
3. Experiment to study graph distance report.
4. Experiment to study graph density report
5. Experiment to use social network analysis as a learning analytical tool.
6. Experiments using visualization.
7. Experiment using privacy preserving mechanism

PRACTICAL: 30HOURS
TOTAL: 60 HOURS

TEXT BOOK:

1. Agarwal, Charu C. Social network data analytics, Springer, Boston, MA, 2011.

REFERENCES:

1. Stanley Wasserman, Katherine Faust Social Network Analysis: Methods and Applications Volume 8 of Structural Analysis in the Social Sciences, ISSN 0954- 366X, Cambridge University Press, 1994
2. Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.
3. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
4. Guandong Xu ,Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition Springer, 2011.
5. John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to

1. Explain the graph representation of knowledge
2. Predict human behaviour in social web and related communities.
3. Understand the evolution and predict community links
4. Visualize social networks.

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2													2
CO2	2	2	1											2
CO3	2	2	1	2	1									2
CO4	2			2	1					2				

COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
UIT2739	**FULL STACK DEVELOPMENT**	**2**	**0**	**2**	**3**

OBJECTIVES:

- Learn the process of full stack web development
- Understand the working principles of the Internet
- Understand software version control
- Understand Servers, Security, Cloud, Containers, and Orchestration
- Understand HTTP, data, and web services

UNIT I INTRODUCTION 6

Introduction: What and Why?, Shells, Terminals, Command Line, Editor: Bash(Standard streams and

redirection, accessing files and directories, searching), VIM. Internet basics: Definition, Addressing, Protocols, DNS, trace routes, packets.

UNIT II VERSION CONTROL 6

Introduction: Definition, evolution, centralized vs distributed. Concepts: navigation, saving changes, tracking history, reverting, tags, labels, branching, merging, continuous builds, IDE integration, shell integration, forward and reverse integration.Case Study.

UNIT III SERVERS AND SECURITY 6

SERVERS: What? working principle, data centers, cloud, Kernel, Windows, Unix/Linux, SSH, Processes Manager, server redirects, subdomain, file compression. Case Study.

SECURITY: Best practices, attacks, logs, checklists, upgrades, ethics, firewalls, ports, permissions. Case Study

UNIT IV HTTP AND CONTAINERS 6

HTTP/s: HTTP Definition, headers, cookies, status codes, HTTPS Definition, HTTP v1.1 Vs HTTP v2, HTTPv3. Containers: Definition, Containers Vs Microservices, Orchestration, Docker, Load Balancing, Deployment.

UNIT V DATA AND WEB SERVICES 6

Data: Relational VS Non-Relational, In-memory stores, Polling Vs Push. Web Services: Definition, pros, REST, SOAP, GraphQL. Case Study.

THEORY: 30 HOURS

LAB COMPONENTS:

LIST OF EXPERIMENTS:

1. Study of different software tools used in full stack development.
2. Study of Bash commands and VIM editor.
3. Experiment to setup server using cloud, containers and orchestration.
4. Experiment to implement load balancing.
5. Experiment to deploy in cloud
6. Experiment to perform data integration and interoperability.

PRACTICAL: 30 HOURS

TOTAL: 60 HOURS

TEXT BOOK:

1. Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", APRESS, 1st edition, 2018
2. Jaosn Cannon, "Shell Scripting: How to Automate Command Line Tasks Using Bash Scripting and Shell Programming", Createspace Independent Pub, 2015

REFERENCES:

1. Jon Loeliger, Matthew Mccullough, "Version Control with Git 2e: Powerful Tools and Techniques for Collaborative Software Development", O′Reilly, 2nd edition, 2012
2. Adam K. Dean, "Linux Administration Cookbook: Insightful recipes to work with system administration tasks on Linux", Packt Publishing Limited, 2018
3. 3.Stephen Ludin, Javier Garza, "Learning HTTP/2: A Practical Guide for Beginners", O′Reilly,1st edition,2017
4. Arnaud Lauret, "The Design of Web APIs", Manning Publications, 1st edition, 2019

COURSE OUTCOMES:

Students will be able to:

1. Getting comfortable with Bash commands and VIM editor
2. Use Git for SVC
3. Use cloud, containers, and orchestration for server setup, security configurations, load balancing, and deployment
4. Use sql/no-sql data and web services/API for data integration and interoperability

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	2				1					
CO2	1	1	1	1	2				2		2			3
CO3	1	3	2	1	3				2		3			3
CO4	1	1												2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2741	ETHICAL HACKING	2	0	2	3

OBJECTIVES:

- To understand and analyse Information security threats & countermeasures
- To perform security auditing & testing
- To understand issues relating to ethical hacking
- To understand penetration and security testing issues

UNIT I ETHICAL HACKING OVERVIEW & VULNERABILITIES 7

Understanding the importance of security, Concept of ethical hacking and essential Terminologies, Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking.

UNIT II FOOTPRINTING & PORT SCANNING 8

Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS.

UNIT III SYSTEM HACKING 7

Aspect of remote password guessing, Role of eaves dropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT IV HACKING WEB SERVICES & SESSION HIJACKING 8

Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools.

