Sri Sivasubramaniya Nadar College of Engineering

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

Rajiv Gandhi Salai (OMR), Kalavakkam – 603110

Curriculum and Syllabus

Bachelor of Technology

Information Technology

Regulations 2018

Choice Based Credit System (CBCS)

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

DEPARTMENT OF INFORMATION TECHNOLOGY

B. Tech. INFORMATION TECHNOLOGY

Program Educational Objectives (PEO)

Technical proficiency
Graduates will apply their technical knowledge and expertise to develop and implement computing technologies for a broad mix of informational purposes of the research /industrial/societal needs.

Professional development
Graduates will continue to grow intellectually and professionally in the dynamic industrial scenarios.

Social responsibility
Graduates will make a positive difference to the society by generating employment and rendering services for the betterment of the society.

Program Outcomes (POs)

1. Apply the knowledge of mathematics, science and engineering fundamentals for computing applications.
2. Identify/Formulate algorithms for practical computing applications.
3. Exploit and utilize computer programming, web technology concepts and computing hardware devices.
4. Design, implement and use human friendly, interactive computing systems.
5. Store, maintain, mine and analyze data repositories.
6. Design, implement, manage and analyze networks and network oriented applications.
7. Demonstrate knowledge and understanding of IT resource planning system development and management principles.
8. Understand the impact of the computing solutions in societal and environmental contexts.
9. Demonstrate the knowledge of professional and ethical responsibilities
10. Communicate effectively in both verbal and written form and able to explore the impact of engineering solutions in the society and be aware of contemporary issues.
11. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

1. Ability to develop applications by combining computer hardware and software concepts.

2. Ability to develop applications in the domain of database, networks and web technology by following ethical values.

PEO to PO Mapping

PEO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO 1	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
PEO 2		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

PSO to PO Mapping

PSO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PSO 1	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
PSO 2		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓

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

B.Tech. INFORMATION TECHNOLOGY
REGULATIONS 2018

CHOICE BASED CREDIT SYSTEM

I -VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

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

SEMESTER II

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UEN1276	Technical English	HS	3	3	0	0	3
2	UMA1276	Complex Functions and Laplace Transforms	BS	5	3	2	0	4
3	UPH1276	Physics for Information Science	BS	3	3	0	0	3
4	UCY1276	Environmental Science	HS	3	3	0	0	3
5	UEE1276	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3.5
6	UIT1201	Fundamentals of C Programming	PC	3	3	0	0	3.5
PRACTICALS								
7	UGE1297	Design Thinking and Engineering Practices Lab	ES	4	0	0	4	1.5
8	UIT1211	C Programming Lab	PC	4	0	0	4	1.5
			Total	**28**	**18**	**2**	**8**	**23**

SEMESTER III

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UMA1377	Discrete Mathematics	BS	5	3	2	0	4
2	UIT1301	Digital Electronics	ES	5	3	2	0	4
3	UIT1302	Fundamentals of Data Structures	PC	3	3	0	0	3
4	UIT1303	Principles of Analog and Digital Communication	ES	3	3	0	0	3
5	UIT1304	Database Management Systems and Applications	PC	3	3	0	0	3
6	UIT1305	Computer Organization	PC	3	3	0	0	3
PRACTICALS								
7	UIT1311	Programming and Data Structures Lab - I	PC	4	0	0	4	2
8	UIT1312	Database Management Systems and Applications Lab	PC	4	0	0	4	2
			Total	**30**	**18**	**4**	**8**	**24**

SEMESTER IV

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	UMA1478	Probability and Statistics	BS	5	3	2	0	4
2	UIT1401	Principles of Software Engineering	PC	3	3	0	0	3
3	UIT1402	Information Theory and Applications	PC	3	3	0	0	3
4	UIT1403	Microprocessors and Microcontrollers	PC	3	3	0	0	3
5	UIT1404	Advanced Data Structures	PC	3	3	0	0	3
6	UIT1405	Algorithm Design and Analysis	PC	3	3	0	0	3
PRACTICALS								
7	UIT1411	Microprocessor and Microcontroller Lab	PC	4	0	0	4	2
8	UIT1412	Programming and Data Structures Lab - II	PC	4	0	0	4	2
			Total	**28**	**18**	**2**	**6**	**23**

SEMESTER V

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	UIT1501	Finite Automata Theory	PC	3	3	0	0	3
2.	UIT1502	Principles of Operating Systems	PC	3	3	0	0	3
3.	UIT1503	Computer Networks and Its Applications	PC	5	3	0	2	4
4.	UIT1504	Introduction to Digital Signal Processing	ES	5	3	0	2	4
5.	UIT1505	Artificial Intelligence Concepts and Algorithms	PC	3	3	0	0	3
6.		Professional Elective I	PE	3	3	0	0	3
PRACTICALS								
7.	UIT1511	Software Design Lab	PC	4	0	0	4	2
8.	UIT1512	Operating Systems Lab	PC	4	0	0	4	2
			Total	**30**	**18**	**0**	**12**	**24**

SEMESTER VI

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	UIT1601	Principles of Complier Design	PC	5	3	0	2	4
2.	UIT1602	Web Programming	PC	3	3	0	0	3
3.	UIT1603	Big Data Engineering	PC	3	3	0	0	3
4.	UIT1604	Machine Learning Fundamentals	PC	5	3	0	2	4
5.		Open Elective I	OE	3	3	0	0	3
6.		Professional Elective II	PE	3	3	0	0	3
PRACTICALS								
7.	UEN1497	Interpersonal Skills/ Listening & Speaking	EEC	2	0	0	2	1
8.	UIT1611	Web Programming Lab	PC	4	0	0	4	2
			Total	**28**	**18**	**0**	**10**	**23**

SEMESTER VII

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	UIT1703	Management Principles and Practices	HS	3	3	0	0	3
2.	UIT1701	Cloud Computing and Virtualization	PC	3	3	0	0	3
3.	UIT1702	Network Security	PC	3	3	0	0	3
4.		Open Elective II	OE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
6.		Professional Elective IV	PE	3	3	0	0	3
PRACTICALS								
7.	UIT1711	Mobile Application Development Lab	PC	4	0	0	4	2
8.	UEN1597	Professional Communication Lab	EEC	2	0	0	2	1
			Total	**24**	**18**	**0**	**6**	**21**

SEMESTER VIII

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.		Professional Elective V	PE	3	3	0	0	3
2.		Professional Elective VI	PE	3	3	0	0	3
PRACTICALS								
3.	UIT1818	Project Work	EEC	20	0	0	20	10
			Total	**26**	**6**	**0**	**20**	**16**

PROFESSIONAL ELECTIVE – I

SEMESTER V

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UIT1521	Fundamentals of Digital Image Processing	PE	3	3	0	0	3
2.	UIT1522	Distributed Computing	PE	3	3	0	0	3
3.	UIT1523	Optimization Techniques	PE	3	3	0	0	3
4.	UMA1553	Graph Theory and its Applications	PE	3	3	0	0	3
5.	UIT1524	Computer Graphics and Multimedia	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – II

SEMESTER VI

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UIT1621	Real Time Embedded Systems	PE	3	3	0	0	3
2.	UIT1622	Speech Processing	PE	3	3	0	0	3
3.	UIT1623	Interactive System Design	PE	3	3	0	0	3
4.	UIT1624	Fundamentals of Reversible and Quantum computing	PE	3	3	0	0	3
5.	UIT1625	Analysis and Design of Service Oriented Architecture	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – III

SEMESTER VII

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UIT1721	Principles of Software Project Management	PE	3	3	0	0	3
2.	UIT1722	Agile Software Development	PE	3	3	0	0	3
3.	UIT1723	Developments and Operations (DevOps)	PE	3	3	0	0	3
4.	UIT1724	Reactive Programming	PE	3	3	0	0	3
5.	UIT1725	Network Management Systems	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – IV

SEMESTER VII

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UIT1726	Web Development Frameworks	PE	3	3	0	0	3
2.	UIT1727	Cyber Forensics and Information Security	PE	3	3	0	0	3
3.	UIT1728	Information Assurance and Security	PE	3	3	0	0	3
4.	UIT1729	Wireless and Mobile Networks	PE	3	3	0	0	3
5.	UIT1731	Introduction to Deep Learning	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – V

SEMESTER VIII

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	UIT1821	Information Search and Retrieval	PE	3	3	0	0	3
2	UIT1822	Natural Language Processing and Its Applications	PE	3	3	0	0	3
3	UIT1823	Web Design and Management	PE	3	3	0	0	3
4	UGE1576	Professional Ethics	PE	3	3	0	0	3
5	UIT1824	Next Generation Networks	PE	3	3	0	0	3
6	UIT1825	Micro Services	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – VI

SEMESTER VIII

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UIT1826	Social Network Information Analysis	PE	3	3	0	0	3
2.	UIT1827	Internet of Things and its Applications	PE	3	3	0	0	3
3.	UIT1828	Drone Technology	PE	3	3	0	0	3
4.	UIT1829	Advanced microprocessors	PE	3	3	0	0	3
5.	UIT1831	Soft Computing and Its Applications	PE	3	3	0	0	3
6.	UIT1832	C# and .Net Essentials	PE	3	3	0	0	3

OPEN ELECTIVES

(Offered by the Department of IT to other branches)

ODD SEMESTER

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UIT1941	Android application design and development	OE	3	3	0	0	3
2.	UIT1942	Music Analysis	OE	3	3	0	0	3
3.	UIT1943	Information Security	OE	3	3	0	0	3

EVEN SEMESTER

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	UIT1041	Introduction to quantum computing	OE	3	3	0	0	3
2.	UIT1042	User Interface Design	OE	3	3	0	0	3
3.	UIT1043	Artificial Neural Networks	OE	3	3	0	0	3

Sl. No.	SUBJECT AREA	CREDITS								CREDITS TOTAL	PERCENTAGE
		I sem	II sem	III sem	IV sem	V sem	VI sem	VII sem	VIII sem		
1	HS	3	6					3		12	6.9
2	BS	11.5	7	4	4					26.5	15.1
3	ES	7.5	5	6		4				22.5	12.9
4	PC		5	13	19	17	16	8		78	44.5
5	PE					3	3	6	6	18	10.3
6	OE						3	3		6	3.4
7	EEC						1	1	10	12	6.9
	Total	**22**	**23**	**23**	**23**	**24**	**23**	**21**	**16**	**175**	

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

OBJECTIVES

- To develop the basic reading and writing skills.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions and seeking clarifications.
- To help learners develop their speaking skills to enable them speak fluently in real contexts.
- To help learners develop general vocabulary through reading pertinent texts.

UNIT I LANGUAGE FOR 'SMALL TALK' 9

- Reading: Short comprehension passages, Practice in skimming-scanning and predicting
- Writing: Completing sentences, Developing hints
- Language Development: asking and answering- Wh- Questions and Yes/ No questions,
- Vocabulary Development: Prefixes and Suffixes, Polite Expressions
- Speaking: Introducing oneself , Exchanging personal information
- Listening: Listening comprehension of short texts

UNIT II DEVELOP WRITING THROUGH READING 9

- Reading: Short narratives and descriptions from newspapers (including dialogues and conversations); Reading Comprehension Texts with varied question types.
- Writing: paragraph writing (topic sentence, cohesive devices, organizational pattern),
- Language Development: prepositions, and clauses
- Vocabulary Development: guessing meanings of words in context
- Speaking: informal conversations, chunking at right places
- Listening: Listening to telephone conversations , short presentations and TV News

UNIT III PREPARING FOR A CAREER 9

- Reading: Short texts and longer passages (close reading)
- Writing: Reordering jumbled sentences
- Language Development: Degrees of comparisons, pronouns
- Vocabulary Development: idioms and phrases
- Speaking: short presentations using power point slides.
- Listening: Listening to ted talks and long speeches for comprehension.

UNIT IV IMPROVING SPEAKING 9

- Reading: Reading different types of texts (literary, journalistic, print media) for comprehension and pleasure.
- Writing: letter writing (informal or personal letters) and e-mails etiquette.
- Language Development: Tenses: simple present and past, present and past continuous
- Vocabulary Development: single word substitutes, collocations
- Speaking: Role Plays (literary and nonliterary texts)
- Listening: Listening comprehension (IELTS, TOEFL and others)

UNIT V LISTENING FOR DEEPER UNDERSTANDING 9

- Reading: Reading for comparisons and contrast and other deeper levels of meaning.
- Writing: Writing short pieces – developing an outline, identifying main and subordinate ideas,
- Language Development: modal verbs, perfect tenses
- Vocabulary Development: phrasal verbs, fixed and semi-fixed expressions (including idioms), fillers
- Speaking: Group Discussions
- Listening: Listening to lectures and making notes

TOTAL PERIODS: 45

OUTCOMES

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

- Apply reading strategies to comprehend articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English in both formal and informal contexts
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOK

1. Board of Editors, Using English: A Course book for Undergraduate Engineers and Technologists, Orient Blackswan Limited, Hyderabad, 2015.

REFERENCES

1. Richards, C. Jack, Interchange Students' Book-2, New Delhi, Cambridge University Press, 2015.
2. Bailey, Stephen, Academic Writing: A practical guide for students, New York, Rutledge, 2011.
3. Means, L. Thomas, and Elaine Langlois, English & Communication for Colleges, Cengage Learning, USA, 2007.
4. Redston, Chris & Gillies Cunningham, Face2Face (Pre-intermediate Student's Book & Workbook), Cambridge University Press, New Delhi, 2005.
5. Comfort, Jeremy, et al., Speaking Effectively: Developing Speaking Skills for Business English, Cambridge University Press, Cambridge, Reprint 2011.

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

OBJECTIVES

The objective of this course is to enable the student to

- Understand De Moivre's Theorem and use it in finding the expansion of trigonometric functions.
- Evaluate the Eigen values and Eigen vectors and diagonalize the given matrix.
- Understand the concept of circle of curvature, evolute and envelope of a given curve.
- Familiarize the functions of two variables and finding its extreme points.
- Understand Beta and Gamma functions and their relations, evaluation of double integrals and triple integrals.

UNIT I TRIGONOMETRIC SERIES 12

De Moivre's Theorem (with proof) – Roots of a complex number, expansion of $\sin n\theta, \cos n\theta$ and $\tan n\theta$ in powers of $\sin\theta$, $\cos\theta$ and $\tan\theta$. Addition formulae for any number of angles, Expansion of $\sin^m\theta, \cos^n\theta$ and $\sin^m\theta \cos^n\theta$ in a series of sinesor cosines of multiples of θ, Complex function – Exponential function of a complex variable, Hyperbolic functions, Real and imaginary parts of circular functions, Logarithmic function of complex variable.

UNIT II MATRICES 12

Eigen values and Eigen vectors – Properties of Eigen values - Linear dependence and independence of eigen vectors - Cayley-Hamilton theorem (excluding proof), Reduction to Diagonal form – Similarity transformation, Quadratic form – Reduction of Quadratic form to canonical form, Nature of a Quadratic form, Complex Matrices.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature – Cartesian and parametric coordinates, radius of curvature – Cartesian form (with proof) parametric and polar form, Centre of curvature and circle of curvature in Cartesian form, Evolute and envelope.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobians - Taylor's expansion – Maxima and Minima – Lagrangian method of undetermined multipliers, Differentiation under the integral sign.

UNIT V INTEGRAL CALCULUS 12

Beta and Gamma functions – Properties, Transformation of Beta and Gamma functions, Relation between Beta and Gamma functions, Double integrals, Change the order of Integration, Evaluation of double integrals in polar co-ordinations, Triple integrals.

TOTAL PERIODS: 60

OUTCOMES

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

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

TEXT BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2016.

REFERENCES

1. Bali N. P, Goyal M, Watkins C, Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.
2. James Stewart, Calculus: Early Transcendental, Cengage Learning, New Delhi, 7th Edition, 2013.
3. Narayanan, S. and Manicavachagom Pillai, T. K., Calculus Volume I and II, S. Viswanathan (Printers & Publishers), Pvt., Ltd., 1997.

4. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus Early Transcendentals, John Wiley & Sons, Inc., 11th Edition, 2016.
5. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 2015.

COURSE CODE	COURSE TITLE	L	T	P	C
UPH1176	ENGINEERING PHYSICS	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 - thermal conductivity- Linear heat flow (Derivation) – Lee's disc method – 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 - Types of Acoustic absorbers - 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 B coefficients –Conditions for Laser action - Types of lasers – Nd: YAG, CO_2, 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 PERIODS: 45

OUTCOMES

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

- Analyze crystal structures and the influence of imperfections on their properties.
- Demonstrate and explain the general concepts of elastic and thermal properties of materials.
- Explain quantum mechanical theories to correlate with experimental results and their applications to material diagnostics.
- Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
- Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.

TEXT BOOKS

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 text book of Engineering Physics, S. Chand & Co. Ltd., Ninth Revised Edition, 2012.

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

OBJECTIVES

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To give an overview about Polymers
- To develop an understanding of the basic concepts of phase rule and its application
- To make the students conversant with the types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

- To provide knowledge on electrochemical cell, measurement of redox potential, electrochemical corrosion and control, electroplating.

UNIT I WATER AND ITS TREATMENT 9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – Alkalinity- boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water- Reverse Osmosis.

UNIT II POLYMER CHEMISTRY 9

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index Preparation, properties and uses of PVC, PE, PS Nylon 6.6, and Epoxy resin. Biodegradable polymers. Effect of polymers on environment.

UNIT III PHASE RULE AND ALLOYS 8

Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process – magnesium-zinc system. Alloys: Introduction- Definition- properties of alloys- significance of alloying – heat treatment of steel.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel.

Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value – theoretical air for combustion (problems) - flue gas analysis (ORSAT Method).

UNIT V ELECTROCHEMISTRY AND CORROSION 10

Electrochemical cell - redox reaction, electrode potential - origin of electrode potential - oxidation potential - reduction potential, measurement and applications – electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion – causes – factors - types chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspects – electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints - constituents and function. Electroplating of Copper and electrode less plating of nickel.

TOTAL PERIODS: 45

OUTCOMES

- The knowledge gained on water treatment techniques, Polymers, Phase rule, Fuels and electrochemistry and Corrosion will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS

1. Jain P.C. and Monika Jain, Engineering Chemistry Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.

2. Vairam, S., Kalyani, P. and Suba Ramesh, Engineering Chemistry, Wiley India Pvt, Ltd, New Delhi, 2013.

REFERENCES

1. Dara, S.S and Umare, S.S., A Textbook of Engineering Chemistry, S. Chand & Company Ltd, New Delhi, 2015.
2. Friedrich Emich, Engineering Chemistry, Scientific International Pvt, Ltd, New Delhi, 2014.
3. Prasanta Rath, Engineering Chemistry, Cengage Learning India Pvt, Ltd, Delhi, 2015.
4. Shikha Agarwal, Engineering Chemistry-Fundamentals and Applications, Cambridge University Press, Delhi, 2015.

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

OBJECTIVES

- To solve algorithmic problems
- To abstract and specify problems
- To compose programs in Python using iteration and recursion
- To construct programs in Python using functions

UNITI ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions); Notation (pseudo code, flow chart, programming language); specification, composition, decomposition, iteration, recursion.

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 PERIODS: 45

OUTCOMES

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

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

TEXT BOOKS

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016. (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES

1. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, Exploring Python, McGraw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
5. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013.

COURSE CODE	COURSE TITLE	L	T	P	C
UGE1177	ENGINEERING GRAPHICS	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 PROJECTION OF SECTIONED 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 PROJECTION AND BUILDING DRAWING 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 – Building drawing – Plan, Elevation and Sectional View showing Foundation of simple buildings like pump room.

TOTAL PERIODS: 75

OUTCOMES

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

- Familiarize with the fundamentals and standards of Engineering graphics
- Perform freehand sketching of basic geometrical constructions and multiple views of objects.
- Project orthographic projections of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Visualize and to project isometric and perspective sections of simple solids.
- Read a building drawing.

TEXT BOOKS

1. Natarajan, K.V., A Text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal, K. and Prabhu Raja, V., Engineering Graphics, New Age International (P) Limited, 2008.

REFERENCES

1. Bhatt, N.D., and Panchal, V.M., Engineering Drawing, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal, and Agarwal, C.M., Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna, K.R., Engineering Drawing (Vol. I&II Combined), Subhas Stores, Bangalore, 2007.

4. Luzzader J Warren, and Jon M Duff, Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Prentice Hall of India Pvt. Ltd, New Delhi, Eastern Economy Edition, 2005.
5. Parthasarathy, N.S., and Vela Murali, Engineering Graphics, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., Engineering Drawing, Pearson, 2nd Edition, 2009.
7. Bhattacharyya, B., and Bera, S.C., Engineering Graphics, I.K. International Publishing House Pvt. Ltd., New Delhi.

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

OBJECTIVES

- To solve problems using algorithms and flowcharts
- To write, test, and debug simple Python programs.
- To develop and execute programs using Python programming constructs.

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 function (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 list and tuples (linear search, binary search, selection sort, insertion sort, quick sort).
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.

TOTAL PERIODS: 45

OUTCOMES

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

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

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

PHYSICS LABORATORY

OBJECTIVES

The students will be trained to perform experiments to study the following

- The Properties of Matter
- The Optical properties like Interference and Diffraction.
- Optical Fibre Characteristics
- Characteristics of Lasers.
- Electrical & Thermal properties of Materials

and enable the students to enhance acuracy in experimental measurements.

LIST OF EXPERIMENTS

(A minimum of 8 experiments to be performed from the given list)

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

OUTCOMES

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

- The physical properties of materials like elasticity, compressibility, and viscosity.
- The optical properties of materials such as diffraction, interference and Numerical aperture.
- Thermal and electrical properties of materials such as conductivity and band gap.