UNIT V ETHICAL HACKING PRACTICES 30

Basics of Ethical Hacking, Gathering Information Required in Order to Attack Target, Finding Critical Bugs in Servers, Methods of Password Encryption and Decryption learn to remain anonymous over the Internet, ways to maintain access to a system using Trojan and backdoor, attacking database server and wireless networks, Basic to Vulnerability Assessment Penetration and Testing tool

TOTAL: 60 HOURS

REFERENCES:

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010
3. Rajat Khare, "Network Seuciryt and Ethical Hacking", Luniver Press, 2006
4. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, 2011
5. Thomas Mathew, "Ethical Hacking", OSB publishers, 2000

COURSE OUTCOMES:

Upon successful completion of this course, a student will be able to:

1. Understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks
2. Perform penetration & security testing
3. Become a professional ethical hacker

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1		3	3		3				1		2
CO2	2	1	1		2	3		3				1		2
CO3	2	1	1		2	3		3				1		2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2742	REAL TIME EMBEDDED SYSTEMS	2	0	2	3

OBJECTIVES:

- To understand the basic concepts of embedded systems.
- To introduce basic concepts of energy efficient storage mechanisms.
- To study and analyze the different energy efficient algorithms.
- To study the different services offered by the RTOS.
- To study and develop the different applications.

UNIT I REAL TIME EMBEDDED SYSTEM CONCEPTS 6

Introduction to real time systems characteristics, soft real time systems, hard real time systems, real time systems - embedded systems single core systems, multicore systems, SOC, On-chip network--Embedded Software Development Tools.

UNIT II ENERGY EFFICIENT STORAGE MECHANISMS 6

Disk Energy Management: Power efficient strategies - Dynamic thermal management for high performance storage systems- Energy saving technique for Disk storage systems.

UNIT III ENERGY EFFICIENT ALGORITHMS 6

Scheduling of Parallel Tasks: Task level scheduling, Dynamic voltage scaling – Speed Scaling– Processor optimization- Memetic Algorithms – Online job scheduling algorithms.

UNIT IV REAL TIME OPERATING SYSTEMS 6

Multi processor system – Tasks: Real Time tasks, Soft and Hard Real-time Tasks-VxWorks: Features, Different services-case study: Porting RTOS into the embedded boards.

UNIT V APPLICATIONS 6

Embedded Boards: Raspberry, Arduino- Optimization of Application: Code level, Memory Level, Execution Level-- Case Study: Design of Robot Controller, Weather Station, Web Bot.

THEORY: 30 HOURS

LAB COMPONENTS:

LIST OF EXPERIMENTS:

1. Study of different software tools used in embedded systems.
2. Study of different Linux commands.
3. Study of different steps involved in porting an OS into the target board.
4. Study of Arduino IDE
5. Arduino for designing weather station.
6. Arduino for designing health monitoring system.

PRACTICAL: 30 HOURS

TOTAL: 60 HOURS

TEXT BOOK:

1. Wang K.C, "Embedded and Real Time operating Systems", Springer International Publishing AG 2017.

REFERENCES:

1. Ishfaq Ah mad, Sanjay Ranka, Handbook of Energy Aware and Green Computing, Chapman and Hall/CRC, 2012.
2. WolfRam Donat, Learn RaspberryPi Programming with Python, Learn to program on the World's Most Popular Tiny Computer, Second Edition.
3. Chong-Min Kyung, Sungioo yoo, Energy Aware system design Algorithms and Architecture, Springer, 2011.
4. Bob steiger wald ,Chris:Luero, Energy Aware computing, Intel Press,2012.
5. Xiaocong Fan, Real-Time Embedded Systems: Design Principles and Engineering Practices, Newnes, 2015

COURSE OUTCOMES:

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

1. Appreciate the usefulness of embedded systems in building different systems specific to their applications.
2. Understand the importance of system-on-chip and network-on-chip in designing power efficient high-performance systems.
3. Understand the different energy efficient strategies used for designing the storage devices.
4. Understand the different energy saving algorithms in embedded systems.
5. Understand the different features and services officered by the RTOS in designing the embedded system.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	3								3	3
CO2	3	3	3	3	3								3	3
CO3	3	3	3	3	3								3	3
CO4	3	3	3	3	3								3	3
CO5	3	3	3	3	3								3	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2743	EMERGING TECHNOLOGIES FOR AR/VR/MR/XR	2	0	2	3

OBJECTIVES:

The objective of this course is to enable the students to

- Understand the concept of virtual reality and augmented reality
- Creation of 2D & 3D Scene
- Development of VR Application
- Development of AR Application
- Creation and Evaluation of applications using AR and VR applications

UNIT I XR DEVELOPMENT APPROACHES 6

Main approaches to XR development: WebXR, Unity, and Unreal. Development tools, programming languages, and technicalskills of WebXR, Unity, and Unreal. In addition to getting a fundamental overview of XR development platforms and tools, Transition from 2D to 3D. Creation of 3D scene using WebXR,

Unity, or Unreal.