CHEMISTRY LABORATORY
(A minimum of 8 experiments to be performed from the given list)

The chemistry laboratory course consists of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

OBJECTIVES

- Understand and apply the basic techniques involved in quantitative analysis
- Apply the knowledge gained in theory course

LIST OF EXPERIMENTS

1. Estimation of Hardness by EDTA method
2. Estimation of Chloride in water
3. Estimation of Alkalinity of water
4. Estimation of iron by spectrophotometry
5. Determination of the strength of strong acid by pH metry
6. Determination of the strength of strong acid by conductometry
7. Determination of the strength of mixture of strong and weak acids by conductometry
8. Estimation of Na by flame photometry
9. Estimation of Fe^{2+} by potentiometric titration
10. Determination of Degree of Polymerization of a low Molecular weight water soluble polymer
11. Determination of rate of corrosion of mild steel in acidic medium
12. Estimation of Barium chloride by conductometry titration

TOTAL PERIODS: 45

OUTCOMES

The students will be able to

- Evaluate the quality of water
- Determine the metals and ions present in any given sample using various analytical techniques
- Measure properties such as conductance of solutions, redox potentials

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

OBJECTIVES

- To develop strategies and skills to enhance their ability to read and comprehend texts in engineering and technology.
- To improve their ability to write convincing job applications and effective reports.
- To develop their speaking skills to make technical presentations, participate in group discussions.
- To strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT I INTRODUCING TECHNICAL WRITING 9

- Reading: Reading short technical texts from journals, newspapers and checking their comprehension
- Writing: Definitions, instructions, recommendations, checklist
- Language Development: Subject Verb Agreement, numerical adjectives
- Vocabulary Development: Avoidance of jargon, Technical vocabulary
- Speaking: Asking for and giving Directions
- Listening: Listening to technical talks with comprehension tasks

UNIT II INTERPRETING CHARTS AND GRAPHS 9

- Reading: Practice in chunking and speed reading
- Writing: Interpreting charts, graphs and other kinds of visual information
- Language Development: Use of passive voice in technical writing
- Vocabulary Development: Important Latin and other foreign expressions in use
- Speaking: Talking about Processes (Technical and General)
- Listening: Listening Comprehension of a discussion on a technical topic of common interest by three or four participants (real life as well as online videos)

UNIT III PREPARING FOR A PRESENTATION 9

Reading: Reading longer texts for detailed understanding. (GRE/IELTS practice tests)

- Writing: Describing general or technical processes using appropriate flow charts
- Vocabulary Development: Informal vocabulary and formal substitutes (based on a small grammatically-streamlined sample)
- Language Development: Embedded sentences and Ellipsis (allowed and disallowed types)
- Speaking: 5 minute presentations on technical/general topics
- Listening: Listening Comprehension (IELTS practice tests)

UNIT IV WRITING AND SPEAKING IN FORMAL SITUATIONS 9

Reading: Technical reports, advertisements and minutes of meeting

- Writing: Writing minutes of a meeting, reports and general essays
- Vocabulary Development: paraphrasing , analogy, collocations
- Language Development: if conditionals and other kinds of complex sentences
- Speaking: Public Speaking (debates, extempore, just a minute)
- Listening: Listening to eminent voices of one's choice (in or outside the class, followed by a discussion in the class)

UNIT V WRITING REPORTS 9

- Reading: Extensive Reading (short stories, novels, poetry and others)
- Writing: reports (accident, issue-/survey-based), minutes of a meeting
- Vocabulary Development: Archaisms and contemporary synonyms, clichés.
- Language Development: Summarising, Elaboration.
- Speaking: Talk to public personalities and share the experience in class.
- Listening: Extensive Listening.(radio plays, rendering of poems, audio books and others)

TOTAL PERIODS: 45

OUTCOMES

At the end of this course learners will be able to:

- Apply reading strategies to comprehend technical texts and write area- specific texts effortlessly.

- Listen and comprehend lectures and talks in science and technology.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write technical documents like reports, emails, resume and winning job applications.

TEXT BOOK

1. Board of editors, Fluency in English: A Course book for Engineering and Technology, Orient Blackswan, Hyderabad, 2016.

REFERENCES

1. Sudharshana, N.P., and Saveetha, C., English for Technical Communication, Cambridge University Press, New Delhi, 2016.
2. Raman, Meenakshi, Sharma, and Sangeetha, Technical Communication Principles and Practice, Oxford University Press, New Delhi, 2014.
3. Kumar, Suresh, E., Engineering English, Orient Blackswan, Hyderabad, 2015.
4. Booth L. Diana, Project Work, Oxford University Press, 2014.
5. Grussendorf, Marion, English for Presentations, Oxford University Press, 2007.
6. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges, Cengage Learning, USA, 2007.

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

OBJECTIVES

The objective of this course is to enable the student to

- Understand C-R equations and use it in the construction of Analytic Functions.
- Understand the methods of Complex Integration using Cauchy's Integral Formula and Cauchy Residue theorem, finding Taylor's and Laurent's Series expansions.
- Find the Laplace Transforms of standard Functions.
- Find the Inverse Laplace Transform of a function and use it in solving Differential Equations.
- Understand the concept of Divergence and curl and use it in evaluating 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, Evaluation of integrals by Laplace transforms, periodic functions, Inverse transforms – Convolution theorem

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

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

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 PERIODS: 60

OUTCOMES

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

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

TEXT BOOKS

1. Grewal, B.S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, Inc., 2016.

REFERENCES

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, Wiley India, 2012.
3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' Calculus: Early Transcendental, 13th Edition, Pearson Education, 2013.
4. O'Neil. P. V., Advanced Engineering Mathematics, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
5. *Howard Anton*, *Irl* C. *Bivens*, *Stephen Davis*, Calculus Early Transcendentals, 11th Edition, John Wiley & Sons, Inc., 2016.
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 CODE	COURSE TITLE	L	T	P	C
UPH1276	PHYSICS FOR INFORMATION SCIENCE	3	0	0	3

OBJECTIVES

Enable the students to

- Understand the transport properties of conducting materials and their modelling using classical and quantum theories.
- Analyze the physics of semiconductors and relate their microscopic properties to observable bulk phenomena.
- Understand the origin of magnetism and data storage principles.
- Study the fundamentals of optical materials and their applications to display devices.
- Develop an overview of Nano materials and their applications to Nano devices.

UNIT I CONDUCTING MATERIALS 9

Classification of solids - Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum free electron theory – Density of energy states - Fermi distribution function – Effect of temperature on Fermi Function — carrier concentration in metals – Electron in periodic potential – Bloch theorem – Kronig - Penney model (qualitative) – Band theory of solids (qualitative), tight binding approximation, E-k curves and effective mass

UNIT II SEMICONDUCTING MATERIALS 9

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 – Bond and energy band diagrams - carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – Direct and indirect band semiconductors – Velocity – electric field relations - Hall effect – Determination of Hall coefficient – Applications& Devices – Formation of PN junction –energy band diagram - biased and unbiased conditions.

UNIT III DATA STORAGE PRINCIPLES 9

Origin of magnetic moment – Bohrmagneton , atomic magnetic moments-magnetic permeability 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 - Holographic optical data storage.

UNIT IV OPTICAL MATERIALS AND DISPLAY DEVICES 9

Absorption emissionandscatteringoflightinmetals,insulatorsandsemiconductors(conceptsonly) - Carrier generation and recombination in semiconductors –- LED – OLED- Semiconductor Laser diodes (Homo and double hetero junction) –Photo detectors – Photodiodes and Photoconductors (concepts only) – Solar cell – Liquid crystal display - Charged Coupled Devices

UNIT V 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.

TOTAL PERIODS: 45

OUTCOMES

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

- Estimate the conducting properties of materials based on classical and quantum theories and understand the formation of energy band structures.
- Acquire knowledge on basics of semiconductor physics and its application to PN junction devices.
- Gain knowledge on magnetic properties of materials and their applications to data storage.
- Relate the use of optical materials to display devices.
- Understand quantum mechanics of nanostructures and their application to Nano electronics and Spintronics.

TEXT BOOKS

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) Private Limited, 2018.
6. Avadhanulu, M.N., P. G. Shirsagar, A Text Book of Engineering Physics, S. Chand & Co. Ltd. Ninth Revised Edition, 2012
7. Theuwissen, A.J., Solid state imaging with Charge-Coupled Devices, Kluwer-Academic Publisher, Springer 1995.

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

OBJECTIVES

- To understand the structure and functions of the ecosystems and biodiversity among life forms within an ecosystem
- To realize the importance of various natural resources and its sustainable use
- To address the various environmental issues related to various types of pollution.
- To address various social issues and the role of various environmental machineries to ensure proper environmental regulations

- To understand the influence of human population on environment issues and role of IT as a tool to minimize the environmental problems.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 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 lifestyles.

UNIT III ENVIRONMENTAL POLLUTION 9

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earth quake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND ENVIRONMENT 9

From unsustainable to sustainable development – water conservation, rain water harvesting, watershed management – role of non-governmental organization - Social Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, case studies – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations – population explosion – family welfare programme –environment and human health – human rights – value education – HIV/AIDS-women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL PERIODS: 45

OUTCOMES

After successful completion of this course, student will be able to

- Understand the importance of the environment and describe the structure and functions of an ecosystem.
- Identify the value and need for conservation of bio-diversity.
- Know the importance of natural resources and its equitable use for sustainable life styles.
- Explain the causes, effects and control measures of different types of pollution.
- Understand various environmentally related social issues and their solutions.
- Recall the tools for environmental regulations
- Relate the role of environment in human population growth and development
- Get knowledge about various techniques used for environmental monitoring and management.

TEXTBOOKS

1. Anubha Kaushik, and Kaushik, C. P., Environmental Science and Engineering, New Age International Publishers, 14th Edition, 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.
2. Tyler Miller, G., and Scott E. Spoolman, Environmental Science, Cengage Learning India Pvt, Ltd, Delhi, 2014.

COURSE CODE	COURSE TITLE	L	T	P	C
UEE1276	BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT ENGINEERING	3	1	0	3.5

OBJECTIVES

- To understand the fundamentals of electronic circuit constructions.
- To learn the fundamental laws, theorems of electrical circuits and also to analyze them
- To study the basic principles of electrical machines and their performance
- To study the different energy sources, protective devices and their field applications
- To understand the principles and operation of measuring instruments and transducers

UNIT I ELECTRICAL CIRCUIT ANALYSIS 12

Ohms Law, Kirchhoff's Law-Instantaneous power- series and parallel circuit analysis with resistive, capacitive and inductive network - nodal analysis, mesh analysis- network theorems – Thevenin's theorem, Norton theorem, maximum power transfer theorem and superposition theorem, three phase supply-Instantaneous, Reactive and apparent power-star delta conversion.

UNIT II ELECTRICAL MACHINES 12

DC and AC Rotating Machines: Types, Construction, principle, EMF and torque equation, application Speed Control- Basics of Stepper Motor – Brushless DC motors- Transformers-Introduction- types and construction, working principle of Ideal transformer- EMF equation-All day efficiency calculation.

UNIT III UTILIZATION OF ELECTRICAL POWER 12

Renewable energy sources-wind and solar panels. Illumination by lamps- Sodium Vapour, Mercury vapour, Fluorescent tube. Domestic refrigerator and air conditioner-Electric circuit, construction and working principle. Batteries-NiCd, Pb Acid and Li ion–Charge and Discharge Characteristics. Protection-need for earthing, fuses and circuit breakers. Energy Tariff calculation for domestic loads.

UNIT IV ELECTRONIC CIRCUITS 12

PN Junction-VI Characteristics of Diode, Zener diode, Transistors configurations - amplifiers. Op amps- Amplifiers, oscillator, rectifiers, differentiator, integrator, ADC, DAC. Multivibrator using 555 Timer IC. Voltage regulator IC using LM 723, LM 317.

UNIT V ELECTRICAL MEASUREMENT 12

Characteristic of measurement-errors in measurement, torque in indicating instruments-moving coil and moving iron meters, Energy meter and watt meter. Transducers-classification-thermo electric, RTD, Strain gauge, LVDT, LDR and piezoelectric. Oscilloscope-CRO.

TOTAL PERIODS: 60

OUTCOMES

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

- Understand the essentials of electric circuits and analysis.
- Understand the basic operation of electric machines and transformers
- Introduction of renewable sources and common domestic loads.
- Introduction to measurement and metering for electric circuits.

TEXT BOOKS

1. Kotharti, D.P., and Nagarath, I,J., Basic Electrical and Electronics Engineering, 3rd Edition, McGraw Hill, 2016.
2. Sukhija, M.S., and Nagsarkar, T.K., Basic Electrical and Electronic Engineering, Oxford, 2016.

REFERENCES

1. Lal Seksena, S.B., and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016.
2. Theraja, B.L., Fundamentals of Electrical Engineering and Electronics, Chand & Co, 2008.
3. Sahdev, S.K., Basic of Electrical Engineering, Pearson, 2015.
4. John Bird, Electrical and Electronic Principles and Technology, Fourth Edition, Elsevier, 2010.
5. Mittle, Mittal, Basic Electrical Engineering, 2nd Edition, Tata McGraw-Hill, 2016.
6. Wadhwa, C.L., Generation, Distribution and Utilization of Electrical Energy, New Age International Pvt. Ltd., 2003.

COURSE CODE	COURSE TITLE	L	T	P	C
UIT1201	FUNDAMENTALS OF C PROGRAMMING	3	1	0	3.5

OBJECTIVES:

- To introduce the basics of C programming language
- To introduce the concepts of ADTs

UNIT I C PROGRAMMING BASICS 12

Introduction to ‘C’ programming: fundamentals – structure of a ‘C’ program – compilation and linking processes – Constants, Variables: Data Types, Expressions using operators in ‘C’, Managing Input and Output operations, Decision Making and Branching, Looping statements, solving simple scientific and statistical problems.

UNIT II ARRAYS AND STRINGS 12

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String - String operations – String Arrays. Simple programs – sorting – searching – matrix operations.

UNIT III FUNCTIONS AND POINTERS 12

Function: Definition of function - Declaration of function –Pass by value – Pass by reference –Recursion, Pointers: Definition – Initialization – Pointers arithmetic – Pointers and arrays. Example Problems.

UNIT IV STRUCTURES AND UNIONS 12

Introduction – need for Structure data type – Structure definition – Structure declaration – Structure within a structure - Union - Programs using Structures and Unions – Storage classes, Pre-processor directives.

UNIT V FILE HANDLING AND ADDITIONAL FEATURES IN C 12

Console input output functions, Disk input output functions, Data files, Additional Features in C; Command line arguments, Bit wise operators, Enumerated data types, Type casting, Macros, C preprocessor, library functions.

TOTAL PERIODS: 60

OUTCOMES

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

- Use the control structures of C appropriately for the problems.
- Implement ADT for linear data structures.

TEXT BOOK

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Edition, Pearson Education, 1988.

REFERENCES

1. Stephen G. Kochan, Programming in C, 3rd edition, Pearson Ed.,
2. Yashavant P. Kanetkar, K, Let Us C, BPB Publications, 2011.

COURSE CODE	COURSE TITLE	L	T	P	C
UGE1297	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.

GROUP A (CIVIL & MECHANICAL)

I - CIVIL ENGINEERING PRACTICE

Buildings:

(a) 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.

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.
(a) Wood working - Demonstration of wood working machinery and furniture manufacturing.

II - MECHANICAL ENGINEERING PRACTICE

Basic Machining:
(a) Drilling Practice

Sheet Metal Work:
(a) Forming & Bending: (b) Model making – Trays, dust pan and funnels. (c) Different type of joints.

Machine assembly practice:
(a) Study of centrifugal pump (b) Study of air conditioner
Design Thinking: Students will be trained to dismantle, understand the functional / aesthetic aspects of the product and to assemble the following components like (a) Three jaw Chuck Assembly (b) Iron Box (c) Pedestal Fan (d) Lathe Tailstock.

Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt. (b) Foundry operations like mould preparation for gear and step cone pulley. (c) Fitting – Exercises – Preparation of square fitting and V – fitting models. (d) Arc welding and Gas Welding (e) Lathe operations.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipment – Resistor color coding measurement of AC signal parameter (peak-peak, RMS period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL PERIODS: 45

COURSE CODE	COURSE TITLE	L	T	P	C
UIT1211	C PROGRAMMING LAB	0	0	3	1.5

OBJECTIVES:

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions and structures.

- To develop applications in C using file processing.

LIST OF EXPERIMENTS:

1. Programs using I/O statements and expressions.
2. Programs using decision-making and looping statements.
3. Programs using arrays and strings.
4. Write a function int* generateprimes (int limit) to generate all the prime numbers between 2 and some given limit and return them as an array. Print all elements from array.
5. Write the function int countchars (char string[], int ch) which returns the number of times the character ch appears in the string.
6. Write the function replace(char string[], char from[], char to[]) which finds the string 'from' in the string 'string' and replaces it with the string 'to'.
7. Write a function GCD (greatest common divisor) that accepts two integers and returns -1 if both the integers are zero, otherwise it returns their GCD.
8. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
9. From a given paragraph perform the following using built-in functions:
    a. Find the total number of words.
    b. Capitalize the first word of each sentence.
    c. Replace a given word with another word.
10. Solve towers of Hanoi using recursion.
11. Write a function with a parameter n that returns the n'th Fibonacci number. The function must be recursive.
12. Sort the list of numbers using pass by reference.
13. Generate salary slip of employees using structures and pointers.
14. Compute internal marks of students for five different subjects using structures and functions.
15. Create a structure Date with day, month, and year as data members. Include functions getDate() and showDate() to read and print the date respectively. Write a program to demonstrate the Date structure.
16. Create an employee with the relevant members. Write a function for finding out total number of male and female employees and to retrieve the salary of the employee.
17. Write a program to find greatest among (i) Array of Integers (ii) Array of strings using functions.
18. Write a program to perform arithmetic operations on complex numbers using structures and functions.
19. Create a structure Time with three fields for hours, minutes and seconds. Write a program to initialize the data members and to perform arithmetic and relational operations using structure.
20. Write a program to count a number of words and characters in a file.
21. Write a program that generates 100 random numbers between -0.5 and 0.5 and writes them in a file ran.dat. The first line of ran.dat contains the number of data and the next 100 lines contain the 100 random numbers.
22. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
23. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
24. Write a program to find the sum of N integer numbers using command line arguments.
25. Write a program to accept a file name as command line argument.

i. Display the contents of the file where each word will be displayed on a new line and display proper message if file does not exist.
ii. Display no. of vowels stored in the file.
iii. Display no. of "the" stored in the file.
iv. Copy contents of the file to another file.

TOTAL PERIODS: 45

OUTCOMES

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

- Develop C programs for simple applications making use of basic constructs, arrays and strings.
- Develop C programs involving functions, recursion, pointers, and structures.
- Design applications using sequential and random access file processing.

COURSE CODE	COURSE TITLE	L	T	P	C
UMA1377	**DISCRETE MATHEMATICS**	**3**	**2**	**0**	**4**

OBJECTIVES

- To understand the classical logic, implications and equivalences, normal forms and its applications.
- To identify the different proof techniques and solve problems using them.
- To have knowledge of the concepts in graph theory.
- To have a clear understanding of group theory.
- To understand the concept of lattices and solve problems using them.

UNIT I LOGIC AND PROOFS 13

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 11

Mathematical Induction - Strong Induction - The pigeonhole principle - Recurrence relations - Solving linear recurrence relations using generating functions - Inclusion and Exclusion Principle and its applications.

UNIT III GRAPHS 10

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 13

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

UNIT V LATTICES AND BOOLEAN ALGEBRA 13

Partial ordering - Posets - Lattices as Posets - Properties of lattices- Lattices as algebraic systems - Sub lattices - Direct product and Homomorphism - Distributive and Modular lattices – Boolean algebra - Stone's representation Theorem.

TOTAL: 60 PERIODS

OUTCOMES

On studying this course, the students will able to

- Apply logical identities and implications in deriving the conclusion.
- Solve problems using different mathematical techniques.
- Have a clear understanding of graph theory.
- Exposed to concepts and properties of algebraic structures such as semi groups, monoids and groups.
- Solve problems in partial ordering relations, equivalence relations and lattices.

TEXT BOOKS

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

REFERENCES

1. Ralph. P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, Pearson Education Asia, Delhi, 4th Edition, 2007.
2. Thomas Koshy, Discrete Mathematics with Applications, Elsevier Publications, 2006.
3. Seymour Lipschutz and Mark Lipson, Discrete Mathematics, Schaum's Outlines, TataMcGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
4. C.L.Liu, D.P.Mohapatra, Elements of Discrete Mathematics, Mcgraw Higher Ed., 4th Edition, 2012.
5. John. M.Harris, Jeffry. L. Hirst, Michael. J. Mossinghoff, Combinatorics and Graph Theory, Verlag New York, 2008.

COURSE CODE	COURSE TITLE	L	T	P	C
UIT1301	DIGITAL ELECTRONICS	3	2	0	4

OBJECTIVES

- To understand the components of digital circuits.
- To provide an in-depth knowledge of the design of digital circuits.
- To study and design hazard-free circuit.

UNIT I INTRODUCTION 12

Number systems – Decimal, Binary, Octal and Hexadecimal – Conversion from one system to another – Floating point representation of numbers – Arithmetic operation – 9's complement, 10's complement - study on BCD, Codes, Introduction to Digital Circuits, Advantages and Disadvantages of Digital circuits over Analog circuits, Logic gates - truth tables.

UNIT II BOOLEAN ALGEBRA AND MINIMIZATION TECHNIQUES 12

Introduction to basic law of Boolean Algebra, Mixed logic, Multilevel gating networks, Sum of products and Product of sum, Simplification of four variable Boolean equations using Karnaugh maps, Quine - McClusky method, Design of basic circuits with VHDL simulation.

UNIT III COMBINATIONAL LOGIC CIRCUITS 12

Binary Adder and Subtractor: Half adder - Full adder - Half Subtractor - Full Subtractor - 4 bit parallel adder and subtractor, 3-bit binary decoder - Two phase method - Decimal to BCD encoder, 8-to-1 multiplexer, 1-to-8 multiplexer.

UNIT IV SEQUENTIAL LOGIC CIRCUITS 12

Flip-flops: Triggering of flip-flops (SR, D, JK and T), study of 3 bit - 4 bit binary asynchronous counter, Design of synchronous counter - Shift registers (SISO, SIPO, PISO, PIPO), Memories (RAM, ROM, EPROM, FLASH), State Diagram - State Table - State Assignment.

UNIT V THE DESIGN OF HAZARD FREE DIGITAL CIRCUIT 12

Hazards – Classification - Steps involved in design process - Design of Hazard free circuits - Case study - Modeling the characteristics of delay in circuits, Application of digital circuits - Digital clock, Time meter, Bar graph display system and Multiplexed display system.

TOTAL PERIODS : 60

OUTCOMES

Upon completion of this course the students will be able to:

- Analyze a problem, Design combinational and sequential circuits.
- Simplify Boolean functions using KMap.
- Design using Programmable Logic Devices.
- Write HDL code for combinational and Sequential Circuits.

TEXT BOOKS

1. S. Salivahanan and S. Arivazhagan, Digital circuits and Design, 5th Edition, Oxford University Press.
2. Charles H.Roth, Jr. Fundamentals of Logic Design, 4th Edition, Jaico Publishing House, Latest Edition. (Units IV and V).

REFERENCES

1. Morris Mano, Digital logic and Computer design, 4th Edition, Pearson, 2008.
2. Donald D. Givone, Digital Principles and Design‖, Tata Mc Graw Hill, 2003
3. Leach, Malvino, and Saha, Digital Principles and Applications, McGraw-Hill Education, 1993
4. G. K. Kharate, Digital Electronics, Oxford University Press, 2010

Course Code	Course Title	L	T	P	C
UIT1302	FUNDAMENTALS OF DATA STRUCTURES	3	0	0	3

OBJECTIVES

- To be familiar with the basics of C programming language.
- To introduce the concepts of ADT.
- To learn various linear and non-linear data structures.
- To be exposed to the concepts of Sorting, Searching, Hashing and Sets.

UNIT I C PROGRAMMING 9

Arrays - Functions - Pointers - Structures - Union - Enumerated Data Types - File Handling - Preprocessor Directives, Primitive and Abstract Data Types.

UNIT II LINEAR DATA STRUCTURES – LIST, STACK AND QUEUE 9

Abstract Data Types (ADTs) – List ADT: array-based implementation, linked list implementation, cursor-based linked lists – Doubly-linked lists – Circular linked list - Applications of lists: Polynomial Manipulation – Stack ADT – Implementation of Stack - Applications, Queue ADT – Queue Implementation - Double ended Queues.

UNIT III NON-LINEAR DATA STRUCTURES - TREES 9

Computational Complexity: Quantification of resources used by algorithms: Time and Space; Complexity measures and Classes, Trees: Preliminaries – Binary Trees – Implementation of Binary trees – Tree traversals – Expression Trees – Binary Search Tree ADT, Priority Queues (Heaps) - Binary Heap Implementations – Applications of priority queues - Complexity analysis of all types of tree and Heap.

UNIT IV SORTING AND SEARCHING TECHNIQUES 9

Sorting algorithms: Insertion sort - Shell sort - Quick sort - Heap sort - Merge sort - External Sort, Searching: Linear search - Binary search - Comparative complexity analysis of all type of searching & sorting.

UNIT V HASHING AND DISJOINT SETS 9

Hashing: Hash Functions – Separate Chaining – Open Addressing: Linear Probing - Quadratic Probing - Double Hashing - Rehashing – Extendible Hashing, Disjoint Sets – Basic data structure - Smart Union Algorithms - Path Compression.

TOTAL PERIODS: 45

OUTCOMES

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

- Use the control structures of ‘C’ appropriately for problems.
- Implement abstract data types for various data structures.
- Apply different data structures to problem solutions.
- Analyze the algorithms.

TEXT BOOKS

1. Stephen G. Kochan, Programming in C, Pearson Education, Third Edition. (Unit I)
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, Second Edition, 1997.

REFERENCES

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, Pearson Education, Second Edition, 1988.
2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education,1983.
3. Horowitz, Sahni, Anderson-Freed, “Fundamentals of Data Structures in C”, Universities Press, second edition, 2008.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, ―Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.

Course Code	Course Title	L	T	P	C
UIT1303	PRINCIPLES OF ANALOG AND DIGITAL COMMUNICATIONS	3	0	0	3

OBJECTIVES

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

UNIT I SIGNALS AND TRANSMISSION OF SIGNALS 9

Signals: Classification of signals - Impulse function, Fourier series, Linear system response, Fourier transform - properties, Distortionless transmission, Convolution, Correlation: Autocorrelation, Frequency translation: Frequency multiplexing - Antenna practicability - Narrow banding.

UNIT II LINEAR MODULATION 9

Amplitude modulation: DSBFC - DSBSC - SSB, Modulators: Multiplier modulators - Nonlinear modulators - Switching modulators - Ring modulators, Demodulation of DSBFC: Rectifier detector - Envelope detector.

UNIT III EXPONENTIAL MODULATION 9

Instantaneous frequency, Angle modulation: Bandwidth - Bessel's function - Carson rule, FM and PM generation, Relation between FM and PM, FM generation and demodulation, FM receiver, Pre-emphasis and De-emphasis.

UNIT IV DIGITAL MODULATION AND DIGITAL TRANSMISSION 9

ASK, FSK, BPSK: Binary - QPSK - 8 PSK - M-ary PSK, QAM: 8 - 16, PCM: Sampling - Quantization - Differential PCM - Delta PCM - Binary polar signalling, Matched filter.

UNIT V MULTIPLEXING TECHNIQUES 9

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

TOTAL: 45 Periods

OUTCOMES

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

- Explain the analog and digital modulation-demodulation techniques
- Explain CDMA
- Utilize multiuser radio communication
- Use the learnt principles to understand the physical layer of a network

TEXT BOOK

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

REFERENCES:

1) B P Lathi, Signal Processing and Linear Systems, 3rd Edition, Oxford University Press. 2000.
2) LLoyd Thmes, and Mitchel E Schultz, Schaum's Outlines of Theory and Problems of Electronic Communication, 2nd Edition, MgGraw Hill, 1998.
3) Gary M Miller, Jeffrey S Beasely, and Jonathon D Hymer, Electronic Communication: A System Approach, Pearson Higher Education, 2013.

4) Herbert Taub, and Donald L Schilling, Principles of Communication Systems, 3rd Edition, McGraw Hill Publishing Company, 1998.
5) Simon Haykin, ―Communication Systems‖, 4th Edition, John Wiley & Sons, 2004

Course Code	Course Title	L	T	P	C
UIT1304	DATABASE MANAGEMENT SYSTEMS AND APPLICATIONS	3	0	0	3

OBJECTIVES

- To expose the students to the fundamentals of Database Management Systems.
- To familiarize the students with ER diagrams.
- To make the students understand the relational model.
- To expose the students to SQL.
- To make the students to understand the fundamentals of transaction processing and query processing.
- To familiarize the students with the various types of advanced databases.

UNIT I INTRODUCTION TO DBMS 9

File Systems Organization - Purpose of Database System - Views of data - Database characteristics - Data models - Types of data models - Components of DBMS - Database languages - Database System architecture - Database users and administrator - Entity Relationship model (E-R model) - Extended ER - Relational DBMS - Codd's rule.

UNIT II RELATIONAL ALGEBRA & SQL 9

Relational algebra operations - Normalization: Functional dependencies, 1NF, 2NF, 3NF, 4NF, 5NF, Denormalization - SQL: Standards - Data types - DDL - DML - DCL - TCL - Integrity - Triggers - Advanced SQL features - Embedded SQL.

UNIT III TRANSACTION MANAGEMENT 9

Introduction - Properties of Transaction - Transaction Recovery - ACID Properties - Save points - SQL facilities for recovery - Concurrency: Need for concurrency - Two phase locking - Deadlock - Serializability - SQL facilities for concurrency.

UNIT IV DATA STORAGE AND QUERYING 9

Overview of physical storage media - Magnetic disks - RAID - Tertiary storage - File organization - Indexing and hashing: Ordered indices - B+ tree Index files - Static hashing - Dynamic hashing - Query processing and optimization: Heuristics and cost estimates in query optimization.

UNIT V ADVANCED DATABASE CONCEPTS 9

Parallel databases: Architecture – Parallel query evaluation – Parallelizing individual operations - Distributed databases: Types - Architecture – Data storage – Query processing – Transactions - Database security: Discretionary access control - Mandatory access control - Statistical databases - SQL facilities.

TOTAL : 45 PERIODS

OUTCOMES

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

- Develop database designs using ER and Relational models.

- Use of SQL for relational databases.
- Apply concurrency control and recovery mechanisms for practical problems.
- Design the query processor and transaction processor.
- Develop a real database application using various concepts of DBMS.

TEXTBOOK

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.

REFERENCES

1. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2016.
2. C.J.Date, A.Kannan, S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education, 2003.
3. Raghu Ramakrishnan, Database Management Systems, Third Edition, McGraw Hill, 2003.
4. G.K.Gupta,"Database Management Systems‖, Tata McGraw Hill, 2011.
5. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, "Advanced Database Systems", Morgan Kaufmann publishers, 2006.

Course Code	Course Title	L	T	P	C
UIT1305	COMPUTER ORGANIZATION	3	0	0	3

OBJECTIVES

- To make students understand the basic structure and operation of digital computer.
- To understand the hardware-software interface.
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
- To expose the students to the concept of pipelining.
- To familiarize the students with hierarchical memory system including cache memories and virtual memory.
- To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

UNIT I PROCESSOR FUNDAMENTALS 9

Computer Components, Performance Metrics, Instruction set architecture, Various addressing modes, Instruction execution in ALU, Simple data path.

UNIT II COMPUTER ARITHMETIC 12

Representing unsigned and signed integer numbers, Representing fractions: Floating point system, Integer addition and subtraction: Ripple carry adder, Carry lookahead adders, Integer multiplication and division, High-Radix Multipliers and High-Radix Dividers, Redundant number systems - Residue number systems.

UNIT III MEMORY SYSTEMS 9

Memory hierarchy, Cache Memory: Organization and Design, Virtual Memory concepts.

UNIT IV INTERCONNECTIONS AND PERIPHERALS 6

Interconnection structures: Bus - PCI - Mesh - Hyper cube - Ring – Star, Keyboard, Monitor, Mouse, Bluetooth, USB, Flash.

UNIT V ILP ARCHITECTURES 9

Pipelining, Hazards in pipelining, Super pipelining, Super scalar, VLIW, Combining super scalar and VLIW with pipelining.

TOTAL PERIODS: 45

OUTCOMES

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

- Explain processor fundamentals.
- Design arithmetic and logic unit.
- Evaluate performance of memory systems.
- Extend the learning to parallel processing architectures.
- Explain interconnection structures.

TEXT BOOKS

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", McGraw Hill Education, Fifth Edition, 2011.
2. Behrooz Parhami, "Computer Arithmetic: Algorithms and Hardware Designs", Oxford University Press, 2nd Edition, 2000. (Unit II)

REFERENCES

1. David A. Patterson, John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Elsevier, Third Edition, 2005.
2. William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson, 8th Edition, 2014.
3. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012
4. Govindarajulu, IBM PC and Clones, McGraw Hill Education, Second Edition, 2002.

Course Code	Course Title	L	T	P	C
UIT1311	PROGRAMMING AND DATA STRUCTURES LAB - 1	0	0	4	2

OBJECTIVES

- To introduce the concepts of structured programming language and ADTs.
- To introduce the concepts of primitive Data Structures.
- To introduce the concepts of Sorting, Searching and Hashing.

LIST OF EXPERIMENTS

1. Practice of C Programming using Structures and Union.
2. Practice of C programming using file handling concepts.
3. Implementation of List using Arrays and Linked List.
4. Implementation of Stack using Arrays and Linked List.
5. Implementation of Queue using Arrays and Linked List.
6. Applications of Stacks and Queues.
7. Implementation of Binary Search Tree and complexity analysis.
8. Implementation of Priority Queue and complexity analysis.
9. Implementation of Searching techniques and complexity analysis.

10. Implementation of Sorting techniques and complexity analysis.
11. Implementation of Hashing techniques and complexity analysis.
12. Implementation of Binary Heap and complexity analysis.
13. Applications of Disjoint Sets.

TOTAL PERIODS: 60

OUTCOMES

On Completion of the course, the students should be able to

- Write programs using structured programming concepts.
- Implement any data structures using ADT's.
- Solve the given problem using appropriate data structures.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Standalone desktops with C compiler 30 Nos.
(or)
Server with C compiler supporting 30 terminals or more.

Course Code	Course Title	L	T	P	C
UIT1312	DATABASE MANAGEMENT SYSTEMS AND APPLICATIONS LAB	0	0	4	2

OBJECTIVES

- To learn 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:

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. Exception Handling.
10. Database Connectivity with Front End tools.
11. Implementation of Indexing and Hashing technique.
12. Application Development
    - 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 PERIODS

OUTCOMES

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

- Design and implement a database schema for a given problem-domain.
- Design a database and query using SQL DML/DDL commands.
- Create and maintain tables using PL/SQL.
- Design and build any GUI application.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

HARDWARE

Standalone desktops 30 Nos. (or) Server supporting 30 terminals or more.

SOFTWARE:

Front end: VB/VC ++/JAVA or Equivalent

Back end: Oracle / SQL / MySQL/ PostGress / DB2 or Equivalent

COURSE CODE	COURSE TITLE	L	T	P	C
UMA1478	PROBABILITY AND STATISTICS (Common to CSE and IT)	3	2	0	4

OBJECTIVES

- To identify the standard distributions and apply them in solving problems.
- To understand the concept of two-dimensional random variables and solve problems in finding the Joint probabilities and correlation between them.
- To perform hypothesis testing using normal, T-distribution and F-distribution.
- To evaluate the tests of significance in analysis of variance.
- To calculate the various statistical quality control measurements.

UNIT I RANDOM VARIABLES 12

Probability - Axioms of probability - Conditional probability - Baye's theorem - Discrete and Continuous random variables - Moments - Moment generating functions -Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Normal distributions- Functions of a random variable

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions - 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 and proportion) - $\chi 2$-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 (X and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits - Acceptance sampling.

TOTAL PERIODS: 60

OUTCOMES

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

- Identify standard distributions and apply them.
- Solve problems in two dimension random variables and find the correlation between them.
- Identify and apply the suitable testing of hypothesis under normal and t and F distribution.
- Solve problems in analysis of variance.
- Analyze quality control by applying control chart methods.

TEXT BOOKS

1. Milton, J. S. and Arnold, J.C., Introduction to Probability and Statistics, Tata McGrawHill, New Delhi, 4th Edition, 3rd Reprint, 2008.
2. Johnson, R.A. and Gupta, C.B., Miller and Freund's Probability and Statistics for Engineers, Pearson Education, Asia, 8th Edition, 2011.

REFERENCES

1. Devore, J.L., Probability and Statistics for Engineering and the Sciences, ThomsonBrooks/Cole, International Student Edition, New Delhi, 7th Edition, 2008.
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., Probability and Statistics for Engineers and Scientists, Pearson Education, Asia, 8th Edition, 2007.
3. Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, New Delhi, 3rd Edition, 2004.
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, 2004.
5. Gupta, S.C and Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan and Chand Company, New Delhi, 2009.

Course Code	Course Title	L	T	P	C
UIT1401	PRINCIPLES OF SOFTWARE ENGINEERING	3	0	0	3

OBJECTIVES

- To understand the process and its models.
- To understand fundamental concepts of requirements engineering and Analysis Modelling.
- To understand the major considerations for enterprise integration and deployment.
- 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, Other classifications – Modelling requirements: Data Flow Diagram, Entity Relation Diagram, Data Dictionary, State Transition Diagram – Software Requirements Document – Requirement Engineering Process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

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 Design: 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 PERIODS

OUTCOMES

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

- Identify the key phases in process models.
- Compare different process models.
- Apply the concepts of requirements engineering and Analysis modelling.
- Apply systematic procedure for software design and deployment.
- Compare and contrast various testing and maintenance.

TEXT BOOKS

1. Roger S. Pressman, Software Engineering – A practitioner's Approach, Seventh Edition, McGraw-Hill International Edition, 2010.

REFERENCES

1. Ian Sommerville, Software Engineering, 9th Edition, Pearson Education Asia, 2011.
2. Rajib Mall, Fundamentals of Software Engineering, Third Edition, PHI Learning PrivateLimited, 2009
3. Kelkar S.A., ―Software Engineering‖, Prentice Hall of India Pvt Ltd, 2007
4. Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.
5. Ghezzi, Fundamentals of Software Engineering, Second Edition, Pearson Education India, 2015.

Course Code	Course Title	L	T	P	C
UIT1402	INFORMATION THEORY AND ITS APPLICATIONS	3	0	0	3

OBJECTIVES

- To learn fundamentals of random variables
- To learn Shannon and Renyi entropy
- To understand error control coding
- Be familiar with the methods for the generation of these codes and their decoding techniques
- 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 Gauaaisn 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, Renyi's 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 - entropy, Least mean square error, Minimum error entropy, correlation - correntropy, Graph-Theoretic Clustering with entropy and correntropy

TOTAL PERIODS: 45

OUTCOMES

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

- Explain and estimate information theory metrics, entropy and cross entropy
- Design an application with error control
- Apply entropy as a cost function in machine learning algorithms
- Make use of MEE in small applications

TEXT BOOK

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 Code	Course Title	L	T	P	C
UIT1403	**MICROPROCESSORS AND MICROCONTROLLERS**	**3**	**0**	**0**	**3**

OBJECTIVES

- To study and understand the architecture and programming of 8086 and 8051.
- To study and understand the basic concepts of interfacing memory and different peripheral devices to a microprocessor.
- To introduce 8051 microcontroller processing.
- To introduce various advanced processor architectures.

UNIT I THE 8086 MICROPROCESSOR 9

Introduction to 8086: Salient features, Architectural blocks, Pin configuration, Addressing modes, Instruction set and assembler directives, Assembly language programming - Stacks - Procedures – Macros – Interrupts and interrupt service routines.

UNIT II PERIPHERAL ICS 9

Study of RAMs, ROMs along with pin diagrams and architectures - Study of Programmable Peripheral Interface (8255), Programmable Interval Timer (8253), Programmable Interrupt Controller (8279), Programmable Keyboard and Display Controller (8259), Universal Synchronous Asynchronous Receiver and Transmitter(8251).

UNIT III INTERFACING APPLICATIONS WITH MICROPROCESSOR 9

Interfacing RAMs and ROMs - Parallel port Interface (8255) - Timer Interface (8253) for waveform generation, Interfacing ADC and DAC, Interfacing LCD and LED display, Keyboard and Display controller Interface (Rolling and Blinking Display), Stepper Motor Interface, Traffic Light Controller Interface.

UNIT IV 8051 MICROCONTROLLER 9

Architecture of 8051: Special Function Registers (SFR), I/O Pins, Ports and Circuits - Instruction sets - Assembler Directives - Addressing modes - Assembly Language Programming.

UNIT V INTERFACING APPLICATIONS WITH MICROCONTROLLER 9

Programming Timers in 8051 – Programming serial port in 8051, Interrupts Programming in 8051, LCD Interface, Keyboard and Display controller Interface (Rolling Display and Blinking display), ADC & DAC Interface, Sensor Interface, Traffic Light Controller Interface, Stepper Motor Interface.

TOTAL PERIODS: 45

OUTCOMES

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

- Write programs to run on 8086 microprocessor based systems.
- Design system using memory chips and peripheral chips for microprocessor and microcontroller.
- Analyze, specify, design, write and test assembly language programs.

TEXT BOOK

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, 2002.

REFERENCES

1. Doughlas V.Hall, Microprocessors and Interfacing, Programming and Hardware, TMH, 2012.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Second Edition, Pearson Education, 2011.
3. Yu-Cheng Liu, Glenn A.Gibson, Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design, Second Edition, Prentice Hall of India, 2007.
4. Mathur A P, Introduction to Microprocessors, Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1989.
5. Leach, Malvino, and Saha, Digital Principles and Applications, McGraw-Hill Education, 1993

Course Code	Course Title	L	T	P	C
UIT1404	**ADVANCED DATA STRUCTURES**	**3**	**0**	**0**	**3**

OBJECTIVES

- To introduce Object Oriented Programming language concepts.
- To implement Data Structures using OOPS concepts.
- To learn about Non linear Data Structures.
- To familiarize Graphs and its algorithms.

UNIT I OBJECT ORIENTED PROGRAMMING FUNDAMENTALS 9

Data Abstraction – Encapsulation – Class – Object – Constructors – Static members – Constant members – Member functions – String Handling – Constructor – Polymorphism – Function overloading – Operators overloading – Dynamic memory allocation –Inheritance.

UNIT II OBJECT ORIENTED PROGRAMMING - ADVANCED FEATURES 9

Generic Programming – Templates – Class template – Function template – Abstract class – Exception handling – Standard libraries – STL – Containers – Algorithms – Iterators.

UNIT III ADVANCED NON-LINEAR DATA STRUCTURES 9

AVL trees – Splay trees – B-Trees – Red Black trees – Heaps – Skew Heaps Comparative complexity analysis of Trees – Amortized Analysis – Binomial Heaps – Fibonacci Heaps.

UNIT IV ELEMENTARY GRAPH ALGORITHMS 9

Graphs: Definitions – Representation of Graphs – Graph Traversals – Topological Sort – Shortest Path Algorithms: Unweighted Shortest Path – Dijkstra's Algorithm – Single source Shortest Paths – Bellman–Ford algorithm – Minimum Spanning Tree – Prim's Algorithm – Kruskal's Algorithm.

UNIT V ADVANCE GRAPH ALGORITHMS 9

Applications of Depth First Search – Undirected Graphs – Biconnectivity – Euler circuit – Directed Graph – Finding Strong Components – All Pair Shortest paths – Floyd – Warshall algorithm – Maximum Flow – Flow Networks – Ford – Fulkerson mMethod.

TOTAL PERIODS: 45

OUTCOMES

On Completion of the course, the students should be able to

- Design and implement programs using object oriented basic concepts - Encapsulation, Abstraction and Inheritance.
- Implement generic OOPS programs using STL and Exception handling.
- Apply appropriate Tree and Graph data structure for a given dataset.
- Analyze various graph algorithms and apply for applications.
- Modify and suggest new data structure for a given program.

TEXT BOOKS

1. Trivedi. B, Programming with ANSI C++, Oxford University Press, 2007.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education, Second Edition, 2005.