UNIT II DEVELOPING VR APPLICATIONS 6

Creation a virtual reality: Menus and navigation techniques, object selection and manipulation in VR. Creation of applications using WebXR, Unity and Unreal. Navigation and interactions in VR. Creation of VR scene using A-Frame, Unity, or Unreal. Creation of basic and immersive VR scenes with WebXR using A-Frame.

UNIT III DEVELOPING AR APPLICATIONS 6

Development of AR applications. Marker-based and marker-less approaches to augmenting the environment. Design and role of markers for prototyping and deployment, Differences to marker-less AR. I will also cover approaches in Unity and Unreal. Hand-held and head-worn AR. Creation of AR scene using A-Frame, Unity, or Unreal. Creation of marker-based and marker-less AR scenes with WebXR using A-Frame.

UNIT IV SPECIAL TOPICS IN XR 6

Introduction to advanced techniques of XR: procedural generation redirected walking and custom controllers for VR - 3D reconstruction, object recognition, and custom displays for AR. Accessibility, collaboration, personalization of XR experiences. Evaluating of AR systems.

UNIT V APPLICATIONS AND CASE STUDY 6

Mobile Augmented Reality: Concept, Advantages, Disadvantages of mobile AR. Magic Box, Mirrors, Windows and doors. A Trend toward Militiaperson Applications and Private Applications. Toward Easy-to-Use Authoring Tools for Augmented Reality Experiences. A Trend Toward Attention to Disabilities and Challenges.

THEORY:30 HOURS

LAB COMPONENTS:

LIST OF EXPERIMENTS:

1. Study of different software tools used in AR/VR/XR technologies.
2. Experiment to Use AR to train new employees on how to operate and repair complex machinery.
3. Experiment to Simulate real-life situations and test learners' responses to microaggressions with 360º VR.
4. Experiment to Use AR plane detection to place a simulated cash register in front of learners and test their customer service skills.
5. Experiment to Place learners in a simulated warehouse environment through full VR.
6. Experiment to study Build AI-based XR apps for better human-machine interaction

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXTBOOKS:

1. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

REFERENCE:

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

COURSE OUTCOMES:

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

1. Develop XR application
2. Experience to use VR and AR tools
3. Use immersion technique to scene creation
4. Apply VR and AR concepts in real world applications

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1			2								2	
CO2	3	2	1	1	3								2	
CO3	3	1	1	1	2								2	
CO4	3	2	2	3	3	2				1		2	3	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2821	REINFORCEMENT LEARNING	2	0	2	3

OBJECTIVES:

The objective of this course is to enable the students to

- Introduce the different basic concepts of reinforcement learning.
- Learn about the Finite Markov Decision Process.
- Study about the dynamic programming.
- Study about the Monte Carlo Methods.
- Learn about the temporal difference learning.

UNIT 1 INTRODUCTION 6

Reinforcement Learning (RL) – elements, limitations and scope; Probability basics - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.

UNIT II FINITE MARKOV DECISION PROCESS 6

Agent-environment interface, Markov property; Goals and rewards, returns and episodes; Policies and value functions – Bellman equation; Optimal policies and optimal value functions - Bellman optimality equations.

UNIT III DYNAMIC PROGRAMMING 6

Iterative policy evaluation, policy improvement theorem, policy iteration, value iteration, asynchronous dynamic programming.

UNIT IV MONTE CARLO METHODS 6

Monte Carlo prediction, Monte Carlo estimation of action values, Monte Carlo control, Off-policy prediction via importance sampling.

UNIT V TEMPORAL-DIFFERENCE (TD) LEARNING 6

TD prediction – TD(0) and TD(λ), optimality of TD(0), Sarsa, Q-learning – Deep Q networks; Function approximation methods – stochastic gradient and semi-gradient methods; Policy gradient methods; RL for real world problems.

THEORY: 30 HOURS

PRACTICAL COMPONENTS:

LIST OF EXPERIMENTS

1. Implementation of value iteration.
2. Implementation of Bridge Grid.
3. Implementation of Discount Grid.
4. Implementation of Action Selection.
5. Implementation of testing Q-Learning.
6. Implementation of approximate Q-Learning.

7. Study of the python library PettingZoo.
8. Study of SuperSuit.
9. Study of Stable Baselines3.
10. Study Pistonball.
11. Study of MAgent

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOKS:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", MIT Press, 2nd edition, 2018.

REFERENCES:

1. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach.", Pearson EducationLimited, 2016.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective"
3. Csaba Szepesvari, "Algorithms for Reinforcement learning"
4. Recent journal articles on application of RL for real world problems

COURSE OUTCOMES:

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

1. Describe the features of reinforcement learning that distinguishes it other learning algorithms.
2. Understand and apply basic RL algorithms for simple sequential decision-making problems in uncertain conditions.
3. Interpret state-of-the-art RL research and communicate their results
4. Apply the Finite Markov Decision Process.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1										2	2
CO2	3	2	2										3	2
CO3	3	3	2										3	2
CO4	3	2	2	1	1				3	3		2	3	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2822	SPEECH TECHNOLOGY	2	0	2	3

OBJECTIVES:

- To make the students learn the basic concepts in digital signal processing that are required to learn speech signal processing.
- To extract relevant parameters from the speech signal, being in the time-domain, and to understand the importance of those parameters.
- To extract relevant parameters from the speech signal, being in the frequency-domain, and to understand the importance of those parameters.
- To extract features relevant for building any practical, speech-based applications.
- To make them learn how to modify a given speech signal, based on the requirement for a specific application.

UNIT I INTRODUCTION TO DIGITAL SIGNAL PROCESSING 6

Discrete-time signals and systems, Response of linear time invariant (LTI) systems to arbitrary inputs (the convolution sum), Difference equation, Correlation of discrete-time signals, The z-transform – Properties of

z-transform, The discrete Fourier transform (DFT) and its properties, Fundamentals of digital filters.

UNIT II TIME-DOMAIN MODELS FOR SPEECH PROCESSING 6

Time-dependent processing of speech, Short-Time Energy and Average Magnitude, Short- Time Average Zero Crossing Rate, Speech vs. Silence Discrimination using Energy and Zero- Crossings. Short-Time Autocorrelation Function, Pitch Period Estimation using autocorrelation function.

UNIT III SHORT-TERM FOURIER ANALYSIS OF SPEECH 6

Fourier transform Interpretation, Linear Filtering Interpretation, Spectrographic Displays, Harmonic Product Spectrum-based Pitch Estimation technique, Analysis-by-Synthesis.

UNIT IV SPECTRAL FEATURES 6

Cepstrum: Definition - Computation of cepstrum - Formant and pitch estimation – Computation of mel-frequency cepstral coefficients, Linear predictive analysis: Principle – autocorrelation method - Pitch estimation using linear prediction error signal -Formant estimation using LPC - Computation of LPCC.

UNIT V RESHAPING OF SPEECH SIGNALS 6

Preprocessing: Scaling - low-pass filtering - Pre-emphasis - Mean subtraction -teager-energy function. Channel VOCODER. Estimation of Glottal Closure Instants, TD-PSOLA. Speech synthesis using source and system parameters, Voice Conversion, Fundamental of Speech Enhancement, Introduction to Speech-to-Speech translation.

THEORY: 30 HOURS

LAB COMPONENTS:
LIST OF EXPERIMENTS:

1. Study of real time speech emotion recognition system.
2. Speech Emotion Recognition with librosa.
3. Write program to extract Mel Frequency Cepstral Coefficients from speech.
4. Study and use DisVoice Python framework to extract features from speech audio files.
5. Experiment to calculate pitch and pitch tracking.
6. Implementation of histogram equalization.
7. Study of Speech Brain speech toolkit.

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXTBOOKS:

1. Lawrence R. Rabiner, and Ronald W. Schafer, Digital Processing of Speech Signals, Englewood Cliffs, NJ: Prentice-hall, 1978.
2. Thomas F Quatieri, Discrete-time Speech Signal Processing: Principles and Practice, Pearson Education India, 2006.
3. John G Proakis, Dimitris G. Manolakis Digital Signal Processing: Principles, Algorithms, and Applications, Pearson Education India, 4th edition, 2007.

REFERENCES:

1. Eric Moulines, and Francis Charpentier, “Pitch-synchronous waveform processing techniques for text-to-speech synthesis using diphones”, Speech communication, vol 9, 1990, pp. 453-467.
2. Thomas Drugman, Mark Thomas, Jon Gudnason, Patrick Naylor, and Thierry Dutoit, “Detection of glottal closure instants from speech signals: A quantitative review”, IEEE Transactions on Audio, Speech, and Language Processing, vol 20, no. 3, 2012, pp. 994-1006.
3. Jani Nurminen, Hanna Silén, Victor Popa, Elina Helander, and Moncef Gabbouj, “Voice conversion”;, Speech enhancement, modeling and recognition- algorithms and applications, IntechOpen, 2012.
4. Seyed Hamidreza Mohammadi, and Alexander Kain, “An overview of voice conversion systems” Speech Communication, vol 88, 2017, pp. 65-82.

COURSE OUTCOMES:

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

1. Explain the usefulness of digital signal processing fundamentals in building speech- based systems.
2. Compare the time and frequency-domain parameters, and know how to compute / estimate those parameters
3. Outline the relevant features that can be extracted from a given speech signal, and in what way the features are relevant to build speech-based systems.
4. Explain the possible techniques to modify a given speech signal, based on the requirement, and to develop the required algorithms.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1											2	
CO2	3	2	1		3								2	
CO3	3	2	1	1	3								3	2
CO4	3	3	3	3	3				1	3		3	3	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2823	FORENSIC ANALYTICS	2	0	2	3

OBJECTIVES:

- To understand the basic methods of forensic investigation.
- To learn to apply Benford's law in forensic data investigation
- To understand the statistical approaches in fraud identification
- To apply the techniques adopted in real time forensic data analysis

UNIT I FORENSIC INVESTIGATIONS 6

Introduction to Forensic Investigations - using Access - using Excel - using Powerpoint, High level Data Overview Tests.

UNIT II BENFORD'S LAW 6

Benford's Law - Basics - Assessing Conformity - Second order and summation Tests - Number Duplication and Last Two Digit Tests.