REFERENCES

1. Bjarne Stroustrup, The C++ Programming Language, Pearson Education, Third Edition, 2007.
2. Michael T Goodrich, Roberto Tamassia, David Mount, Data Structures and Algorithms in C++, Wiley Publishers, 7th Edition, 2004.
3. Herbert Schildt, Java The Complete Reference, Eighth Edition, Oracle Press, 2017.
4. Horowitz, Sahni, Anderson-Freed, “Fundamentals of Data Structures in C”, Universities Press, second edition, 2008

Course Code	Course Title	L	T	P	C
UIT1405	ALGORITHM DESIGN AND ANALYSIS	3	0	0	3

OBJECTIVES

- To understand and apply the algorithm analysis techniques.
- To understand and apply different algorithm design techniques.
- To understand the limitations of algorithmic power.

UNIT I INTRODUCTION 9

Fundamentals of Algorithmic Problem Solving – Important problem types –Analysis of Algorithmic Efficiency – Space Time Tradeoff - Asymptotic Notations and its properties – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms - Visualization.

UNIT II BRUTE FORCE AND DIVIDE AND CONQUER 9

Brute Force: Sorting – String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem, Divide and Conquer: Methodology – Binary Search – Merge sort – Quick sort – Multiplication of Large Integers – Closest-Pair and Convex - Hull Problems. Transform and Conquer: Balanced Search Trees - Heap Sort.

UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9

Dynamic programming: Computing a Binomial Coefficient – Warshall's and Floyd's algorithm – Multi stage graph - Optimal Binary search trees – Knapsack Problem and Memory functions, Greedy Technique: Container loading problem - Prim's algorithm and Kruskal's Algorithm – Dijkstra's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern - Huffman Trees.

UNIT IV ITERATIVE IMPROVEMENT AND BACKTRACKING 9

Iterative Improvement: The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem, Backtracking: n-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem – Graph Coloring.

UNIT V LIMITATIONS OF ALGORITHM POWER 9

Lower bound arguments – Decision Trees - P, NP, NP-Complete and NP-Hard Problems, Branch and Bound: LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman Problem, Approximation Algorithms for NP-Hard Problems: Travelling Salesman problem – Knapsack problem.

TOTAL PERIODS: 45

OUTCOMES

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

- Design algorithms for various computing problems.
- Analyze the time and space complexity of algorithms.
- Analyze different algorithm design techniques to solve a problem efficiently.

TEXT BOOK

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

REFERENCES

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.
3. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
4. Harsh Bhasin, Algorithms Design and Analysis, Oxford university press, 2016.
5. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms‖, Third Edition, PHI Learning Private Limited, 2012.

Course Code	Course Title	L	T	P	C
UIT1411	MICROPROCESSOR AND MICROCONTROLLER LAB	0	0	4	2

OBJECTIVES

- To understand the programming concepts of microprocessors and microcontrollers.

- To use microprocessors and microcontrollers for applications.

LIST OF EXPERIMENTS

1. Study of Logic gates.
2. Study of Flip Flops
3. Design of Synchronous counter and 4-bit register.
4. 8086 ALP Programs (Using Kit and MASM).
    a. 8 and 16 bit Arithmetic operations (Using Kit and MASM).
    b. Sorting the numbers.
    c. String manipulation operations.
    d. implementing Digital clock.
    e. Program for finding the size of the RAM, Checking the password.
5. 8051 ALP Programs (Using Kit)
    a. 8 and 16 bit Arithmetic operations.
    b. Sorting the numbers.
    c. Program for implementing Digital Clock.
6. Interfacing using Microprocessor and Microcontroller
    a. DAC for waveform generation.
    b. Interfacing to simulate Traffic Light controller signals.
    c. Interfacing Stepper Motor.
    d. Interfacing with built-in keyboard and display controller for displaying static message, blinking message and rolling message.

TOTAL PERIODS: 45

OUTCOMES

On Completion of the course, the students should be able to

- Make use of microprocessors for an application.
- Make use of microcontrollers for an application.

Course Code	Course Title	L	T	P	C
UIT1412	**PROGRAMMING AND DATA STRUCTURES LAB - II**	**0**	**0**	**4**	**2**

OBJECTIVES

- To understand the concepts of Object Oriented Programming.
- To use standard template library in the implementation of standard data structures.
- To learn various tree structures using OOP concepts.
- To expose graph structures and traversals using OOP concepts.
- To understand various graph algorithms using OOP concepts.

LIST OF EXPERIMENTS

1. Practicing Object Oriented programs with Classes, Objects, Constructors and Destructors.
2. Function overloading and Operator overloading.
3. Templates (Function Template and Class Template).
4. Exception handling.
5. Implementation of AVL tree with complexity analysis.
6. Implementation of Splay Tree with complexity analysis.
7. Implementation of Red black tree with complexity analysis.
8. Implementation of B Tree with complexity analysis.

9. Implementation of Fibonacci Heap with Amortised analysis.
10. Graph Traversals Algorithms - Breadth-First Search – Depth-First Search Algorithms - Analysis based on complexity.
11. Applications of DFS - Topological Sort / Strongly connected components.
12. Single Source Shortest Path Algorithms – Dijkstra‘s Algorithm, Bellman-Ford Algorithm with complexity analysis.
13. All Pairs Shortest Path Algorithm – Floyd-Warshall algorithm with complexity analysis.
14. Minimum Spanning Tree Implementation – Kruskal and Prim‘s algorithm.
15. Network Flow Problem - Ford Fulkerson Method.

TOTAL PERIODS: 60

OUTCOMES

On Completion of the course, the students should be able to

- Implement the solution to a problem using object oriented programming concepts.
- Implement advanced data structures using OOP concepts.
- Analyze and apply the tree / graph data structures for real world problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

HARDWARE:

Standalone desktops 30 Nos. (or) Server supporting 30 terminals or more.

SOFTWARE::

(JAVA / C++)

Course Code	Course Title	L	T	P	C
UIT1501	FINITE AUTOMATA THEORY	3	0	0	3

OBJECTIVES

- To understand the language hierarchy.
- To construct automata for any given pattern and find its equivalent regular expressions.
- To understand the need for Turing machines and their capability.
- To understand undecidable and NP problems.

UNIT I FINITE AUTOMATA 9

Introduction: Basic Mathematical Notation and techniques - Finite State Systems - Basic Definitions, Finite Automaton: DFA-NDFA - with € moves, Regular Languages: Regular Expression Equivalence of NFA and DFA, Equivalence of NDFA’s with and without € moves - Equivalence of finite Automaton and regular expressions, Minimization of DFA - Pumping Lemma for Regular sets, Problems based on Pumping Lemma.

UNIT II GRAMMARS 9

Grammar Introduction: Types of Grammar, Context Free Grammars and Languages, Derivations, Ambiguity, Relationship between derivation and derivation trees, Simplification of CFG: Elimination of Useless Symbols Simplification of CFG: Unit productions, Null productions, Chomsky normal form, Problems related to CNF, Greiback Normal form: Problems related to GNF.

UNIT III PUSHDOWN AUTOMATA 9

Pushdown Automata: Definitions Moves, Instantaneous Descriptions - Deterministic Pushdown Automata - Problems related to DPDA - Non-Deterministic pushdown automata, Equivalence: Pushdown automata to CFL, CFL to Pushdown automata, Problems related to

PDA to CFG and CFG to PDA -Pumping lemma for CFL, Problems based on pumping Lemma.

UNIT IV TURING MACHINE 9

Turing Machines: Introduction - Formal definition of Turing Machines - Instantaneous descriptions, Turing Machine as Acceptors - Problems related to Turing Machine as Acceptors - Turing Machine for computing functions (Transducer) - Turing Machine Constructions - Modifications of Turing Machines.

UNIT V COMPUTATIONAL COMPLEXITY 9

Undecidability: Basic definitions - Decidable Problems - Examples of undecidable problems - Rice's Theorem, problems about Turing Machine - Post's Correspondence Problem - Properties of Recursive and Recursively enumerable languages, Introduction to Computational Complexity: Definitions, Time and Space complexity of TMs, Complexity classes: Class P-Class NP, Complexity classes: Introduction to NP - Hardness and NP-Completeness.

TOTAL PERIODS: 45

OUTCOMES

After completing this course, the student should be able to

- Construct automata, regular expression for any pattern.
- Write Context free grammar for any construct.
- Design Turing machines for any language.
- Propose computation solutions using Turing machines.
- Analyze time and space complexity for a given problem.
- Examine whether a problem is decidable or not.

TEXTBOOK

1. John E Hopcroft and Jeffery D Ullman, Introduction to Automata Theory, Languages and Computations, Narosa Publishing House, 2002.

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. Muneeswaran. K, ―Compiler Design, Oxford University Press, 2012
4. Steven S. Muchnick, ―Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
5. Randy Allen, Ken Kennedy, ―Optimizing Compilers for Modern Architectures: A Dependence-based Approach, Morgan Kaufmann Publishers, 2002.

Course Code	Course Title	L	T	P	C
UIT1502	PRINCIPLES OF OPERATING SYSTEMS	3	0	0	3

OBJECTIVES

- To study the basic concepts and functions of operating systems.
- To understand the structure and functions of OS.
- To learn about processes, threads and scheduling algorithms.
- To understand the principles of concurrency and Deadlocks.

- To learn various memory management schemes, I/O management and file system implementations.

UNIT I INTRODUCTION TO OPERATING SYSTEMS 7

Introduction: Computer system organization - Computer system architecture - Operating system operations, Operating system structures: Operating system Services - System calls - System programs - Operating system structure - Operating system generation - System Boot.

UNIT II PROCESSES AND THREADS 10

Processes: Process concept - Process scheduling - Operations on processes - Interprocess communication, Threads: Multi core programming - Multithreading models - Threading issues, CPU Scheduling: Basic concepts - Scheduling criteria - Scheduling algorithms - Thread scheduling - Multiple processor scheduling - Real time CPU scheduling.

UNIT III CONCURRENCY 9

Process Synchronization: Background - The Critical Section problem - Peterson's solution - Synchronization hardware - Mutex Locks - Semaphores - Classic problems of synchronization – Monitors, 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 - Memory-Mapped Files - Allocating Kernel Memory.

UNIT V STORAGE MANAGEMENT 10

Mass-Storage Structure: Disk Structure - Disk Scheduling - Disk Management - Swap-Space Management - I/O Systems: I/O Hardware - Application I/O Interface - Kernel I/O Subsystem - 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.

TOTAL PERIODS : 45

OUTCOMES

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

- Design various scheduling algorithms.
- Apply the principles of concurrency.
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Design and implement a prototype file systems.

TEXT BOOK

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCES

1. William Stallings, Operating Systems – Internals and Design Principles, 8th Edition, Pearson, 2014.
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, ―Operating Systems‖, Third Edition, Pearson Education, 2004
6. Achyut S.Godbole, Atul Kahate, ―Operating Systems‖, Mc Graw Hill Education, 2016.

Course Code	Course Title	L	T	P	C
UIT1503	COMPUTER NETWORKS AND ITS APPLICATIONS	3	0	2	4

OBJECTIVES

- To understand the division of network functionalities into layers.
- To be familiar with the components required to build different types of networks.
- To be exposed to the required functionality at each layer.
- To learn the flow control and congestion control algorithms.

UNIT I INTRODUCTION TO NETWORKS 7

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

UNIT II MEDIA ACCESS & INTERNETWORKING 12

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), Basic Internetworking: IP - CIDR - ARP - DHCP - ICMP.

UNIT III NETWORK DEVICES AND NETWORK LAYER 8

Network Devices: Router, Switch, HUB, Bridge, Routing: Static Routing, Introduction to dynamic routing, RIP v1 and RIP v2- OSPF-DSDV.

UNIT IV TRANSPORT LAYER 9

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

UNIT V APPLICATION LAYER 9

Traditional applications: SMTP - POP3 - IMAP - MIME - HTTP –DNS – SNMP.

PRACTICE TOPICS 15

Sockets: Simple sockets using UDP and TCP, Simulation of error control and flow control mechanism, Simulation of DSDV, OSPF, DSR, AODV and RPL, Packet analyzing: Cisco Packet Tracer – Wireshark.

TOTAL PERIODS : 60

OUTCOMES

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

- Choose the components required to build different types of networks.
- Select the required functionality at each layer for given application.

- Develop a solution for each functionality at each layer.
- Explain the flow of information from one node to another node in the network.

Tools: C, Cisco Packet Tracer, Wireshark, NS2/NS3, Cooja

TEXT BOOK

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 System Approach", Fifth Edition, Morgan Kaufmann, 2011.
2. Todd Lammle, "CompTIA Network+ - Study guide", Third edition, Sybex Wiley india Private limited.
3. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
4. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
5. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.

Course Code	Course Title	L	T	P	C
UIT1504	**INTRODUCTION TO DIGITAL SIGNAL PROCESSING**	**3**	**0**	**2**	**4**

OBJECTIVES:

- To make the students to have a feeling for discrete-time signals and systems.
- To teach the frequency-domain representation of the discrete-time signals.
- To make learn the method to design simple digital filters.
- To make them understand the methods and issues in the implementation of digital filters**.**

UNIT I INTRODUCTION TO SIGNALS AND SYSTEMS 9

Introduction: Classification of signals, Concept of frequency in continuous-time and discrete-time signals, the sampling theorem. **Discrete-time signals and systems**: Discrete-time signals, discrete-time systems, Response of LTI systems to arbitrary inputs (Convolution Sum). **Correlation:** Cross-correlation and autocorrelation sequences, Correlation of periodic sequences.

UNIT II THE DISCRETE FOURIER TRANSFORM 9

Introduction of Z-Transform, Introduction to frequency analysis of discrete-time signals. **Frequency-domain sampling:** The discrete Fourier transform, DFT as a linear transformation, properties of DFT, DFT in linear filtering, Time and frequency resolution. **Efficient computation of DFT:** Radix-2 FFT algorithms, decimation-in-time FFT.

UNIT III FINITE IMPULSE RESPONSE (FIR) FITER DESIGN 9

General Considerations: Causality and its implications, general characteristics of frequency-selective filters. Symmetric and Anti-symmetric FIR filters. **FIR filters using windows:** Rectangular, Hanning, and Hamming window functions and their characteristics, Design of frequency-selective filters using windows.

UNIT IV INFINITE IMPULSE RESPONSE (IFIR) FITER DESIGN 9

General specifications. Characteristics of analog Butterworth filter. Frequency transformation. **Analog to Digital Conversion techniques:** Approximation of derivatives, Impulse invariance, and bilinear transformation.

UNIT V IMPLEMENTATION OF DISCRETE-TIME SYSTEMS 9

Realization structures: Direct-Form Structures, Cascade-Form Structures, Parallel-Form Structures, Linear-phase realization structures. **Finite-word Length Effects:** Errors due to Rounding and Truncation, Quantization of Filter Coefficients, Limit-Cycle Oscillations, Scaling to prevent overflow.

Practice (MATLAB-Based): 15

(1) Analyzing the effect of varying the sampling rate
(2) Analyzing the effect of varying the frequency resolution in spectrum estimation
(3) Implementation of convolution
(4) Filtering speech signal using Window-based FIR filters
(5) Estimation of formant frequencies of vowels using DFT
(6) Estimation of pitch frequency using autocorrelation function
(7) Comparing the performance of FIR and IIR Filters, for a given order.
(8) Introducing echo and reverberation in clean speech.
(9) Synthesizing keyboard music using additive synthesis
(10) Identifying strings in a guitar using FT-based spectral analysis.

TOTAL PERIODS : 60

OUTCOMES

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

- Define various types of discrete-time signals and systems, and to perform, given a digital signal, the basic operations.
- Estimate the frequency content of a given signal using discrete Fourier transform, and to appreciate the time vs frequency resolution issues.
- Design simple FIR and IIR filters, and to understand the difference between them.
- Design the digital filters and to analyze the issues due to finite-word-length effects.

TEXT BOOK

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing – Principles, Algorithms, and Applications, Fourth Edition, Pearson.
2. S. Salivahanan, Digital Signal Processing, McGraw Hill Education, New Delhi, Third Edition, 2015.

REFERENCES

1. Alan V. Oppenheim, Ronald W. Schafer, Discrete-time Signal Processing, Third Edition, Pearson.
2. Sanjit K. Mitra, Digital Signal Processing – A Computer-based Approach, Third Edition, Tata McGraw-Hill.
3. Lawrence R. Rabiner, Ronald W. Schafer, Digital Processing of Speech Signals, Pearson.
4. Richard G. Lyons, Understanding Digital Signal Processing, Second Edition, Pearson Education, 2005.

Course Code	Course Title	L	T	P	C
UIT1505	ARTIFICIAL INTELLIGENCE CONCEPTS AND ALGORITHMS	3	0	0	3

OBJECTIVES

- To study the basic concepts of Artificial Intelligence.
- To learn the methods of solving problems using model-driven (symbolic) AI and data- driven AI.
- To learn applications of AI to solve some of today's real world problems.

UNIT I PROBLEM SOLVING BY SEARCHING 8

Introduction to AI - Intelligent agents, Searching - Uninformed, Informed, Stochastic search strategies.

UNIT II CSPs AND GAMING 8

Constraints satisfaction problems, Gaming: minimax algorithm, alpha-beta pruning.

UNIT III LOGIC AND INFERENCE 9

Knowledge based agents, Knowledge representation using Propositional and First-Order logic, Resolution, Unification, Inference - Backward chaining, Forward chaining.

UNIT IV REASONING WITH UNCERTAINTY 10

Quantifying uncertainty - Semantics and Inference of Bayesian Networks, Inference in Temporal Models - Hidden Markov Models, Markov Decision Processes.

UNIT V DECISION MAKING AND LEARNING 10

Decision networks, Markov Decision Processes, Learning from examples, Reinforcement learning, Case study - Natural Language Processing.

TOTAL PERIODS : 45

OUTCOMES

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

- Explain autonomous agents that efficiently make decisions in fully informed, partially observable and adversarial settings.
- Choose appropriate algorithms for solving given AI problems.
- Illustrate the working of AI algorithms in Natural Language Processing / Computer Vision / Robotics

TEXT BOOK

1. Stuart Russell and Peter Norvig AI – A Modern Approach, 3rd Edition, Pearson Education 2010

REFERENCES:

1. Dan W. Patterson, Introduction to AI and ES", Pearson Education, 2007. (Unit-III)
2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE), McGraw Hill-2008. (Unit- I,II, IV, & V).
3. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006
4. Deepak Khemani Artificial Intelligence, Tata Mc Graw Hill Education 2013.
5. http://nptel.ac.in/

Course Code	Course Title	L	T	P	C
UIT1511	SOFTWARE DESIGN LAB	0	0	4	2

OBJECTIVES

- To understand the methodologies involved in design of software .
- To gain knowledge about Computer Aided Software Engineering Tools
- To develop and test the software.

Prepare the problem statement, SRS document, UML diagrams for the following projects and implement and test the same.

1. Course Registration System.
2. Online Examination System.
3. Payroll Management System.
4. ATM System.
5. Passport Automation System.
6. Hotel Management System.
7. Hospital Management System.
8. Library Management System.
9. Foreign Trading System.
10. Recruitment System.
11. e-Ticketing.

TOTAL PERIODS : 45

OUTCOMES

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

- Make use of CASE tools to develop software.
- Analyze and Design software requirements in an efficient manner.

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE:

ArgoUML / StarUML / UMLGraph / Topcased or Equivalent.

HARDWARE:

Standalone desktops 30 Nos.

Course Code	Course Title	L	T	P	C
UIT1512	OPERATING SYSTEMS LAB	0	0	4	2

OBJECTIVES

To learn shell programming and the use of basic commands in the Linux environment.

- To be exposed to programming in C using system calls.
- To learn to create, manage and terminate threads.
- To be exposed to process creation and inter process communication.
- To be familiar with implementation of CPU scheduling algorithms, memory allocation algorithms, page replacement algorithms and deadlock avoidance algorithms.
- To be exposed to virtual memory, disk scheduling, file allocation methods and file organization techniques.

LIST OF EXPERIMENTS

Shell Programming.

1. Simulation of Linux Commands.
2. System Calls Programming.
3. Implementation of Inter Process Communication (IPC) using Shared Memory.
4. Implementation of Inter Process Communication (IPC) using Pipes.
5. Implementation of CPU Scheduling Algorithms.
6. Creation of Threads and Synchronization Applications.
7. Implementation of Process Synchronization, Deadlock Avoidance and Detection Mechanisms.
8. Implementation of Dynamic Storage Allocation Schemes.
9. Implementation of Page Replacement Algorithms.
10. Designing a Virtual Memory Manager.
11. Implementation of Disk Scheduling Algorithms.
12. Implementation of File Allocation Methods.
13. Implementation File Organization Techniques.

TOTAL PERIODS : 45

OUTCOMES

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

- Write shell script, basic commands and system calls.
- Make use of deadlock avoidance and virtual memory.
- Compare the performance of various CPU Scheduling Algorithms.
- Create processes, threads, implement IPC and synchronization.
- Analyze the performance of the various memory management,
- page replacement, disk scheduling algorithms, file allocation and organization methods.

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C / C++ / Java / Equivalent compiler 30 Nos. (or)
Server with C / C++ / Java / Equivalent compiler supporting 30 terminals or more.

REFERENCES:

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

Course Code	Course Title	L	T	P	C
UIT1601	PRINCIPLES OF COMPILER DESIGN	3	0	2	4

OBJECTIVES

- To understand different phases of the compiler.
- To understand, design and implement a lexical analyzer.
- Learn the various parsing techniques and different levels of translation.
- Learn how to optimize and effectively generate machine codes.
- Be exposed to compiler writing tools.

UNIT I INTRODUCTION AND LEXICAL ANALYSIS 9

The Phases of Compiler: Errors Encountered in Different Phases – The Grouping of Phases – Compiler Construction Tools, Lexical Analysis: Need and Role of Lexical Analyzer –

Specification of Tokens – Lexical Errors – Expressing Tokens by Regular Expressions – Converting Regular Expression to DFA – Optimization of DFA.