UNIT III DESCRIPTIVE ANALYSIS OF FRAUDULENT DATA 6

Identifying Fraud using Largest Subset and Largest Growth Tests - Identifying Anomalies using Relative Size Factor Test - Identifying Fraud using Abnormal Duplications.

UNIT IV PREDICTIVE ANALYSIS OF FRAUDULENT DATA 6

Identifying Fraud Using Correlation - Identifying Fraud Using Time-Series Analysis - Risk Assessment - Risk Scoring.

UNIT V APPLICATIONS 6

Applications and Practical Systems for Forensic Data Analytics – Detection of Financial Statement Fraud - Analytics on Purchasing Card Transactions.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Numeric Data Analysis - Detection of Fraud and Errors using Benford's Law.
2. Descriptive Analysis for Fraud Detection in Inventory Data using Largest Subset and Growth Tests.
3. Descriptive Analysis for Fraud Detection in Insurance Claims using Abnormal Duplications Test.
4. Predictive Analysis for Detection of Fraud from sales data using correlation co-efficient.

5. Predictive Analysis for Detection of Fraud from Stock Market Data using Time-Series Analysis.
6. Application Development - Fraud Detection in Credit Card Transactions

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOK:

1. Mark J Nigrini, "Forensic Analytics - Methods and Techniques for forensic accounting investigations", 2nd edition, John Wiley & Sons, Inc, 2020.

REFERENCES:

1. Leonard W Vona, "Fraud Data Analytics Methodology", John Wiley & Sons, Inc, 2017.
2. Sunder Gee, "Fraud and Fraud Detection - A Data Analytics Approach", John Wiley & Sons, Inc, 2014.

COURSE OUTCOMES:

Students will be able to:

1. Analyse structured data using formulas to detect fraud
2. Apply concepts of Benford's law in analysis of fraudulent data.
3. Use correlation and time series analysis to detect frauds.
4. Use appropriate statistical method to detect frauds in financial statements and transactions.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1			2								1	2
CO2	2	1											2	2
CO3	2	2	2	1	2							1	2	2
CO4	2	2	2	1	2							1	2	2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2824	HUMAN COMPUTER INTERACTION	2	0	2	3

OBJECTIVES:

- To learn the foundations of Human Computer Interaction.
- To be familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.

UNIT I FOUNDATIONS OF HCI 6

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT II DESIGN & SOFTWARE PROCESS 6

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale; Design rules – principles, standards, guidelines, rules; Evaluation Techniques.

UNIT III MODELS AND THEORIES 6

Cognitive models – Socio-Organizational issues and stake holder requirements – Communication and collaboration models - Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI 6

Mobile Ecosystem: Platforms, Application frameworks - Types of Mobile Applications: Widgets,

Applications, Games - Mobile Information Architecture, Mobile Design: Elements of Mobile Design, Tools, Mobile 2.0.

UNIT V WEB INTERFACE DESIGN 6

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Design a system based on a user-centered approach.
2. Design the existing GUI with screen complexity.
3. Design web user interface based on Gestalt theory.
4. Implementation of various kinds of menus.
5. Implementation of various kinds of windows.
6. Implementation of various kinds of icons.

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXTBOOK:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004.

REFERENCES:

1. Brian Fling, "Mobile Design and Development", First Edition , O"Reilly Media Inc., 2009.
2. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O"Reilly, 2009.
3. Ben Shneiderman, Designing for Effective Human/Computer Interaction, Pearson, 2010.
4. Jenifer Tidwell, Designing Interfaces, Second Edition, O'Reilly publishers, 2011.
5. David Benyon, Designing Interactive Systems: A Comprehensive Guide to HCI, UX and Interaction Design, Third Edition, Pearson, 2013.

COURSE OUTCOMES:

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

1. Design effective dialog for HCI.
2. Design effective HCI for individuals and persons with disabilities.
3. Assess the importance of user feedback.
4. Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
5. Develop meaningful user interface.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	1							1			1	
CO2	2	1	2							1			2	
CO3	1	1	2						1	1	1		1	
CO4	2	1	2						1	2			1	
CO5	2	1	1						1	1			3	

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2825	FINTECH SECURITY	2	0	2	3

OBJECTIVES:

1. To give awareness on foundational technologies in FinTech
2. To understand the Encryption methods and key management in FinTech.
3. To understand the security and privacy in FinTech
4. To analyze the limits, technology risks, security policies and social implications of FinTech
5. To learn about case studies on cyber-crimes, frauds and regulations to mitigate risks

UNIT I INTRODUCTION 6

Introduction - FinTech opportunity to improve the financial systems, Fintech – Financing: Crowd Funding, Credit & Factoring, Asset Management: Social trading, Investment and Banking, Payments, Other Fintech: Insurance, Technology and Infrastructure: Commercial Banking, Core Banking, Internet and Mobile Banking, Customer - Centric Banking, Blockchains – Cryptocurrencies.

UNIT II ENCRYPTION AND INFORMATION SECURITY 6

Symmetric key Encryption – DES, AES, Triple-DES, Public Key Cryptography – Elliptic Curve Cryptography, RSA, Two Fish, Blow Fish, Cryptography in Banking – ATM, Credit/Debit card, Mobile Banking security, Key Management – Key distribution techniques in FinTech.

UNIT III SECURITY AND PRIVACY IN BANKING 6

Security and privacy in Fintech: Issues, threats and risks, Physical Security – Human resources, Data center and Physical asset management, Access control, Authentication, Authorization, Data Security – Data usage protection, Data processing security in Fintech, Data Privacy, Fraud detection in FinTech.

UNIT IV RISK MANAGEMENT IN FINTECH 6

Technological risks on IVR, ATM, Card Management, Internet and Mobile Banking, Data based security Risks in FinTech, Cloud based security risks, Risk detection, Risk reduction and prevention tools and methods in Fintech, Cyber risks.

UNIT V FRAUD, CRIMES AND REGULATIONS 6

Introduction to Fraud, Crimes and Security, Cyber Security issues: case studies on Human, data and technology related attacks, impacts of crimes, Digital forensics and Electronic Evidence discovery process, Indian model law on E-Commerce and FinTech – e-KYC, InsurTech, Prevention of Money Laundering Act (PMLA), Payment and Settlement Systems (PSS) Act, Guidelines for FinTech – NPCI, NBFC, GDPR.

THEORY: 30 HOURS

PRACTICAL COMPONENTS:

1. Implementation of symmetric key cryptography for Fintech security
2. Implementation of public key cryptography for Fintech security
3. Role based access control
4. Secure application logic
   - OTP
   - Mandatory password change
   - Monitoring
   - Short login-session
   - Adaptive authentication
5. DevSecOps
   - Using tools – OWASP
6. Blockchain implementation and cryptocurrency demonstration

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOK:

1. Kannan Subramanian and Chithra Selvaraj, "Bank of the future – Minimise Technology risk, Maximise Business Return, Wolters Kluwer publication, 2018.
2. Allen N. Berger, Philip Molyneux and John O.S. Wilson – The Oxford Handbook of Banking, 3rd Edition.

REFERENCES:

1. J.W. Rittiaghouse and William M. Hancok, "Cyber Security Operations Handbook", Elsevier.
2. William Stallings, "Cryptography and Network Security Principles and Practice Fourth Edition", Pearson Education

COURSE OUTCOMES:

On successful completion of this module, students should be able to:

1. Define all areas of FinTech
2. Understand the challenges and opportunities in various financial applications.
3. Analyze the risks related to FinTech and to pinpoint the areas where modernization is still required
4. Understand the linkage between certain technologies and regulations
5. Analyze the fintech regulations related to cyber use and cyber-crimes in financial institutions.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2		1			2				2				2
CO2	2		1		2	3		3		2		1		2
CO3	2	1	1		2	3		3		2		1		2
CO4	2	1	1		2	3		3		2		1		2
CO5	2	1	1		2	3		3				1		2

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2826	MOBILE AUTONOMOUS ROBOTS	2	0	2	3

OBJECTIVES:

- To introduce and compare different robotic systems that navigate independently in complex environments.
- To develop knowledge on basic sensor systems related to state measurements, navigation and localization.
- To study computer vision perception and learn sensors for environment perception.
- To understand mobile robot locomotion, kinematics, probabilistic map based localization.

UNIT I ROBOT LOCOMOTION 6

Introduction to AI and Robotics – robot locomotion – legged mobile robots – wheeled mobile robots – aerial mobile robots.

UNIT II MOBILE ROBOT KINEMATICS 6

Kinematic models and constraints – mobile robot maneuverability – mobile robot workspace – advanced kinematics – motion control.

UNIT III ROBOT PERCEPTION 6

Sensors for mobile robots – computer vision for robots – image processing for robotics – place recognition – range data.

UNIT IV MOBILE ROBOT LOCALIZATION 6

Introduction to localization – noise and aliasing – localization-based navigation – belief representation – map representation – probabilistic map-based localization – autonomous map building.

UNIT V ROBOT PLANNING AND NAVIGATION 6

Planning and navigation – planning and reacting – path planning – obstacle avoidance – navigation architectures.

THEORY: 30 HOURS

PRACTICAL COMPONENTS:

1.Mobile object detection.

2.Application to perceive the environment.

3.Decision-based actions around obstacles.

4.Motion planning and navigation schemes for mobile robots.

5.Implementation of kinematics for mobile robots

PRACTICAL: 30 HOURS
TOTAL: 60 HOURS

TEXT BOOK:

1. R. Siegwart, I. R. Nourbaksh, and D. Scarramuzza, "Introduction to Autonomous Mobile Robots", Second Edition, MIT Press, 2011.

REFERENCES:

1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.

COURSE OUTCOMES:

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

1. Understand and analysis algorithmic approaches, compare the mathematical models on various mobile robots.
2. Address several key challenges in localization, and mapping, and find research issues in visual object detection.
3. Develop knowledge on motion planning and navigation schemes for mobile robots
4. Apply and implement path planning and kinematics for mobile robots.
5. Plan and design mobile robots that act autonomously for practical applications.