UNIT II SYNTAX ANALYSIS - TOP DOWN PARSING 8

Need and Role of the Parser – Context Free Grammars – Error Handling and Recovery in Syntax Analyzer, Top Down parsing: Recursive Descent Parsing – Predictive Parsing.

UNIT III SYNTAX ANALYSIS - BOTTOM DOWN PARSING 8

Bottom-up parsing: Shift Reduce Parsing, Operator Precedence Parsing, LR Parsers: SLR Parser – Canonical LR Parser – LALR Parser.

UNIT IV INTERMEDIATE CODE GENERATION 10

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Syntax Directed Translation Schemes, Intermediate Languages: Syntax Tree, Three Address Code, Postfix Code, Declarations, Translation of Expressions, Type Checking, Back Patching.

UNIT V CODE OPTIMIZATION AND CODE GENERATION 10

Principal Sources of Optimization, DAG, Optimization of Basic Blocks, Global Data Flow Analysis, Efficient Data Flow Algorithms, Issues in Design of a Code Generator, A Simple Code Generator Algorithm.

PRACTICE TOPICS 15

Symbol Table, LEX: Design of Lexical Analyzer for a sample language, Implementation of FIRST and FOLLOW, Implementation of Parsing Techniques, YACC: Design of a syntax Analyzer for a sample language, Type Checking, DAG construction, Optimization Techniques.

TOTAL PERIODS : 60

OUTCOMES

After completing this course, the student should be able to:

- Design and implement a prototype compiler.
- Apply the various optimization techniques.
- Make use of the different compiler construction tools.
- Build the different Phases of compiler.

Tools: C / C++ compiler and Compiler writing tools LEX and YACC.

TEXTBOOK

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, Compilers – Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007.

REFERENCES

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence-based Approach, Morgan Kaufmann Publishers, 2002.
2. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.
3. Allen I. Holub, Compiler Design in C, Prentice-Hall Software Series, 1993.
4. Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
5. Muneeswaran. K, ―Compiler Design‖, Oxford University Press, 2012.

Course Code	Course Title	L	T	P	C
UIT1602	WEB PROGRAMMING	3	0	0	3

OBJECTIVES

- To understand the basics of web technology.
- To learn to design web pages using HTML, CSS, Java Script.
- To learn client and server side web development using JavaScript libraries and frameworks.
- To understand document oriented database for web development.
- To understand the web service concepts.

UNIT I WEB BASICS 9

Web Essentials: Introduction to HTML, CSS, JavaScript - Data types, Arrays, Functions, Other built-in objects. DOM - Document tree traversal and manipulations, Event handling. Introduction to AJAX - Request, Response.

UNIT II CLIENT SIDE PROGRAMMING 9

Angular Programming: Angular JS Overview, Expressions, Binding, Controllers, Services, Filters, Components, Directives, Events, Forms and Form Validation, CSS styles, Animations, Templates, SQL, Bootsrap, Routing, Server Interaction, Progressive web, Real time web, Dependency injection.

UNIT III SERVER SIDE PROGRAMMING 9

Express Framework: Introduction - Components and APIs, Routing, Parameters, Handlers, Chaining. Middleware - Fundamentals, Batteries, Error Handling, Extensions. Debugging, Proxies, Security.

UNIT IV DATABASE 9

Mongo DB: Overview, Advantages, Data Modeling, Environment, CRUD Operations, Projection - Limiting and sorting, Indexing, Aggregation, Replication, Sharding, Backup, Deployment - Mongo & node.

UNIT V WEB SERVICES 9

Introduction- SOAP, REST, OData, Micro services, XML-RPC, WSDM, WS-*. **REST**: Architecture, Requests and Responses, Designing, Creating, Testing and Validating RESTful APIs.

TOTAL PERIODS : 45

OUTCOMES

After completing this course, the student should be able to:

- Design web pages using HTML, CSS, Java Script.
- Develop web sites and build web applications.
- Build web service APIs.

TEXT BOOKS:

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, “Internet & World Wide Web How to Program”, Pearson, Fifth Edition, 2012. (Unit I & V)
2. Brad Dayley, Brendan Dayley, Caleb Dayley , “Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications”, Pearson Education, Second Edition, 2017. (Unit II,III & IV)

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 Code	Course Title	L	T	P	C
UIT1603	**BIG DATA ENGINEERING**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To be exposed to big data analysis.
- To be familiar with data streams.
- To learn handling & mining large data.
- To be familiar with big data framework & visualization.

UNIT I INTRODUCTION 8

Introduction to Intelligent data analysis: Nature of data - Modern Data analytics tools, Statistical concepts: Probability – Sampling – Statistical inference – Prediction & Prediction errors – Resampling.

UNIT II STATISTICAL AND MACHINE LEARNING METHODS 10

Statistical Methods: Regression modelling – Classical Multi-Variant analysis, Bayesian Methods: Bayesian Inference – Modelling – Bayesian Network, SVM & Kernel Method: Overfitting & generalized bounds – SVM , Neural Network: Multi-layer feedforward – Learning & Generalization – Radial basic functions.

UNIT III MINING DATA STREAMS 9

Introduction, Stream data model, Sampling data in a stream, Filtering streams, Counting distinct elements in a stream, Estimating moments, Counting oneness in a window, Decaying window.

UNIT IV BIG DATA MINING 9

Frequent Item Sets: Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream, Clustering Techniques: Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and parallelism.

UNIT V FRAMEWORKS & VISUALIZATION 9

Frameworks: MapReduce – Hadoop Distributed file systems - NoSQL Databases, Visualization: Introduction - Classification of visual data analysis techniques - Data types to be visualized - Visualization techniques.

TOTAL PERIODS : 45

OUTCOMES

After completing this course, the student should be able to:

- Apply the statistical analysis methods.
- Make use of data mining in large data sets and streams.

- Model distributed file systems in big data mining.
- Make use of visualization techniques.

TEXT BOOKS

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007. (Unit I & II).
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012 (Unit III, IV & V).

REFERENCES

1. Jawei Han, Micheline Kamber, “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.
2. Holmes, Dawn E., "Big data: A Very Short Introduction", Oxford University Press, 2017.
3. Hastie, Trevor, et al.,"The Elements of Statistical Learning", Vol. 2. No. 1. New York: Springer, 2009.
4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.

Course Code	Course Title	L	T	P	C
UIT1604	MACHINE LEARNING FUNDAMENTALS	3	0	2	4

OBJECTIVES

- To introduce the basic concepts and techniques of Machine Learning.
- To enable design and implementation of machine learning solutions to classification, regression, and clustering problems.
- To study the concepts of deep learning.

UNIT I LINEAR ALGEBRA REVIEW 7

Review of Linear Algebra: Matrix and Vector manipulation, Eigen values and Eigen vectors. Introduction and Basic Concepts of Machine Learning, Various paradigms of learning, Hypothesis spaces, Inductive bias, PAC learning.

UNIT II SUPERVISED LEARNING 15

Linear Regression: Single & multiple variables - Cost function - Gradient descent, Classification: Logistic regression - Decision Boundary - Cost Function, Overfitting & Underfitting, Regularization & Generalization, Bias variance trade-off, VC inequality, Decision Trees, Neural Networks: Single layer and multilayer perceptron, Support Vector Machines, KNN, Case study with California Housing dataset.

UNIT III ENSEMBLE LEARNING 8

Model selection, feature selection, feature extraction, Ensemble learning: bagging - random forests, boosting – adaboost, XGBoost, stacking - combining classifiers, Case study with Adult dataset.

UNIT IV UNSUPERVISED LEARNING 7

Dimensionality Reduction - Principal Component Analysis, Clustering - K-means, Gaussian Mixture Models, Case study with Breast Cancer dataset, imbalanced data, outliers, missing values etc.

UNIT V RECENT TRENDS IN MACHINE LEARNING 8

Deep learning: Image Processing with Convolutional Neural Networks – Text Processing with Recurrent Neural Networks - Deep Unsupervised learning: autoencoders, Case study using CIFAR10/ MNIST/Intl. Airline Passengers.

PRACTICE TOPICS

Python fundamentals and scripts for Data Science, Implement Decision Tree learning, Logistic Regression, classification using multilayer perceptron, classification using SVM. Implement Adaboost, and Bagging using Random Forests. Implement K-means clustering to find natural patterns in data, etc.

TOTAL PERIODS : 60

OUTCOMES

After completing this course, the student should be able to

- Explain machine Learning algorithms and their limitations.
- Apply common Machine Learning algorithms in practice and implement them for structured data.
- Make use of the Deep Learning algorithms for unstructured data.

TEXTBOOK

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

REFERENCES

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Prentice Hall of India, Third Edition 2014.
2. MehryarMohri, Afshin Rostamizadeh, Ameet Talwalkar, Foundations of Machine Learning, MIT Press, 2012.
3. Tom Mitchell, Machine Learning, McGraw Hill, 3rd Edition,1997. 4. Charu C. Aggarwal, Data Classification Algorithms and Applications ,CRC Press, 2014.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
5. Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

Course Code	Course Title	L	T	P	C
UEN16	INTERPERSONAL SKILLS/LISTENING & SPEAKING	0	0	2	1

OBJECTIVES

The Course will enable learners to:

• Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
• Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
• Improve general and academic listening skills
• Make effective presentations.

UNIT I

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

• Listen and respond appropriately.
• Participate in group discussions
• Make effective presentations
• Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS

1. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

Course Code	Course Title	L	T	P	C
UIT1611	WEB PROGRAMMING LAB	0	0	4	2

LAB EXERCISES

OBJECTIVES

- To be familiar with web page design using HTML/DHTML and style sheets.
- To learn to create dynamic web pages using client and server side scripting.
- To learn Mongo database for creating web applications.
- To learn to create web services.

LIST OF EXPERIMENTS

1. Design a web site using HTML and DHTML. Use Internal hyperlinking, basic text formatting, images, forms, frames, links, tables, CSS, animations.
2. HTML/DHTML form validation using scripting language.
3. Write an Angular program to switch between layouts.
4. Write an Angular program to implement search to filter items.

5. Write an Angular program to create form with real-time updations.
6. Write an Angular program for navigation menu.
7. Create a video player using Angular.
8. Create an editor using Angular.
9. Creating a simple web application using MEAN stack.
10. Create dynamic website using Node and Express.
11. Create a chat application with multiple rooms using Node and Express.
12. Write a program to implement RESTful web service for calculator application.

TOTAL PERIODS : 45

OUTCOMES

After completing this course, the student should be able to

- Design web pages using HTML/DHTML and style sheets.
- Build dynamic web pages using client and server side scripting.
- Design and implement full stack web applications.
- Develop RESTful web services.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS

SOFTWARE: Text Editor (Atom/Visual studio code/sublime text..), Node, Angular, Express, Mongo.
HARDWARE: Standalone desktops 30 Nos.

Course Code	Course Title	L	T	P	C
UIT1703	MANAGEMENT PRINCIPLES AND PRACTICES	3	0	0	3

OBJECTIVES

- To familiarize the students to the basic concepts of management in order to aid in understanding
- To understand how an organization functions, and the complexity and wide variety of issues that includes decision making and forecasting
- To learn organizational behaviour and interpersonal communication skills
- To know the issues Managers' face in today's business firms.

UNIT I INTRODUCTION TO MANAGEMENT 9

Organization - Management - Role of managers - Evolution of management thought - Organization And the environmental factors - Managing globally - Strategies for International business.

UNIT II PLANNING 9

Nature and purpose of planning- Planning process - Types of plans - Objectives - Managing by Objective (MBO) strategies - Types of strategies – Policies – Decision Making - Types of decision-Decision making process - Rational decision making process - Decision making under different conditions – Statistical Decision Making : Z-test - T-Test - F-Test - Annova.

UNIT III ORGANISING 9

Nature and purpose of organizing- Organization structure- Formal and informal groups / Organization- Line and staff authority- Departmentalization- Span of control- Centralization and decentralization- Delegation of authority- Staffing- Selection and Recruitment- Orientation- Career Development- Career stages- Training- Performance appraisal.

UNIT IV DIRECTING 9

Managing people – Individual behaviour: Personality Type – Factors Influencing personality – Learning – Types of Learner - Misbehaviour – Group Behaviour: Organization Structure – Group Formation – Group Dynamics - Communication- Hurdles to effective communication - Organization culture - Elements and types of culture - Managing cultural diversity.

UNIT V CONTROLLING AND FORECASTING 9

Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing productivity - Cost control - Purchase control - Maintenance control - Quality control - Statistical Quality Tools: Control charts – Correlation – Regression – Time Series analysis –Seasonal variation – Cyclical Variation - Planning operations.

TOTAL PERIODS : 45

OUTCOMES

After completing this course, the student should be able to

- Explain and discuss the elements of effective management.
- Apply the planning, organizing, control and decision making processes.
- Explain various theories related to the development of leadership skills, motivation techniques, team work and effective communication.
- Analyze the different control activities of management and forecasting methodologies.

TEXT BOOKS

1. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, 9th edition,2012.
2. Samuel C. Certo and Tervis Certo, Modern management: concepts and skills, Pearson education, 12th edition, 2012.
3. Harold Koontz and Heinz Weihrich, Essentials of management: An International & Leadership Perspective, 9th edition, Tata McGraw-Hill Education, 2012.

REFERENCES

1. Charles W.L Hill and Steven L McShane, Principles of Management, McGraw Hill Education, Special Indian Edition, 2007.
2. Don Hellriegel, Susan E. Jackson and John W. Slocum, Management- A competency-based approach, Thompson South Western,11th edition, 2008.
3. Heinz Weihrich, Mark V Cannice and Harold Koontz, Management- A global entrepreneurial perspective, Tata McGraw Hill, 12th edition, 2008.
4. Stephen P. Robbins, David A.De Cenzo and Mary Coulter, Fundamentals of management, Prentice Hall of India, 2012.
5. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
6. Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, 7th Edition, 2011.
7. Aczel A.D. and Sounderpandian J., Complete Business Statistics, 6th edition, Tata McGraw – Hill Publishing Company Ltd., New Delhi, 2012.

Course Code	Course Title	L	T	P	C
UIT1701	CLOUD COMPUTING AND VIRTUALIZATION	3	0	0	3

OBJECTIVES

- To understand the basics of Cloud.

- To gain knowledge on the concept of virtualization that is fundamental to cloud computing.
- To understand the architecture and security issues in cloud computing.

UNIT I INTRODUCTION TO CLOUD COMPUTING 9

Surveying the role of Cloud Computing – Analysis and Assessment of Cloud Architectural models: Public, Private, Hybrid and Community Clouds – Classifications of Cloud Services – Advantages and Characteristics of Cloud Computing.

UNIT II VIRTUALIZATION 9

Components and Benefits of Virtualization – Cloud resource virtualization, Virtual Machines Provisioning and Migration Services - Virtualization –Virtualization Architectures – Virtualization Management – Storage Virtualization – Network Virtualization–Server Virtualization – Desktop Virtualization – Application Virtualization -Implementation levels of virtualization – Virtualization of CPU, Memory and I/O devices - Tools of Virtualization.

UNIT III CLOUD ARCHITECTURE 9

A Generic Cloud Architecture Design – Layered cloud Architectural Development – Evaluation and Analysis of physical data center – Architectural Design Challenges - Cloud Storage and architecture – Public Cloud Platforms : Scalability and on-demand services.

UNIT IV CLOUD SECURITY 9

Cloud security mechanism : Cloud security threats and attacks – Encryption – Hashing – Key privacy issues in the cloud – Cloud based security groups – Hardened virtual storage images - Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud – Cloud Security and Trust Management.

UNIT V CLOUD ORCHESTRATION 9

Cloud Software Environments: Eucalyptus – Open Nebula – Open Stack – Nimbus – CloudSim.

TOTAL PERIODS : 45

OUTCOMES

After completing this course, the student should be able to

- Explain the concepts of Cloud Computing.
- Apply the concept of virtualization in the cloud computing.
- Compare the architecture, infrastructure and delivery models of cloud computing.
- Illustrate the cloud security mechanisms that can be applied to combat the various cloud security threats.
- Illustrate the capabilities of Cloud Tools.

TEXTBOOK

1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.

REFERENCES

1. Danielle Ruest, Nelson Ruest, Virtualization: A Beginner"s Guide, McGraw-Hill Osborne Media, 2009.
2. Jim Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005

3. John W.Rittinghouse and James F.Ransome, Cloud Computing: Implementation, Management, and Security, CRC Press, 2010.
4. Tim Mather, Subra Kumaraswamy, and Shahed Latif , Cloud Security and Privacy, O"Reilly Media, Inc.,2009.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw-Hill Osborne Media, 2009.
6. Michael J.Kavis, "Architecting the Cloud". Wiley India, 2014.

Course Code	Course Title	L	T	P	C
UIT1702	NETWORK SECURITY	3	0	0	3

OBJECTIVES

- To understand the fundamentals of Cryptography.
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks.
- To 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, 802.11 wireless security.

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 PERIODS: 45

OUTCOMES

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

- Build basic security algorithms required by any computing system.
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.

- Analyze the possible security attacks in complex real time systems and their effective countermeasures.
- Classify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical derivation, modeling, and simulations.
- Formulate research problems in the computer security field.

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.

Course Code	Course Title	L	T	P	C
UIT1711	MOBILE APPLICATION DEVELOPMENT LAB	0	0	4	2

OBJECTIVES

- To demonstrate the knowledge of different software engineering techniques for mobile applications and apply this knowledge to develop an application for a mobile device.
- To know the components and structure of mobile application development frameworks for Android OS based mobiles.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices.
- To know the systems for mobile application distribution.

LIST OF EXPERIMENTS:

- Develop an application that uses GUI components, Font and Colours.
- Develop an application that uses Layout Managers and event listeners.
- Develop a native calculator application.
- Write an application that draws basic graphical primitives on the screen.
- Develop an application that makes use of database.
- Develop an application that makes use of RSS Feed.
- Implement an application that implements Multi threading.
- Develop a native application that uses GPS location information.
- Implement an application that writes data to the SD card.
- Implement an application that creates an alert upon receiving a message.
- Write a mobile application that creates an alarm clock.

- Develop a simple gaming application with multimedia support.
- Write a mobile application for data handling and connectivity via SOAP or REST to backend services potentially hosted in a cloud environment.
- Write a mobile application that will take advantage of underlying phone functionality including GEO positioning, accelerometer, and rich gesture based UI handling.
- Write an application for integrating mobile applications in the market, including social networking software integration with Facebook and Twitter.

TOTAL PERIODS: 60

OUTCOMES:

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

- Describe the design and architecture of a mobile application.
- Design and implement various mobile applications using Android Studio.
- Invent new programming techniques to meet the requirements of a mobile application.
- Perceive the challenges that mobile programming has in providing an effective user interface.
- Develop applications for hand-held devices.

PREREQUISITES IN TERMS OF KNOWLEDGE, SKILLS AND OTHER COMPETENCIES:

- Basic knowledge of modern operating systems (Windows and Linux in particular).
- Fundamentals Android SDK.
- Basic knowledge of the anatomy of Android Application Development using Android Studio.
- Basic knowledge of mobile technologies.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers - 30 Nos.

Course Code	Course Title	L	T	P	C
UEN1597	**PROFESSIONAL COMMUNICATION LAB**	**0**	**0**	2	**1**

OBJECTIVES:

The course aims to:

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I

Introduction to Soft Skills– Hard skills & soft skills – employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II

Self-Introduction-organizing the material – Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics – brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V

Recognizing differences between groups and teams- managing time-managing stress-networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

TOTAL: 30 PERIODS

OUTCOMES:

At the end of the course Learners will be able to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software 1. Globearena 2. Win English

REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

Course Code	Course Title	L	T	P	C
UIT1521	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	3	0	0	3

OBJECTIVES

- To learn digital image fundamentals.
- To be exposed to simple image processing techniques.
- To be familiar with image compression and segmentation techniques.
- To learn to represent image in form of features.

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Introduction – Applications - Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color models: RGB, CMY, HIS.

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain: Basic Intensity Transformation Functions – Histogram processing – Basics of Spatial Filtering – Smoothing and Sharpening Spatial Filters – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters: Ideal, Butterworth and Gaussian filters.

UNIT III IMAGE RESTORATION AND SEGMENTATION 9

Image Restoration: A Model of the Image Degradation - Noise models – Spatial Filtering: Mean, Order Statistics, Adaptive filters - Frequency Domain Filtering: Band reject filter, Band pass, Notch Filters, Optimum Notch Filtering – Inverse Filtering – Wiener filtering - Segmentation: Detection of Discontinuities – Edge Linking and Boundary detection – Region based segmentation - Morphological processing - Erosion and dilation.

UNIT IV WAVELETS AND IMAGE COMPRESSION 9

Wavelet Transforms in One Dimension - Fast Wavelet Transform - Wavelet Transforms in Two Dimensions - Compression: Fundamentals – Image Compression models – Variable Length Coding – Bit-Plane Coding – Predictive Coding – Digital Image Watermarking.

UNIT V IMAGE REPRESENTATION AND RECOGNITION 9

Boundary representation: Chain Code, Polygonal approximation, signature, boundary segments – Boundary description: Shape number, Fourier Descriptor, moments - Regional Descriptors: Topological feature, Texture - Patterns and Pattern classes - Recognition based on decisions.

TOTAL PERIODS: 45

OUTCOMES

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

- Explain digital image fundamentals.
- Apply image enhancement and restoration techniques.
- Make use of image compression and segmentation Techniques.
- Determine the features of images.

TEXTBOOK

1. Rafael C. Gonzales, Richard E. Woods, Digital Image Processing, Third Edition, Pearson Education, 2010.

REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, Third Edition Tata McGraw Hill Pvt. Ltd., 2011.
2. Anil Jain K. Fundamentals of Digital Image Processing, PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, Digital Image Processing, John Willey, 2002.
4. Malay K. Pakhira, Digital Image Processing and Pattern Recognition, First Edition, PHI Learning Pvt. Ltd., 2011.
5. Kenneth R. Castleman, _Digital Image Processing‘, Pearson, 2006.

Course Code	Course Title	L	T	P	C
UIT1522	DISTRIBUTED COMPUTING	3	0	0	3

OBJECTIVES

- To understand foundations of distributed systems.

- To introduce the idea of peer to peer services and file system.
- To understand in detail the system level and support required for distributed system.
- To understand the issues involved in studying process and resource management.