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	3								3	3
CO2	3	3	3	3	3		2						3	3
CO3	3	3	3	3	3								3	3
CO4	3	3	3	3	3								3	3
CO5	3	3	3	3	3								3	3

COURSE CODE	COURSE TITLE	L	T	P	C
UIT2827	USER EXPERIENCE AND INTERACTION DESIGN FOR AR/VR/MR/XR	2	0	2	3

OBJECTIVES:

- To learn the basics of UX design, research, and Interaction design
- To Understand UX data flows
- To Understand UX prototyping
- To Understand UX design for Muti devices

UNIT I INTRODUCTION TO UX DESIGN, UX RESEARCH 6

Introduction: What is UX?, Benefits, Alternatives, Specialist Vs Genaralist, Types, Tools. UX Research-Overview: Usability testing, interviewing, Card sorts, eye tracking, multivariate testing, A/B testing, surveys, personas, workshops. Types: qualitative vs quantitative research, behavioral vs attitudinal research, moderated vs unmoderated research. Environmental factors:agile vs waterfall, in-house vs agency, product stage, research goal. Methodology, Analysis, and Results

UNIT II DATA FLOW 6

User data analysis: getting data, observing users, experience mapping, setting goals, developing metrics. Personas: Definition, Benefits, creation, data-driven personas. Ideation: Definition, Benefits, Techniques. Scenarios and Storyboards: Uses, Creating scenarios, Creating storyboards. Paper Prototyping: Definition, benefits, creation, user testing. Implementation Planning: The need, story mapping.

UNIT III PROTOTYPING 6

Fundamentals: Definition, benefits, factors, guidelines. Fidelity: Overview, Low and High Fidelity. prototyping, prototype testing and evaluation. Tools: Introduction, techniques, use case, POP, Moqups, InVision, Keynote, Axure.

UNIT IV MUTIDEVICE DESIGN 6

Overview: Principles, Context of use, responsive design, hybrid apps, native apps. Factors: mobile/tablet interfaces, watch interface,TV interface, voice design, The 3Cs. Planning: user flow across devices, scalable interaction model. Frameworks and guidelines: Bootstrap, Foundation, Wordpress, Material design, iOS human interface guidelines.

UNIT V INTERACTION DESIGN 6

Definition, psychology, overview, model, dimensions, structure, flow, interface, design patterns, anti-patterns, dark patterns, navigation structure and systems, content, inputs, gestures, voices, sensors, microinteractions, motion, sound, haptics, error handling, usability and accessibility.

THEORY: 30 HOURS

LAB COMPONENT:

LIST OF EXPERIMENTS:

1. Study of different tools used in AR/XR/VR technologies.
2. Study of different services offered in AR/VR/XR/MR technologies.
3. VR based job training system.
4. Unity and Vuforia to augment an object.
5. Object based AR.
6. Virtual College Tour.

PRACTICAL: 30 HOURS

TOTAL: 60 HOURS

TEXT BOOKS:

1. Don Norman, "The Design of Everyday Things", Basic Books, Revised edition, 2013
2. Russ Unger, Carolyn Chandler, "A Project Guide to UX Design: For User Experience Designers in the Field or in the Making", New Riders Pub, 1st edition, 2009
3. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed, "Observing the User Experience: A Practitioner's Guide to User Research", Morgan Kaufmann, 2nd edition, 2012
4. Ben Coleman, Dan Goodwin, "Designing UX: Prototyping", SitePoint, 1st edition, 2017
5. Michal Levin, "Designing Multi-Device Experiences: An Ecosystem Approach to User Experiences across Devices", O'Reilly Media, 1st edition, 2014

REFERENCES:

1. https://www.nngroup.com/
2. https://careerfoundry.com/en/blog/ux-design/what-is-user-experience-ux-design-everything-you-need-to-know-to-get-started/
3. https://www.uxbooth.com/articles/complete-beginners-guide-to-design-research/
4. https://www.uxmatters.com/mt/archives/2015/09/ux-generalists-or-specialists.php
5. https://www.playbookux.com/what-type-of-qualitative-ux-research-method-should-i-run/
6. Bill Scott, Theresa Neil, "Designing Web Interfaces: Principles and Patterns for Rich Interactions",

O'Reilly Media, 1st edition. 2009
7. Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel, "About Face: The Essentials of Interaction Design", Wiley, 4th edition, 2014
8. Bill Moggridge, "Designing Interactions", MIT Press, 1st edition, 2007
9. Stephen P. Anderson, "Seductive Interaction Design: Creating Playful, Fun, and Effective User Experiences", New Riders Pub, 1st edition, 2011
10. Claire Rowland, Elizabeth Goodman, Martin Charlier, Ann Light, Alfred Lui, "Designing Connected Products: UX for the Consumer Internet of Things", O'Reilly Media, 1st edition, 2015

COURSE OUTCOMES:

1. Learn, Understand and Apply user centered Design principles
2. Design Digital Experiences across devices and platforms
3. Build UX portfolios
4. Use Interaction Design skills to Explore, Test, and Validate your design decisions

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	2	1	1									1	
CO2	2	1	1	1	3								1	
CO3	1	1	1	1	2								2	
CO4	1		1	1	2							1	1	

LIST OF OPEN ELECTIVES OFFERED BY OTHER DEPARTMENTS

OPEN ELECTIVE I (SEMESTER VI)