UNIT I INTRODUCTION 7

Characterization of Distributed Systems: Introduction - Examples of Distributed Systems - Trends in Distributed Systems - Focus on Resource Sharing - Challenges, Case Study: World Wide Web.

UNIT II COMMUNICATION IN DISTRIBUTED SYSTEM 10

System Model, Inter Process Communication: The API for Internet Protocols - External Data Representation and Multicast Communication, Network Virtualization: Overlay networks, Case Study: MPI, Remote Method Invocation and Objects: Remote Invocation – Introduction - Request-Reply Protocols - Remote Procedure Call - Remote Method Invocation, Case Study: Java RMI, Indirect Communication: Group communication - Publish- Subscribe Systems - Message Queues - Shared Memory Approaches, Distributed Objects: From Objects to Components, Case Study: Enterprise Java Beans.

UNIT III PEER TO PEER SERVICES AND FILE SYSTEM 10

Peer-to-Peer Systems: Introduction - Napster and its Legacy - Peer-to-Peer Middleware - Routing Overlays - Overlay Case Studies: Pastry - Tapestry, Distributed File Systems: Introduction - File Service Architecture, Case Study: Andrew File system, File System: Features - File Model - File Accessing Models -File Sharing Semantics, Naming: Desirable Features of a Good Naming System - Fundamental Terminologies and Concepts - Name Caches.

UNIT IV SYNCHRONIZATION AND REPLICATION 9

Time and Global States: Introduction – Clocks - Events and Process States - Synchronizing Physical Clocks - Logical Time and Logical Clocks -Global States, Coordination and Agreement: Introduction - Distributed Mutual Exclusion – Elections, Transactions and Concurrency Control: Transactions - Nested Transactions – Locks - Optimistic Concurrency Control - Timestamp Ordering, Distributed Transactions: Atomic Commit Protocols - Distributed Deadlocks - Replication, Case Study: Coda.

UNIT V PROCESS & RESOURCE MANAGEMENT 9

Process Management: Process Migration – Features - Mechanism, Threads: Models – Issues – Implementation - Resource Management: Introduction - Features of Scheduling Algorithms - Task Assignment Approach - Load Balancing Approach - Load Sharing Approach.

TOTAL PERIODS: 45

OUTCOMES

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

- Explain the trends in Distributed Systems.
- Apply network virtualization.
- Apply remote method invocation and objects.
- Design process and resource management systems.

TEXT BOOKS

1. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, Pearson Education, Fifth Edition, 2012. (Chapters: 1, 2, 4, 5, 6, 8, 10, 12 14, 15, 16, 17 & 18)

2. Pradeep K Sinha, Distributed Operating Systems: Concepts and Design, Prentice Hall of India, 2007. (Chapters: 7, 8, 9, 10)

REFERENCES

1. Tanenbaum A.S, Van Steen M, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
2. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.
3. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003.
4. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

Course Code	Course Title	L	T	P	C
UIT1523	OPTIMIZATION TECHNIQUES	3	0	0	3

OBJECTIVES

- To find the optimal solution of an optimization problem.
- 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 Computational procedure – Conversion offinal value problem in to initial value problem.

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 and search, Taguchi's method of optimization.

UNIT V PRACTICAL ASPECTS OF OPTIMIZATION 9

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

TOTAL PERIODS: 45

OUTCOMES

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

- Explain efficient computational procedures to solve optimization problems.
- Apply engineering minima/maxima problems into optimization framework.

TEXT BOOKS

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

REFERENCE

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 Code	Course Title	L	T	P	C
UMA1553	GRAPH THEORY AND ITS APPLICATIONS	3	0	0	3

OBJECTIVES

- To comprehend graph as modelling and analysis tool
- To introduce various data structures with graph theory
- To learn fundamentals behind the principles of counting and combinatory

UNIT I INTRODUCTION TO GRAPH THEORY 9

Overview – Application, Finite & infinite graphs, incidence & edges, Null graph, Paths & Circuits – Isomorphism, sungraph, Walks, Paths, Circuits, Types of graphs, Euler graph, Operations of graphs, Trees and Fundamental circuits – Properties of trees, Distance & Centres in trees, Rooting & Binary trees, Spanning trees, Cut-sets & Cut-vertices – Properties, Connectivity & Separatability, Isomorphism.

UNIT II COMBINATORICS & VECTOR SPACES OF GRAPHS 9

Planar & Dual graphs – Combinatorial vs Geometric graphs, Planar graphs, Kuratowski’s Two graphs, Planarity, Combinatorial dual and Geometric graphs, Vector spaces of graph – Sets with one operation, Sets with one operations, Modular arithmetic, Vector space associated with a graph, Basic vectors of a graph, Orthogonal vectors and spaces.

UNIT III REPRESENTATION OF GRAPHS 9

Matrix representation – Incidence matrix, Submatrices, Circuit matrix, Cut- set matrix, Path matrix, Adjacency matrix, Coloring, Covering & Partitioning – Chromatic number, partitioning & polynomial, Matchings, Coverings, Four color problem, Directed graphs – Overview, Euler digraphs, Adjacency matrix of digraphs, Acyclic digraphs & decyclization.

UNIT IV GRAPH THEORETIC ALGORITHMS & COMPUTER PROGRAMS 9

Overview, Computer representation of a graph, Basic algorithms – Connectedness and Components, Spanning tree, Cut-vertices, Shortest path algorithms, Isomorphism, Performance of graph theoretic algorithms.

UNIT V APPLICATION OF GRAPH THEORY - SOCIAL NETWORK GRAPH ANALYSIS 9

Social Networks as Graphs, Centrality measures, Neighbourhood properties of graphs, counting triangles in graphs, Clustering - Node-Edge Diagrams - Matrix representation,

Social graph models, community detection and mining, Case study - Analysis of Co-Citation networks using Gephi.

TOTAL PERIODS: 45

OUTCOMES

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

- Explain the basic graph algorithms.
- Compare and contrast the potential use of directed and undirected graphs.
- Outline the concepts of permutations and combinations.
- Apply the graph theory in computing applications.

TEXTBOOK

1. Narsingh Deo, Graph Theory: With Application to Engineering and Computer Science, Prentice Hall of India, 2003.

REFERENCE

1. John M. Harris, Jeffry L. Hirst, Michael J. Mossingoff, Combinatorics and Graph Theory, Second Edition, Springer.
2. Robin Wilson, Introduction to Graph Theory, 2nd Revised edition edition, Dover Publications Inc.1994.
3. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, PHI, 1979.
4. Alan Tucker, Applied Combinatorics, Sixth Edition, Wiley, 2012.
5. Arthur T. Benjamin, Gary Chartrand, and Ping Zhang, The Fascinating World of Graph Theory, Princeton University Press, 2015

Course Code	Course Title	L	T	P	C
UIT1524	COMPUTER GRAPHICS AND MULTIMEDIA	3	0	0	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 9

Basic − Line − Curve and ellipse drawing algorithms − Examples – Applications - Attributes − Two- Dimensional geometric transformations − Two-Dimensional clipping and viewing – Input techniques.

UNIT II THREE-DIMENSIONAL CONCEPTS 9

Three dimensional concepts; Three dimensional object representations –Polygon surfaces-Polygon tables-Plane equations - Polygon meshes; Curved Lines and surfaces; Quadratic surfaces; Blobby objects; Spline representations – Cubic Spline Interpolation Methods – Bezier curves and surfaces - B-Spline curves and surfaces - Fractal Geometric Methods, Three dimensional geometric and modelling transformations.

UNIT III THREE-DIMENSIONAL VIEWING AND VISIBLE SURFACE DETECTION 9

Viewing pipeline, Viewing Coordinates, Projections, View Volume and General 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, Curved Surfaces.

UNIT IV COLOUR MODELS AND ANIMATION 9

Light sources - Basic illumination models – Halftone patterns and dithering techniques; Properties of light -Standard primaries and Chromaticity diagram; Intuitive colour concepts - RGB colour model -YIQ colour model-CMY colour model - HSV colour model - HLS colour model - Applications; Virtual reality - Animation.

UNIT V MULTIMEDIA SYSTEM 9

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.

TOTAL PERIODS: 45

OUTCOMES

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

- Apply two dimensional transformations.
- Apply three dimensional transformations.
- Apply illumination and color models.
- Apply clipping and projection techniques.
- Design animation sequences.
- Describe the characteristics and representations of various multimedia data.

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 Code	Course Title	L	T	P	C
	IT INFRASTRUCTURE MANAGEMENT	**3**	**0**	**0**	**3**

OBJECTIVES

- To understand the foundational level of the ITIL framework.
- To know the concepts and terminologies in ITIL service lifecycle.
- To know the concept of service delivery and support process.
- To learn the storage and security concepts in ITIL framework.

UNIT I: IT INFRASTRUCTURE: OVERVIEW

Definitions, Infrastructure management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client-server computing-to-New age systems) and their Management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment, Total cost of complexity issues, Value of Systems management for business.

UNIT II: IT INFRASTRUCTURE MANAGEMENT

Factors to consider in designing IT organizations and IT infrastructure, determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL).

UNIT III CURRENT COMPUTING ENVIRONMENT AND IT SYSTEM MANAGEMENT

Complexity of current computing, multiple technologies, multiple vendors, multiple users, e-Waste disposal, Total cost of ownership - Common tasks in IT system management, approaches for organization Management, Models in IT system design, IT management systems context diagram, patterns for IT system Management.

UNIT IV SERVICE DELIVERY PROCESSES AND SUPPORT MANAGEMENT

Service-level management, financial management and advantages of financial management - IT services continuity management, Capacity management, Availability management and service desk - Service support process, Configuration Management - Incident management - Problem management, Change management, Release management.

UNIT V STORAGE AND SECURITY MANAGEMENT

Types of Storage management, Benefits of storage management, backups, Archive, Recovery, Disaster recovery - Space management, Hierarchical storage management, Network attached storage, Storage area network, bare Machine recovery, data retention, database protection - Introduction Security, Identity management, Single sign-on, Access Management - Basics of network security, LDAP fundamentals, Intrusion detection, firewall, security information management

OUTCOMES

Upon completion of the course, the student should be able to:

- Identify, evaluate and select an integrated IT infrastructure (hardware, software, architectures, and services) to best fulfill a given set of organizational requirements.
- Analyze an existing IT infrastructure, identify its strengths and weaknesses, and develop a roadmap for future evolution.
- Assess an emerging technology and demonstrate how it can be used to enhance a firm’s competitive position.
- Analyze and review the technical, managerial, security, regulatory, and ethical issues associated with the acquisition, deployment, and management of modern ITinfrastructures and emerging technologies

TEXTBOOK

1. Phalguni Gupta, Surya Prakash, Umarani Jayaraman, IT Infrastructure and its Management, Tata McGraw Hill Education Private Limited, 2010.

REFERENCE

1. Jan Van Bon, Introduction to the ITIL Service Lifecycle, The Stationery Officem 2011
2. Anita Sengar, IT Infrastructure Management, S K Kataria and Sons, 2012
3. Rich Schiesser, IT Systems Management, Second Edition, Prentice Hall, 2010
4. Kief Morris, Infrastructure as Code: Managing Servers in the Cloud, O'Reilly Media, 2016.
5. Anna Murray, The Complete Software Project Manager: Mastering Technology from Planning to Launch and Beyond, John Wiley & Sons, 2016.

Course Code	Course Title	L	T	P	C
UIT1621	REAL TIME EMBEDDED SYSTEMS	3	0	0	3

OBJECTIVES

- To understand the basic concepts of embedded systems.
- To introduce basic concepts of energy efficient storage mechanism.
- 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 9

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 9

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 9

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 9

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 9

Embedded Boards: Raspberry, Arduino- Optimization of Application : Code level, Memory Level, Execution Level-- Case Study: Design of Robot Controller, Weather Station, Web Bot.

TOTAL PERIODS: 45

OUTCOMES

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

- Explain the basics of real time embedded systems and energy efficient storages
- Explain the various services of RTOS
- Develop different applications

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 Code	Course Title	L	T	P	C
UIT1622	SPEECH PROCESSING	3	0	0	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 9

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 9

Time-dependent processing of speech, Short-Time Energy and Average Magnitude, Short-Time Average Zero Crossing Rate, Speech vs. Silence Discrimation using Energy and Zero-Crossings. Short-Time Autocorrelation Function, Pitch Period Estimation using autocorrelation function.

UNIT III SHORT-TERM FOURIER ANALYSIS OF SPEECH 9

Fourier transform Interpretation, Linear Filtering Interpretation, Spectrographic Displayes, Harmonic Product Spectrum-based Pitch Estimation technique, Analysis-by-Synthesis.

UNIT IV SPECTRAL FEATURES 9

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 9

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.

TOTAL PERIODS: 45

OUTCOMES

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

- Explain the usefulness of digital signal processing fundamentals in building speech-based systems.
- Compare the time and frequency-domain parameters, and know how to compute/estimate those parameters
- 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.
- Explain the possible techniques to modify a given speech signal, based on the requirement, and to develop the required algorithms.

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 Code	Course Title	L	T	P	C
UIT1623	**INTERACTIVE SYSTEM DESIGN**	**3**	**0**	**0**	**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 9

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 9

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 9

Cognitive models – Socio-Organizational issues and stake holder requirements – Communication and collaboration models - Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI 9

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 9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow.

TOTAL PERIODS: 45

OUTCOMES

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

- Design effective dialog for HCI.
- Design effective HCI for individuals and persons with disabilities.
- Assess the importance of user feedback.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- Develop meaningful user interface.

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 Code	Course Title	L	T	P	C
UIT1624	FUNDAMENTALS OF REVERSIBLE AND QUANTUM COMPUTING	3	0	0	3

OBJECTIVES:

- To understand reversible logic.
- To understand reversible circuits.
- To understand quantum computing.

UNIT I BOOLEAN ALGEBRA AND GROUP THEORY 9

Boolean Functions of One, two Variables, *n* Variables, Minterm and Maxterm Expansion, Reed–Muller Expansion, Minimal ESOP Expansion, Linear Functions, Affine Linear Functions, Monotonic Functions, Boolean Derivative, Boolean Decompositions.

UNIT II REVERSIBLE CIRCUITS 9

Conservative Circuits, Monotonic Circuits, Linear Circuits, Affine Linear Circuits, Exchange Gates, SWAP Gates, Affine Exchange Gates, Control Gates, Sylow Circuits, Gate Cost and Logic Depth, Methods of Synthesis, Cosets, Double Cosets, The Synthesis Algorithm, Variable Ordering, Linear Synthesis Algorithm, Preset Bits and Garbage Bits, Duplicating Circuit, Controlled NOT, Full Adder.

UNIT III BASIC LINEAR ALGEBRA 9

Vector spaces, Basis and dimension, Inner products, Ortho normality, Gram-Schmidt orthogonalization, Bra-Ket formalization, Hilbert spaces, Products, Tensor products, Matrices, Complex spaces, Hadamard Matrices, Fourier matrices, Pauli matrices, Hermitian, Unitary, and normal operators.

UNIT IV INTRODUCTION TO QUANTUM COMPUTING 9

Doubly Stochastic Matrices, System of Qubits, Qubits and measurement, Entanglement, Single Qubit gates, controlled gates, Gate decomposition.

UNIT V QUANTUM ALGORITHMS 9

Deutsch algorithm, Deutsch - Jozsa algorithm, Simon algorithm, Shor algorithm, Grover algorithm.

TOTAL PERIODS: 45

OUTCOMES

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

- Explain the reversible computing systems
- Explain the quantum computing areas

TEXT BOOK

1. Alexis De Vos, Reversible Computing: Fundamentals, Quantum computing with applications, Wiley-VCH Verlag GmBH & Co. KGaA, 2010.

REFERENCES

1. David McMahon, Quantum computing explained, Wiley-Interscience, John Wiley & Sons, Inc., 2008.
2. Vincent Moret-Bonillo, Adventures in computer science: From classical bits to quantum bits, Springer, 2017.
3. Richard Lipton, and Kenneth W Regan, Quantum algorithms via linear algebra, MIT Press, 2014.
4. Scott Anderson, Quantum computing since Democritus, Cambridge university press, 2013.
5. Kalyan S. Perumalla, Introduction to Reversible Computing, CRC Press, 2014.

Course Code	Course Title	L	T	P	C
UIT1625	ANALYSIS AND DESIGN OF SERVICE ORIENTED ARCHITECTURE	3	0	0	3

OBJECTIVES

- To understand the key principles behind SOA.
- To be familiar with the web services technology elements for realizing SOA.
- To learn the various web service standards.
- To analyze and model services using REST and SOAP based web services.
- To learn and apply advanced concepts such as service composition and orchestration.

UNIT I INTRODUCTION TO SERVICE ORIENTED ARCHITECTURE 9

Introduction to Service Orientation- Comparing SOA with Client-Server and Distributed architectures - Needs and effects of Service - Orientation on the Enterprise – Characteristics of SOA - Types of SOA.

UNIT II SOA PROJECT AND LIFECYCLE STAGES 9

Methodology and Project Delivery Strategies-SOA Project Stages-SOA Adoption Planning-Service Inventory Analysis-Service Modeling- Service Oriented Design - Service Logic Design-Service Development- Service Testing-Service Deployment and Maintenance-Service Usage and Monitoring - Service Discovery-Service Versioning and Retirement - Project Stages and Organizational Roles, Case Study: Apply the concepts of SOA Lifecycle to an appropriate use case.

UNIT III WEB SERVICES AND SERVICE LAYERING 9

Web services – Service descriptions – Messaging with SOAP –Message exchange Patterns – Coordination –Atomic Transactions – Business activities – Orchestration – Choreography - Service layer abstraction – Application Service Layer – Business Service Layer – Orchestration Service Layer.

UNIT IV SOA ANALYSIS AND DESIGN 9

Service oriented analysis – Business-centric SOA – Deriving business services- service modeling - Service Oriented Design – Service Modelling -WSDL basics – SOAP basics – SOA composition – Entity-centric business service design – Application service design – Task centric business service design- Design standards and guidelines - Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security .

UNIT V ANALYSIS AND MODELLING USE CASE 9

Analysis and Modeling with web services and Microservices - Analysis and Modeling with REST Services and Microservices - Service API and Contract Versioning with Web Services and REST Services – Versioning - Versioning Strategies - Case Study-Implement an application using web services and REST services.

TOTAL PERIODS: 45

OUTCOMES

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

- Analyze and Design SOA based applications.
- Explain SOA applications using SOAP based Web services and REST services.
- Build SOA-based applications for intra-enterprise and inter-enterprise applications.

TEXT BOOK

1. Thomas Erl. “Service-Oriented Architecture: Analysis and Design for Services and Microservices, Second Edition”, Prentice Hall, 2016

REFERENCES

1. H. Howell-Barber and James P. Lawler, Service-Oriented Architecture: SOA Strategy, Methodology, and Technology, Auerbach Publications, 2007.
2. Ron Schmelzer et al., XML and Web Services‖, Pearson Education, 2002.
3. Sandeep Chatterjee and James Webber, Developing Enterprise Web Services: An Architect's Guide, Prentice Hall, 2004.
4. Thomas Erl, Next Generation SOA: A Concise Introduction to Service Technology & Service-Orientation, PHI, 2014
5. https://www.ibm.com/developerworks/library/ws-soad1/.

Course Code	Course Title	L	T	P	C
UIT1721	PRINCIPLES OF SOFTWARE PROJECT MANAGEMENT	3	0	0	3

OBJECTIVES

To understand the basic concepts of project management.

- To understand the various cost estimation models.
- To learn the process of Project kickoff and tracking.
- To understand the use of umbrella activities in project management.
- To learn the project management issues in testing and maintenance phase.
- To appreciate the challenges in people management.

UNIT I PROJECT MANAGEMENT CONCEPTS 9

Project Management Process Framework: phases, Artifacts, workflows, checkpoints – Software Management disciplines: planning, organization, responsibilities, automation – Problems in Software cost estimation – function point models – COCOMO model- Delphi method.

UNIT II PROJECT SCHEDULING AND TRACKING 9

Project initiation – Project Planning and tracking: what, cost, when and how – organisational processes: assigning resources, project tracking – Project Closure: when and how, metrics, Critical path – Tracking - Timeline chart – Earned value chart.

UNIT III UMBRELLA ACTIVITIES 9

Metrics: Roadmap, measure, setting target and track, minimise variability, act, checklist and tools – Software Configuration Management: basic definitions, processes and activities, status accounting, audit, SCM in geographically distributed teams, metrics – Risk management: cycle, identification, quantification, monitoring, mitigation, risks in global project teams.

UNIT IV IN TESTING AND MAINTENANCE PHASE 9

Project Management in testing phase: Test Scheduling, types of tests, people issues in testing, management structures for testing in global teams, metrics – Project Management in the maintenance phase: activities, Management issues, Configuration management, skill sets, Estimation of size, effort and people resources, metrics – Impact of the internet on project Management.

UNIT V PEOPLE MANAGEMENT 9

Globalisation Issues: Evolution, Challenges in building Global Teams, Models, effective management techniques – People Focused Process Models: Need for People centric models, P-CMM, other models, criteria to choose the models.

OUTCOMES

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

- Compare the various elements of software management process framework.
- Explain existing risk and apply risk assessment.
- Design software metric for software project management.
- Outline the global issues in geographically distributed development.

TEXT BOOK

1. Gopalaswamy Ramesh, "Managing Global Software Projects", Tata McGraw Hill Publishing Company, New Delhi, 2002.

REFERENCES

1. Bob Hughes, Mikecotterell, Software Project Management, Third Edition,Tata McGraw Hill, 2004.
2. Anna Murray, The Complete Software Project Manager: Mastering Technology from Planning to Launch and Beyond, John Wiley & Sons, 2016.
3. Robert T. Futrell, Quality Software Project Management, PHI, 2002
4. Stark, John, Decision Engineering: Product Lifecycle Management: 21st Century Paradigm for Product Realisation,2nd Edition., 2011, XXII, 559 p., Springer London
5. Royce, W. Software Project management: A Unified Framework, Addison Wesley, 1998.