SL.NO	DEPARTMENT OFFERING	COURSE CODE	COURSE TITLE	L	T	P	C
1	EEE	UEE2041	Autonomous Vehicles	3	0	0	3
2		UEE2042	Sensors and Instrumentation	3	0	0	3
3		UEE2043	Energy Management	3	0	0	3
6	CSE	UCS2041	Introduction to Data Structures	2	0	2	3
7		UCS2042	Object Oriented Programming Techniques	2	0	2	3
8		UCS2043	Problem Solving and Programming in C	2	0	2	3
9	ECE	UEC2041	Foundation course on Digital Signal Processing	3	0	0	3
10		UEC2042	Introduction to Communication systems	3	0	0	3
11		UEC2043	Development of Nano sensors	3	0	0	3
12		UEC2044	Introduction to Internet of Things	3	0	0	3
13		UEC2045	Introduction to Sensors and Actuators	3	0	0	3
14	BME	UBM2041	Principles of Biomedical Instrumentation	3	0	0	3
15		UBM2042	Materials for Biomedical Applications	3	0	0	3
16		UBM2043	Hospital planning and Waste Management	3	0	0	3
17	Chemical	UCH2041	e-Waste Management	3	0	0	3
18		UCH2042	Nanoscience for Engineers	3	0	0	3
19		UCH2043	Sustainable Development	3	0	0	3
20	Mechanical	UME2041	Six Sigma Data analysis	2	0	2	3
21		UME2042	Product Engineering	3	0	0	3
22		UME2043	Operations Management	3	0	0	3
23	Civil	UCE2041	Green Building Design	3	0	0	3
24		UCE2042	Sustainable Infrastructure	3	0	0	3
25		UCE2043	Integrated Water Resource Management	3	0	0	3
26		UCE2044	Environmental Impact Assessment	3	0	0	3

27	MBA	PBA2041	Entrepreneurship	3	0	0	3
28		PBA2042	Supply Chain and Logistics Management	3	0	0	3
29		PBA2043	Design Thinking	2	0	2	3
30	Mathematics	UMA2041	Graph Theory and Applications	3	0	0	3
		UMA2042	Introduction to Linear Algebra	3	0	0	3
		UMA2043	Numerical Methods for Engineering	3	0	0	3
31	Physics	UPH2042	Nanotechnology and Imaging Techniques	3	0	0	3
32							
33		UPH2044	Crystal growth and Radiation detection Measurements	3	0	0	3
34	English	UEN2041	English for Career needs	2	0	2	3
35		UEN2042	Word power for Academic needs	2	0	2	3
36		UEN2043	Writing skills for university admission	2	0	2	3

OPEN ELECTIVE II (SEMESTER VIII)

SL. NO	DEPARTMENT OFFERING	COURSE CODE	COURSE TITLE	L	T	P	C
1	EEE	UEE2044	Cyber Security in Smart Grid	3	0	0	3
2		UEE2045	FEA and CAD for Electromagnetic design	3	0	0	3
3		UEE2046	Renewable Energy Systems	3	0	0	3
7	CSE	UCS2044	Introduction to Big Data Analytics	2	0	2	3
8		UCS2045	Machine Learning Applications	2	0	2	3
9		UCS2046	Web Technology	2	0	2	3
10	ECE	UEC2046	Foundations of Cryptography	3	0	0	3
11		UEC2047	Introduction to Wireless Networks	3	0	0	3
12		UEC2048	Introduction to Microcontrollers	3	0	0	3
13		UEC2049	Consumer Electronics	3	0	0	3
14		UEC2051	Introduction to Bio electromagnetics	3	0	0	3
15		UEC2052	Machine learning for signal and image processing	3	0	0	3
16	BME	UBM2044	Brain Machine Interface	3	0	0	3
17		UBM2045	Biomedical Physics	3	0	0	3
18		UBM2046	Telehealth Technology	3	0	0	3
19	Chemical	UCH2044	Industrial Safety	3	0	0	3
20		UCH2045	Industrial Waste Management and Audit	3	0	0	3
21		UCH2046	Energy Conservation and Audit	3	0	0	3
22	Mechanical	UME2044	Enterprise Resource Planning	3	0	0	3
23		UME2045	Project Management and Planning	3	0	0	3
24		UME2046	Introduction to Industrial Engineering	3	0	0	3
25	Civil	UCE2045	Experimental Techniques and Instrumentation	3	0	0	3
26		UCE2046	Air Pollution and Control Engineering	3	0	0	3
27		UCE2047	Remote Sensing and GIS	3	0	0	3
		UCE2048	Environmental Geo-technology	3	0	0	3
28	MBA	PBA2044	Innovation and Creativity	3	0	0	3

29		PBA2045	Intellectual Property Rights	3	0	0	3
30	Mathematics	UMA2044	Random Variables and Partial Differential Equations	2	1	0	3
31	Physics	UPH2041	Optical and luminescence characteristics of materials	3	0	0	3
		UPH2046	Nanoscience and nanomaterials	3	0	0	3
32		UPH2047	Astrophysics	3	0	0	3
33	English	UEN2044	Creative writing	2	1	0	3
34		UEN2045	Introduction to Children's literature	2	0	2	3