Course Code	Course Title	L	T	P	C
UIT1722	AGILE SOFTWARE DEVELOPMENT	3	0	0	3

OBJECTIVES

- To understand the basic concepts of Agile software process.
- To gain knowledge in various agile methodologies.
- To develop agile software process.
- To learn the principles of agile testing.

UNIT I INTRODUCTION 9

Software is new product development – Iterative development – Risk-Driven and Client-Driven iterative planning – Time boxed iterative development – During the iteration, No changes from external stakeholders – Evolutionary and adaptive development - Evolutionary requirements analysis – Early "Top Ten" high-level requirements and skilful analysis – Evolutionary and adaptive planning – Incremental delivery – Evolutionary delivery – The most common mistake – Specific iterative and Evolutionary methods.

UNIT II AGILE PROCESSES 9

Agile development – Classification of methods – The agile manifesto and principles – Agile project management – Embrace communication and feedback – Simple practices and project tools – Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype

– Specific agile methods. The facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall.

UNIT III AGILE METHODOLOGIES I 9

SCRUM and Extreme programming: Method overview, Lifecycle, Work products, Roles and Practices values, Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus "Other" history.

UNIT IV AGILE METHODOLOGIES II 9

Crystal – Dynamic Systems Development method – Feature Driven Development– Lean Development–Unified Process – EVO – How to choose a process.

UNIT V AGILE ROLES AND TESTING 9

Deep Dive in Scrum roles - Roles in other methodologies - Testing: Creating a quality focused culture, TDD- Refactored code: Refactoring example, Complex Test cases, Comparison of test cases, Manual, automated, Customer testing.

TOTAL PERIODS: 45

OUTCOMES:

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

- Compare evolutionary, iterative and adaptive development
- Explain agile software process.
- Apply agile methodologies for software design.
- Apply agile based testing.

TEXT BOOKS:

1. Craig Larman Agile and Iterative Development – A Manager's Guide Pearson Education – 2004. ([Unit 1,2,3,4)
2. Sondra Ashmore, Kristin Runyan, Introduction to Agile methods, Addison-Wesley. (Unit4, 5)

REFERENCES:

1. Alistair Agile Software Development series Cockburn - 2001.
2. www.agileintro.wordpress.com/2008.
3. Elisabeth Hendrickson, Agile Testing Quality Tree Software Inc 2008.
4. Jim Highsmith, Agile Project Management, Addison-Wesley Professional, 2004.

Course Code	Course Title	L	T	P	C
UIT1723	DEVELOPMENTS AND OPERATIONS (DevOps)	3	0	0	3

OBJECTIVES

- To understand DevOps fundamentals.
- To understand the tangible and real benefits of DevOps.
- To understand DevOps culture.
- To understand Infrastructure Automation, Continuous Delivery, & Reliability Engineering Concepts.
- To understand the Practices and tools used in DevOps.
- To understand DevOps emerging areas including DevOps security.

UNIT I FUNDAMENTALS 9

Definition, Values, Principles, Methodologies, Practices, Tools, Communication, Wall of confusion, Communication, Collaboration, Transition, Continuous improvement (Kaizen)

UNIT II BUILDING BLOCKS 9

Lean & Agile - Methodologies, Implementations, Build, Measure, Learn ITIL, ITSM, SDLC.

UNIT III INFRASTRUCTURE AUTOMATION 9

Basics, Infrastructure options, Provisioning, Deployment, Orchestration, Architectural considerations.

UNIT IV CONTINUOUS DELIVERY 9

CI practices, CD pipeline, QA, CI tools, Securing CI/CD pipeline - DevSecOps, Development tools, inherit tools, Build tools, Deploy tools, Operation tools.

UNIT V RELIABILITY ENGINEERING 9

SRE basics, Practice - Release Engineering, Change Management, Self-service automation, SLAs, Incident Management, Postmortems, Troubleshooting, Performance Engineering, Scalability, Organization, Emerging areas: Cloud, Containers, Server-less, Security.

TOTAL PERIODS: 45

OUTCOMES:

Upon completion of the course, the student should be able to:

- Explain the core concepts/principles of DevOps.
- Experiment DevOps concepts by using various tools.
- Outline the benefits of DevOps.

TEXT BOOK

1. Gene Kim, Kevin Behr, George Spafford, "The Phoenix Project - a Novel IT, DevOps, and helping your Business Win", 2018.

REFERENCES

1. Gary Gruver, Tommy Mouser, Leading the Transformation - Applying Agile and DevOps principles at scale, IT Revolution, Portland.
2. Gene Kim, Jez Humble, Patrick Debois, John Willis, The DevOps Handbook - How to create world class agility, reliability, and security in technology organizations".
3. Kenin, Gene, George, The Visible OPS Handbook - Implementing ITIL in 4 practical and auditable steps".
4. Jez Humble, David Farley, Continuous Delivery, Addison –Wesley Signature series.
5. Jeninfer Davis & Katherine Daniels, Effective DevOps - Building a culture of collaboration, affinity, and tooling at scale.
6. Mary Poppendieck & Tom Poppendieck, Lean Software Development - An Agile Toolkit.
7. John Allspaw, Web Operations - Keeping the Data on Time.
8. Thomas, The Practice of cloud system administration - Designing and operating large distributed systems.

Course Code	Course Title	L	T	P	C
UIT1724	REACTIVE PROGRAMMING	3	0	0	3

OBJECTIVES

- To understand reactive programming.

- To create reactive programs in Java.
- To create reactive programs in JS.
- To understand and apply reactive design patterns for android apps.
- To create reactive programs using Spring.

UNIT I FUNDAMENTALS 9

Introduction, benefits, streams, asynchronous programming, observer, observables.

UNIT II REACTIVITY IN JAVA 9

Introduction, flow API, functions & lambdas, streams, backpressure, creating and observing sources, operators, concurrency, unit testing, Akka.

UNIT III REACTIVITY IN JS 9

Observable creation, subject, behaviour, replay, operators - take, map, filter, mergeMap, switchMap, UI - button observable, debounce, API wrap, slack API.

UNIT IV ANDROID REACTIVE DESIGN PATTERNS 9

Observables, shortcuts for creating observables, traits, subjects, API service calls grouping, binding, UI controls and threading.

UNIT V REACTIVITY IN SPRING 9

Reactor, Reactive core, Web flux, data and mongo, bootstrapping, controllers, Unit testing.

TOTAL PERIODS: 45

OUTCOMES

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

- Explain the core concepts and benefits of reactive programming.
- Build Java programs using reactive style.
- Build JS using reactive style.
- Apply reactive design patterns to create Android apps.
- Develop programs using reactive style with Spring.

TEXT BOOK

1. Tomasz Nurkiewicz, Shroff, Reactive Programming with RxJava: Creating Asynchronous, Event-Based Applications, O'Reilly Publication, First edition (2016).

REFERENCES

1. Erich de Souza Oliveira, “Mastering Reactive JavaScript”, Packt Publishing Limited (2017).
2. Rivu Chakraborty, “Reactive Programming in Kotlin: Design and build non-blocking, asynchronous Kotlin applications with RXKotlin, Reactor-Kotlin, Android, and Spring”, Packt Publishing; 1st Edition 2017.
3. Oleh Dokuka, Igor Lozynskyi, “Hands-On Reactive Programming in Spring 5: Build cloud-ready, reactive systems with Spring 5 and Project Reactor”, Packt Publishing Limited, 2018.
4. Nickolay Tsvetinov, Learning Reactive Programming with Java 8, Packt Publishing, 2015.
5. Anthony Jones and Stephen, Functional Reactive Programming, Manning Publications, 2016.

Course Code	Course Title	L	T	P	C
UIT1725	NETWORK MANAGEMENT SYSTEMS	3	0	0	3

OBJECTIVES:

- To understand the principles of network management.
- To understand different standards and protocols used in managing complex network.
- To understand the Automation of network management operations.
- To learn how to deploy available network management systems.

UNIT-I NETWORK MANAGEMENT 9

Analogy of Telephone Network Management, Communications protocols and Standards, Case Histories of Networking and Management, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

UNIT-II SNMPV1 NETWORK MANAGEMENT 9

Organization and Information Models – Managed Network: Case History and Examples, History of SNMP Management, SNMP Model, SNMPV1 Network Management: Communication and Functional Models, SNMPv2: System architecture, Structure of Management Information, Management Information Base, Protocol - Compatibility with SNMPv1.

UNIT-III RMON 9

Remote Monitoring – RMON, SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, Case Study of Internet Traffic Using RMON -Telecommunications Management Network: Operations Systems, Conceptual Model, Standards, Architecture, Implementation Issues.

UNIT-IV NETWORK MANAGEMENT TOOLS 9

Network Management Tools - Network Statistics Measurement Systems - Enterprise Management - Commercial Network management Systems - Enterprise Management Solutions.

UNIT-V WEB-BASED MANAGEMENT 9

NMS with Web Interface, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management.

TOTAL PERIODS: 45

OUTCOMES:

After the completion of course, the student will able to:

- Explain the network management standards.
- Compare the various network management tools.
- Evaluate various commercial network management systems and open network management.
- Analyze and interpret the data provided by a Network Management System.

TEXT BOOK

1. Mani Subramanian, Network Management Principles and Practice, 2nd Edition, Pearson Education, 2010.

REFERENCES

1. Morris, Network management, 1st Edition, Pearson Education, 2008.

2. Mark Burges, Principles of Network System Administration, 1st Edition, Wiley DreamTech, 2008.
3. James.D.McCabe, Practical Computer Network Analysis and Design, 1st Edition, Morgan Kaufaman, 1997.
4. Daw Sudira, Network Management, Sonali Publications, 2004
5. Laura Chappel and Gerald Combs, Wireshark 101: Essential Skills for Network Analysis, Kindle Edition,2013.

Course Code	Course Title	L	T	P	C
UIT1726	WEB DEVELOPMENT FRAMEWORKS	3	0	0	3

OBJECTIVES:

- To understand the fundamentals of web framework.
- To know the concept of Java web framework, Express web framework.
- To learn the technologies of Python web framework.
- To analyze and choose a suitable web framework for a problem.

UNIT I FUNDAMENTALS OF WEB FRAMEWORK 9

Introduction to Web framework – History, Types of framework, architectures, Model view controller (MVC), Three-tier organization, Framework applications - General purpose website frameworks: Server side, Client side.

UNIT II JAVA WEB FRAMEWORK 9

Introduction to the Struts Framework - Applying Struts - The Struts Tag Libraries - Struts Configuration Files - Basic Configuration - Actions and Action Support - Results and Result Types - OGNL, the Value Stack, and Custom Tags - Form Tags - Exceptions and Logging.

UNIT III EXPRESS FRAMEWORK 9

Introduction to Express framework, Basics of NODE.js, middleware routing - Form data - Extending request and response - Views and templates – Angular.js, Persisting data with MongoDB, Cookies and sessions.

UNIT IV PYTHON WEB FRAMEWORKS 9

Introduction to Python Frameworks - Web 2.0, Python, and Frameworks, The Role of AJAX in Web 2.0 - Leveraging the power of DSLs, TurboGears, Django, Python, Comparing the frameworks, Web Application Frameworks, MVC in Web Application Frameworks, Common Web Application Framework Capabilities.

UNIT V TURBOGEARS and DJANGO 9

TurboGears: Introduction, History, Main Components, Alternate Components, MVC Architecture in TurboGears - Creating an Example Application - Controller and View, Django: Introduction, History, Components, Alternate Components, MVC Architecture in Django -Creating an Example Application.

TOTAL PERIODS: 45

OUTCOMES

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

- Analyze the fundamentals of web framework.
- Apply the concept of Java web framework.
- Make use of Express framework to develop web applications.
- Apply the concept of python web framework to model web applications.

- Analyze the various Web frameworks.

TEXT BOOK

1. James Holmes, "Struts The Complete Reference", 2nd Edition, McGraw Hill Professional 2006.

REFERENCES

1. Evan M. Hahn, "Express in action-Writing, building, and testing Node.js applications", 2016.
2. Dana Moore, Raymond Budd, William Wright, "Professional Python Frameworks Web 2.0", John Wiley & sons, 2008.
3. https://en.wikipedia.org/wiki/Web_framework
4. Sue Spielman, "The Struts Framework 1: A Practical guide for Java Programmers", 1st Edition, Elsevier 2002.
5. Adrian Holovaty, Jacob Kaplan, Moss, "The Definitive Guide to Django: Web Development Done Right", Apress, 2009.
6. Mark Ramm, "Rapid Web applications with TurboGears", Prentice Hall, 2009.

Course Code	Course Title	L	T	P	C
UIT1727	CYBER FORENSICS AND INFORMATION SECURITY	3	0	0	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 9

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 9

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 9

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 9

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 9

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.

TOTAL PERIODS: 45

OUTCOMES

Upon completion of the course, the student should be able to:

- Explain the security issues network layer and transport layer.
- Explain computer forensics.
- Make use of forensics tools.
- Analyze and validate forensics data.

TEXT BOOK

1. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003.

REFERENCES

1. Nelson, Phillips, Enfinger, Steuart, Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.
2. John R.Vacca, Computer Forensics, Cengage Learning, 2005.
3. Richard E.Smith, Internet Cryptography, 3rd Edition Pearson Education, 2008.
4. Marjie T.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
5. Peterson, Gilbert, and Sujeet Shenoi, Advances in Digital Forensics IX, Vol. 410, Springer, 2013.

Course Code	Course Title	L	T	P	C
UIT1728	INFORMATION ASSURANCE AND SECURITY	3	0	0	3

OBJECTIVES

- To understand the basics of Information Security and assurance.
- To know the legal, ethical and professional issues in Information Security.
- To know the aspects of risk management.
- To become aware of various standards in Security and Assurance.
- To know the technological aspects of Information Security.

UNIT I SECURITY REQUIREMENTS AND SECURE SDLC 9

Introduction to Information Security: CIA requirements- security model, Components of an information system - Securing the components - Balancing security and access - Security in SDLC.

UNIT II THREATS, ATTACKS AND RISKS MANAGEMENT 9

Need for security - Business needs - Threats – Attacks – Risk management: Identifying and assessing risk - Assessing and controlling risk.

UNIT III SECURITY TECHNOLOGIES 9

Security Technology: Access Control, Firewalls, and VPNs, Intrusion Detection and Prevention Systems, Honeypots and Padded Cell Systems, Scanning and Analysis Tools, Introduction to Big Data Security Analytics and Security Breaches.

UNIT IV PHYSICAL, PERSONNEL AND OPERATIONAL SECURITY 9

Physical Security: Physical Access Controls, Fire Security and Safety, Failure of Supporting Utilities and Collapse, Interception of Data, Securing Mobile and Portable Systems, Special Considerations, - Security and personnel – Information Security Maintenance.

UNIT V INFORMATION ASSURANCE 9

IA policy, Security Control Testing, Contingency and Disaster Recovery Planning, Legal and ethical issues of information security.

TOTAL PERIODS: 45

OUTCOMES

Upon completion of the course, the student should be able to:

- Explain the basics of information security.
- Illustrate the legal, ethical and professional issues in information security.
- Design and implementation of Security Techniques.
- Apply Appropriate Security Technology for Risk Control.
- Apply Appropriate Physical, Personnel and Operational Security.

TEXTBOOK

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Sixth Edition, Cengage Learning, 2017.

REFERENCES

1. Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004.
2. Stuart McClure, et al., “Hacking Exposed”, Tata McGraw- Hill, Sixth edition2009. 4. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002.
3. Matt Bishop, ―Computer Security Art and Science‖, Pearson/PHI, 2002.
4. Bob Rudis and Jay Jacobs, Data-Driven Security: Analysis, Visualization and Dashboards, Wiley, 2014.
5. Monnappa K A, Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware, Packt Publishing, 2018.

Course Code	Course Title	L	T	P	C
UIT1729	WIRELESS AND MOBILE NETWORKS	3	0	0	3

OBJECTIVES

- To understand the fundamentals wireless communication networks.
- To learn the architecture, network components, design issues, network protocols, technologies, standards and applications of WBAN, WLAN, WMAN, WWAN and Wireless Ad-hoc networks.
- To identify the various research issues in wireless networks.
- To understand the evolution of mobile technologies.
- To learn about the 4G LTE architecture and Wireless Network Security.

UNIT I FUNDAMENTALS OF WIRELESS COMMUNICATION NETWOR 9

Wireless Communication System: Media - Frequency Spectrum - Technologies - Channel Specifications - Types of Wireless Communication Systems - Basics of Wireless Networks: Wireless Switching Technology - Wireless Communication Problems - Wireless Network Reference Model - Wireless Networking Issues - Wireless Networking Standards.

UNIT II WBAN AND WPAN 9

Wireless Body Area Networks (WBAN): Network Architecture - Network Components - Design Issues - Network Protocols - WBAN Technologies - WBAN Applications, Wireless Personal Area Networks (WPAN): Network Architecture - WPAN Components -WPAN Technologies and Protocols - WPAN Applications.

UNIT III WLAN AND WMAN 9

Wireless Local Area Networks (WLAN): Network Components - Design Requirements of WLAN - Network Architecture - WLAN Standards - WLAN Protocols - IEEE 802.11p - WLAN Applications - Wireless Metropolitan Area Networks (WMAN): WMAN Network Architecture - Network Protocols - Broadband Wireless Networks - WMAN Applications.

UNIT IV WWAN AND WIRELESS ADHOC NETWORKS 9

Wireless Wide Area Networks (WWAN): Cellular Networks - Satellite Networks - WLAN versus WWAN - Interworking of WLAN and WWAN - WWAN Applications, Wireless Ad Hoc Networks: Mobile Ad Hoc Networks - Wireless Sensor Networks - Wireless Mesh Networks - Vehicular Ad Hoc Networks (VANETs) - Research Issues in Wireless Networks.

UNIT V 4G LTE NETWORKS AND WIRELESS NETWORK SECURITY 9

Evolution of Mobile Technologies, Long-Term Evolution (LTE): LTE Architecture - Protocol Layer Architecture - LTE Advanced - 5G Networks Overview, Wireless Network Security: Introduction - Wired Equivalent Privacy (WEP) - Wi-Fi Protected Access (WPA), Robust Secure Network (RSN), Virtual Private Network (VPN).

TOTAL PERIODS: 45

OUTCOMES

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

- Explain different classes of wireless networks.
- Compare the various research issues in wireless networks.
- Improve the design and development skills in wireless networks.
- Explain the characteristics of modern wireless and cellular communication networks.
- Outline the various security mechanisms and protocols in wireless communication networks.

TEXT BOOKS

1. Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, Wireless and Mobile Networks: Concepts and Protocols, Wiley-India, Second Edition, 2016.

REFERENCE BOOKS

1. Amjad Umar, Mobile Computing and Wireless Communications: Applications, Networks, Platforms, Architectures and Security, NGE Solutions, 2004.
2. Yi-Bing Lin, Imrich Chlamtac, “Wireless Mobile Architectures, John Wiley & Sons, Inc., 2001.
3. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005
4. William.C.Y.Lee, Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition,Tata Mc Graw Hill Edition ,2006.
5. C.K.Toh, AdHoc Mobile Wireless Networks, First Edition, Pearson Education, 2002

Course Code	Course Title	L	T	P	C
UIT1731	INTRODUCTION TO DEEP LEARNING	3	0	0	3

OBJECTIVES

- 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 9

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 11

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 8

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 9

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 8

Autoencoder, Generative Adversarial Networks, Deep Reinforcement Learning -Policy gradients, hard attention, Q-Learning, Actor-Critic, Case Study – Text-to-Image Synthesis using GAN.

TOTAL PERIODS: 45

OUTCOMES

After completing this course, the student should be able to

- Explain Deep Learning algorithms and their limitations
- Apply Deep Learning algorithms in practice

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 Code	Course Title	L	T	P	C
UIT1821	INFORMATION SEARCH AND RETRIEVAL	3	0	0	3

OBJECTIVES

- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing.
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval in searching and ranking.

UNIT I INTRODUCTION 8

Motivation, Basic Concepts, Practical Issues, Retrieval Process, Open Source IR Systems, History of Web Search, Web Characteristics, Impact of the web on IR, IR Versus Web Search, Components of a Search engine.

UNIT II MODELING 10

Taxonomy and Characterization of IR technique, Classic IR: Boolean Model - Vector Model - Probabilistic Models, Alternative models: Boolean model – Probabilistic model- Structured Text Retrieval Models, Retrieval performance evaluation.

UNIT III QUERIES AND TEXT OPERATIONS 9

Introduction, Keyword-based querying, Pattern matching, structural queries, Query operations: User relevance feedback – Automatic local and global analysis, Text operations: Document pre-processing – Document clustering – Text compression.

UNIT IV: INDEXING AND SEARCHING 9

Introduction, Inverted files, Other indices for text: Suffix trees and suffix arrays- Signature files, Boolean Queries, Sequential searching- Brute force- KMP- Boyer-Moore family - Suffix automaton, Pattern matching, Structural Queries.

UNIT V: PARALLEL AND DISTRIBUTED IR: 10

Introduction, Parallel IR: MIMD architecture – SIMD architecture, Distributed IR: Collection Partitioning - Source Selection - Query Processing, Case Study.

TOTAL PERIODS: 45

OUTCOMES

Upon completion of this course, the student should be able to

- Build an Information Retrieval system using the available tools.
- Design the various components of an Information Retrieval system.
- Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
- Design an efficient search engine and analyze the Web content structure.

TEXTBOOK

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, Modern Information Retrieval: The concepts and Technology behind Search, (ACM Press Books), Second Edition 2011.

REFERENCES

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Introduction to Information Retrieval, Cambridge University Press, First South Asian Edition 2012.
2. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts London, England, 2010.
3. Amy N. Langville and Carl. D. Meyer, Google's Page rank and beyond: Science of search engine rankings, Princeton University Press, 2006 http://www.jstor.org/stable/j.ctt7t8z9.
4. Peter Morville, and Louis Rosenfeld, Information Architecture for The World Wide Web: Designing Large-Scale Web Sites, O'Reilly, 2018.
5. Shivani Karwal, SEO Handbook for Beginners: Learn Search Engine Optimization With Smart Strategies to Dominate, Kindle Edition, 2018.

Course Code	Course Title	L	T	P	C
UIT1822	NATURAL LANGUAGE PROCESSING AND ITS APPLICATIONS	3	0	0	3

OBJECTIVES

- To learn the fundamentals of natural language processing.
- To learn the language models.
- To understand the levels of knowledge in language processing.
- To explore the learning algorithms for text processing.
- To understand the NLP applications.

UNIT I FUNDAMENTALS OF NLP 9

Human languages, natural language processing paradigms and applications. Text representation in computers, encoding schemes. Linguistics resources- Introduction to corpus, elements in balanced corpus, Treebank, WordNet. Management of linguistic data with NLTK. Language Model – N-gram Model, Smoothing Techniques.

UNIT II WORD LEVEL AND SYNTACTIC ANALYSIS 9

Word Level Analysis: Regular Expressions, Survey of Morphology, Word and Sentence Tokenization, Stemmer, Spelling Error Detection and correction, Word classes, HMM Part-of-Speech Tagging. Syntactic Analysis: Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs.

UNIT III SEMANTIC ANALYSIS 9

Semantic Analysis: Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labeling and Semantic Parsing, Word Similarity - thesaurus-based, distributional similarity. Discourse Processing: Reference Resolution, Anaphora Resolution Algorithms, Co-reference Resolution.

UNIT IV WORD EMBEDDINGS AND TEXT ANALYSIS 9

Word Embeddings - Skip-gram, CBOW, Word2Vec, GloVe: Text Classification techniques, Text Clustering techniques, Text Summarization -Singular Value Decomposition, Latent Semantic Analysis, Latent Dirichlet Allocation.

UNIT V ADVANCES IN TEXT PROCESSING 9

Deep Neural Networks for text processing - RNN, Bidirectional RNN, LSTM. Machine Translation: Classical MT, Statistical MT, Language Modelling, Named Entity Recognition, Relation Detection, Sentiment Analysis - A Case study using PyTorch.

TOTAL PERIODS: 45

OUTCOMES

Upon completion of this course, the student should be able to

- Explain the language models.
- Explain levels of knowledge in language processing.
- Apply learning algorithms for text processing.
- Apply NLP techniques to MT, IR and IE systems.

TEXTBOOK

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008.

REFERENCES

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Christopher D. Manning, Hinrich Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.
3. Nitin Indurkhya, Fred J. Damerau, "Handbook of Natural Language Processing", 2nd Edition, CRC Press, 2010.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
5. NLTK – Natural Language Tool Kit - http://www.nltk.org/.

Course Code	Course Title	L	T	P	C
UIT1823	WEB DESIGN AND MANAGEMENT	3	0	0	3

OBJECTIVES

- To understand the fundamentals of web framework.
- To know the concept of Java web framework.
- To know the concept of Express web framework.
- To learn the technologies of Python web framework.
- To get exposed to the concepts of Web framework.
-

UNIT I WEB DESIGN - HTML MARKUP FOR STRUCTURE 9

Working of Web - HTML Markup for Structure - Creating simple page - Marking up text - Adding Links - Adding Images - Table Markup - Forms - HTML5.

UNIT II CSS AND JAVASCRIPT 9

CSS - Formatting text - Colours and Background - Padding, Borders and Margins - Floating and positioning - Page Layout with CSS - Transition, Transforms and Animation – Java Script - Using Java Script.

UNIT III RESPONSIVE WEB DESIGN 9

Sass for Responsive Web Design - Marking Content with HTML5 - Mobile-First or Desktop-First - CSS Grids, CSS Frameworks, UI Kits, and Flexbox for RWD - Designing small UIs by Large Finger – Handling Images and Videos in Responsive Web Design.

UNIT IV WEB MANAGEMENT 9

Web Application Life Cycle Management- Project Definition, Discovery and Requirements collection, Project Schedule and Budgeting Running the project- Technical Documentation - Development, Communication, Documentation - QA and testing -Deployment - Support and operations.

UNIT V PROJECT CASE STUDY 9

Using HTML, CSS, JS or using Open source CMS like WordPress, design and develop a Website having Aesthetics, Advanced and Minimal UI Transitions based on the project - Host and manage the project live in any public hosting.

TOTAL: 45

OUTCOMES

Upon completion of the course, the student should be able to:

- Design Website using HTML CSS and JS.
- Design Responsive Sites.
- Manage, Maintain and Support Web Apps.

TEXT BOOK

1. Jennifer Niederst Robbins, Learning Web Design, O'REILLY 4th Edition

REFERENCES

1. Ricardo Zea, Mastering Responsive Web Design, PACKT Publishing, 2015
2. Justin Emond, Chris Steins, Pro Web Project Management, Apress,2011
3. Jon Duckett, HTML and CSS: Design and Build Websites, John Wiley and Sons, edition 2014
4. Jon Duckett, Jack Moore, JavaScript & JQuery: Interactive Front-End Web Development, John Wiley and Sons, edition 2014
5. Uttam K. Roy Web Technologies Oxford University Press, 13th impression, 2017
6. Wordpress - http://www.wpbeginner.com/category/wp-tutorials/

Course Code	Course Title	L	T	P	C
UGE1576	PROFESSIONAL ETHICS	3	0	0	3

OBJECTIVES

- To enable the students to create an awareness on Professional Ethics.
- To instill Moral and Social Values in the society and working environment.
- To instill loyalty and the quality to appreciate the rights of others.
- To inculcate Human Values.

UNIT I HUMAN VALUES 9

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation –Commitment – Empathy – Self-confidence – Character – Spirituality – Social Expectations.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion- Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Ethics in Research – Need for ethical clearance in Research - Codes of Ethics – A Balanced Outlook on Law – Challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 9

Multinational Corporations – Business Ethics -- Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership–Code of Conduct – Sample code of conduct (IEEE, IETE)-Corporate Social Responsibility.

TOTAL PERIODS: 45

OUTCOMES

Upon completion of the course, the student should be able to:

- Apply ethics in society.
- Explain the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXTBOOK

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi,2003.

REFERENCES

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India,New Delhi, 2004.
2. Charles B. Fleddermann, Engineering Ethics, Pearson Prentice Hall, New Jersey, 2004.
3. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, Engineering Ethics – Concepts and Cases, Cengage Learning, 2009.
4. John R Boatright, Ethics and the Conduct of Business, Pearson Education, New Delhi, 2003.
5. Edmund G Seebauer and Robert L Barry, Fundametals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.
6. Laura P. Hartman and Joe Desjardins, Business Ethics: Decision Making for Personal Integrity and Social Responsibility McGraw Hill education, India Pvt. Ltd.,New Delhi 2013.

Course Code	Course Title	L	T	P	C
UIT1824	NEXT GENERATION NETWORKS	3	0	0	3

OBJECTIVES

The primary objective of this course is

- Give overview of wireless network and Technologies
- To introduce the mobility management concepts.
- to explore the security concepts in NGN
- to apply the concepts in engineering and scientific applications.

UNIT I WIRELESS IP NETWORK ARCHITECTURES 9

Packet Data Networks - Network Architecture - Protocol Reference Model - Packet Data Protocols - Bearers and Connections for Packet Services - Packet Data Protocol (PDP) Context - Steps for a Mobile to Access 3GPP Packet - Switched Services-

UNIT II IP MULTIMEDIA SUBSYSTEMS AND APPLICATION 9

Signaling in IP Networks - Session Initiation Protocol (SIP)- Session Description Protocol (SDP) - 3GPP IP Multimedia Subsystem (IMS) - IMS Architecture- Mobile Station Addressing for Accessing the IMS - Reference Interfaces - Service Architecture - Registration with the IMS - Deregistration with the IMS - End-to-End Signaling Flows for Session Control - 3GPP2 IP Multimedia Subsystem (IMS).

UNIT III MOBILITY MANAGEMENT 9

Basic Issues in Mobility Management - Impact of Naming and Addressing on Mobility Management - Location Management - Packet Delivery to Mobile Destinations - Handoffs - Roaming - Mobility Management in IP Networks - Routing Area Update - Serving RNS Relocation - Hard Handoffs - Paging Initiated by Packet-Switched Core Network - Service Request Procedure - Handoff and Roaming Between 3GPP and Wireless LANs.

UNIT IV SECURITY 9

Different Facets of Security - Security Attacks - Cryptography - Public-Key Infrastructure (PKI) - Internet Security - IP Security (IPsec) - Authentication - Authorization - and Accounting (AAA) - Security in Wireless Networks - Security in GSM - Security in GPRS - Security in 3GPP - Security Principles - Security Architecture - Network Access Security - Network Domain Security.

UNIT V QUALITY OF SERVICE MODELS 9

Internet QoS - Integrated Services (Int-Serv) - Differentiated Services - QoS Challenges in Wireless IP Networks - QoS in 3GPP - UMTS QoS Architecture - UMTS QoS Management - UMTS QoS Classes - QoS Attributes (QoS Profile).

TOTAL : 45 PERIODS

OUTCOMES

After completing this course- students will be able to:

- Explain the emerging network technologies, how they are used, what their advantages - disadvantages are, and what their future offers
- Evaluate technologies with a view to judging their suitability for specific purposes, and recognizing associated risks.

TEXT BOOK

1. JYH – CHENG CHEN - TAO ZHANG - "IP – Based Next Generation Wireless Networks (Systems - Architectures and Protocols)".

REFERENCES

1. Wireless Communications and Networks, 3G and beyond, ITI Saha Misra, TMH.
2. Perahia, Next Generation Wireless Lans, Second Edition, Cambridge University Press, 2014.
3. Robert Wood, Next-Generation Network Services, Wiley, 2017.
4. Christian Makaya (Editor), Samuel Pierre, Emerging Wireless Networks: Concepts, Techniques and Applications, CRC Press, 2017.
5. Savo Glisic, Advanced Wireless Networks, 3ed: Technology and Business Models, Wiley, 2016.

Course Code	Course Title	L	T	P	C
UIT1825	**MICRO SERVICES**	**3**	**0**	**0**	**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 FUNDAMENTALS 9

SOA history, microservices benefits costs and best bractices, microservices concepts - services, communication, latency, bounded context, domains, BASE, API layer, logging, CD, hybrid architectures. Architectural options - design considerations, tradeoffs, edge services, devops

UNIT II JAVA MICROSERVICES 9

DDD, aggregates, repository, factory, modules, wrapping pages and controls, OTRS

UNIT III MICROSERVICES FOR DEVOPS 9

Service readiness - standardisation, testing, CI, CD, artifacts, versioning, discovery, documentation, ownership. Service scalability, reliability, and resilience - measures of safety, integration monitoring, logging, alerting, incidents, SLOs, capacity planning. Case study

UNIT IV MICROSERVICES WITH KUBERNETES 9

Design patterns for microservices, deployment patterns, runtime patterns, YAML, context, liveness probes, helm, proxying, metrics, logging, issue tracing

UNIT V SPRING BOOT MICROSERVICES 9

Yarn, Yeoman & JHipster, JHipster-generator options, batteries, archivecture. API gateway, creating a microservice, registry, endpoints, managing multiple microservices, deployment using docker, cloud deployment options

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the student should be able to:

- Explain the core concepts and benefits of microservices
- Develop microservices using Java
- Make use of microservices for devops
- Build microservices with kubernetes
- Create angular and spring boot microservices using JHipster

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 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 Code	Course Title	L	T	P	C
UIT1826	**SOCIAL NETWORK INFORMATION ANALYSIS**	**3**	**0**	**0**	**3**

OBJECTIVES

The primary objective of this course is to

- Model social network and mine the communities for knowledge
- Understand privacy preservation in Online Social Network
- Learn visualization of social networks.

UNIT I INTRODUCTION 9

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 – Text analysis

UNIT II COMMUNITY DISCOVERY AND NODE CLASSIFICATION 9

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 9

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 9

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 9

Introduction, Taxonomy of visualization: structural- semantic – temporal, Visualization and analytics: Centrality-based Visual Discovery and Exploration

TOTAL PERIODS: 45

OUTCOMES

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

- Explain the graph represention of knowledge
- Predict human behaviour in social web and related communities.
- Visualize social networks.

TEXT BOOK

1. Aggarwal, 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 Code	Course Title	L	T	P	C
UIT1827	INTERNET OF THINGS AND ITS APPLICATIONS	3	0	0	3

OBJECTIVES

The primary objective of this course is

- To understand the key concepts in sensors and IOT
- To understand the architecture of sensors to be used in the IOT applications.
- To understand the concepts and issues involved in designing low power protocols for IOT.
- To make the students to know about the different domains of applications for IOT.

UNIT I INTRODUCTION 9

Definition – phases – Foundations – Policy – Challenges and Issues – identification – security – privacy. Components in internet of things : Control Units – Sensors – Communication modules – Power Sources –Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks – Mobile Internet – Wired Communication

UNIT II SENSOR ARCHITECTURE AND FABRICATION 9

Basics of Sensors and actuators – examples and working principles of sensors and actuators – Cloud computing and IOT–Arduino/Equivalent Microcontroller platform– Setting up the

board - Programming for IOT –Reading from Sensors Communication: Connecting microcontroller with mobile devices – communication through bluetooth and USB – connection with the internet using WiFi / Ethernet

UNIT III IOT ARCHITECTURE 9

IOT Architecture: M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture- Clustering Principles in an Internet of Things Architecture - The Role of Context -Design Guidelines - Software Agents for Object – Data Synchronization -Types of Network Architectures

UNIT IV DIFFERENT PROTOCOLS IN IOT 9

Protocol: Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security- Design and development of Security and Privacy protocols related to IOT.

UNIT V IOT APPLICATIONS 9

The Meaning of DiY in the Network Society – Sensor - actuator Technologies and Middleware as a Basis for a DiY Service Creation Framework - Device Integration - Middleware Technologies Needed for a DiY Internet of Things Semantic Interoperability as a Requirement for DiY Creation**,** Case studies – Open Source e – Health sensor platform – Be Close Elderly monitoring – Other recent projects

TOTAL PERIODS : 45

OUTCOMES

After completing this course, students should be able to

- Apply the concepts of sensor for interfacing with the environment.
- Evaluate the performance of different types of applications for performance.
- Synthesize new IOT protocols by doing some minor changes.
- Apply the different architectural features of Embedded systems for IOT application design.
- Apply the concepts for sensors and IOT for health care applications.

TEXT BOOK

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands-on approach, Universities Press, 2015

REFERENCES

1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things, Springer, 2011.
2. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012.
3. Jan Holler, 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. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
5. Charalampos Doukas , Building Internet of Things with the Arduino, Create space, April 2002

Course Code	Course Title	L	T	P	C
UIT1828	DRONE TECHNOLOGY	3	0	0	3

OBJECTIVES

The primary objective of this course is

- To teach students to use and be inspired by Unmanned Aerial Vehicles (UAVs), more commonly known as drones.
- To understand the working principles of Drone
- To apply engineering and scientific applications.

UNIT I INTRODUCTION TO UNMANNED AERIAL VEHICLES 9

History of UAS- Introduction to fixed-wing UAVs, Introduction - Classification of UAV's Unmanned aircraft system elements. Case study of Predator C : Avenger - Advantages and Dis-advantages of UAV's - Applications of UAV's

UNIT II DRONE PROTOCOLS 9

Basic drone protocols for collecting data - Collect, process, control, clean up, and import Drone and Acoustic Doppler Profiler- Classify drone imagery in ArcGIS- discerning water from other habitat and land use categories.

UNIT III WORKING PRINCIPLE 9

Main controller- main sensor- electronic speed controller- receiver - motor-GPS- optical flow - ground station - saftey.

UNIT IV TYPES AND PAYLOAD 9

Drone Technology: Types, Payloads - Applications, Frequency Spectrum Issues and Future Development

UNIT V BUILDING THE DRONE 9

Basic drone terminology - choosing the drone frame-motor -propeller - propulsion- flight controller- putting all together.

TOTAL PERIODS : 45

OUTCOMES

After completing this course- students will be able to:

- Compare the different classes of the UAS
- Explain the technology of Drone
- Explain the essential foundational, design, integration and operational knowledge of drone

TEXT BOOK

1. Ben Rupert, Drones - the Ultimate Guide: How They Work, Learning to Fly, How to Fly, Building, CreateSpace Independent Publishing Platform, 2017.

REFERENCES

1. The Future of Drone Use: Opportunities and Threats from Ethical and Legal Perspectives. usters, Bart. (2016).
2. Douglas M. Marshall, Richard K. Barnhart, Eric Shappee, Michael Thomas Most. "Introduction to Unmanned Aircraft Systems, CRC Press, 2016.
3. Grégoire Chamayou, Drone Theory, Penguin, 2015.
4. Michael J. Boyle, Legal and Ethical Implications of Drone Warfare, Routledge; 2017.

5. Daisuke Nakazawa, David W. Wang, Farid Kendoul, Kenzo Nonami, and Satoshi Suzuki, Autonomous Flying Robots: Unmanned Aerial Vehicles and Micro Aerial Vehicles, Springer, 2010.

Course Code	Course Title	L	T	P	C
UIT1829	ADVANCED MICROPROCESSORS	3	0	0	3

OBJECTIVES

- To study the basic pipelining and RISC and Dataflow processors.
- To study and understand the CISC and multiple issue processors.
- To study and understand the Future processors that will use coarse-grain and Fine-grain parallelism
- To study, understand and apply the processor-in-memory and reconfigurable architecture.
- To study, understand and apply the architecture of Intel and Motorola processors.

UNIT I BASIC PIPELINING, RISC AND DATAFLOW PROCESSORS 9

The RISC Movement in Processor Architecture-Instruction Set Architecture-Basic Structure of a RISC Processor and Basic Cache MMU Organization-Basic Pipeline Stages-Pipeline Hazards and Solutions-RISC Processors-Dataflow Processors: Pure Dataflow, Augmenting Dataflow with Control-Flow.

UNIT II CISC AND MULTIPLE ISSUE PROCESSORS 9

A Brief Look at CISC Processor- Out-of-Order Execution- Dynamic Scheduling-Some CISC Microprocessors- Overview of Multiple-Issue Processors-I-Cache Access and Instruction Fetch-Dynamic Branch Prediction and Control Speculation-Decode-Rename-Issue and Dispatch-Execution Stages-Finalizing Pipelined Execution-State-of-the-Art Superscalar Processors-VLIW and EPIC Processors

UNIT III FUTURE PROCESSORS TO USE FINE-GRAIN COARSE-GRAIN PARALLELISM 9

Trends and Principles in the Giga Chip Era-Advanced Superscalar Processors-Super speculative Processors-Multiscalar Processors-Trace Processors-Data Scalar Processors-Chip Multiprocessors-Multithreaded Processors-Simultaneous Multithreading-Simultaneous Multithreading versus Chip Multiprocessor.

UNIT IV PROCESSOR-IN-MEMORY, RECONFIGURABLE AND ASYNCHRONOUS PROCESSORS 9

Processor-in-Memory-Reconfigurable Computing-Asynchronous Processors-Processors with multi-core architecture

UNIT V ADVANCED MICROPROCESSOR-CASE STUDIES 9

Intel Pentium Processors: Architecture, Register file, Instruction set, Addressing mode, Programming

TOTAL PERIODS : 45

OUTCOMES

After completing this course, the student should be able to

- Explain the data and control flow mechanisms
- Compare the modern day processors

- Choose a processor for the given application

TEXT BOOK

1. Dr. Jurij Silc, Dr. Borut Robic, Professor Dr. Theo Ungerer, Processor Architecture, From Dataflow to Superscalar and Beyond, Springer.

REFERENCE

1. Kai Hwang, "Advanced Computer Architecture", Tata McGrah Hill Publishing Company Ltd., 2000.
2. John A. Sharp, Data Flow Computing: Theory and Practice, Intellect Ltd, 1992.
3. Ali Hurson and Veljko Milutinovic, Creativity in Computing and DataFlow SuperComputing, Elsevier, 2017.
4. Sven-Ole Voigt, Dynamically Reconfigurable Dataflow Architecture for High Performance Digital Signal Processing on Multi FPGA Platforms, Shaker Verlag GmbH, Germany, 2008.
5. Chenxin Zhang (Author), Liang Liu (Author), Viktor Öwall, Heterogeneous Reconfigurable Processors for Real-Time Baseband Processing: From Algorithm to Architecture, Springer, 2016.

Course Code	Course Title	L	T	P	C
UIT1831	SOFT COMPUTING AND ITS APPLICATIONS	3	0	0	3

OBJECTIVES

- Understand the fundamentals of soft computing techniques - fuzzy systems, neural networks, genetic algorithms, and swarm intelligence.
- Learn to integrate intelligent systems technologies for engineering applications.

UNIT I FUZZY LOGIC 8

Introduction to Computational Intelligence, Uncertainty, Fuzzy sets and operations of fuzzy sets, Fuzzy rules and fuzzy inference, Fuzzy Expert Systems, Case Study

UNIT II NEURAL NETWORKS 10

Artificial neurons, activation functions, Supervised learning: single and multilayer Perceptron, backpropagation learning, recurrent neural networks, Unsupervised learning: self-organizing feature maps; Case Study

UNIT III GENETIC ALGORITHM 8

Genetic Algorithms - Chromosomes, fitness functions, and selection mechanisms, crossover and mutation, real life problem advances in GA

UNIT IV SWARM INTELLIGENCE AND OPTIMIZATION 9

Ant Colony Optimization, Particle Swarm Optimization, Simulated Annealing, Case Study

UNIT V ADVANCES AND APPLICATIONS 10

Reinforcement Learning, Hybrid systems: Neural Fuzzy Systems, GA tuned Fuzzy System; Applications: Speech systems; Image processing; Natural language processing

TOTAL PERIODS : 45

OUTCOMES

The student will be able to

- Explain how basic soft computing techniques work

- Develop some familiarity with current applications using soft computing techniques

TEXT BOOK

1. Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine by Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, Prentice Hall, 1997.

REFERENCES

1. Mohamad H. Hassoun, Foundamentals of Artificial Neural Networks, The MIT Press, 1995
2. R.J. Jr., Bauer, Genetic Algorithms and Investment Strategies, John Wiley & Sons, 1994.
3. Simon Haykin, Neural Networks: A Comprehensive Foundation, Macmillan College Publishing Company, 1994.
4. E. Cox, The Fuzzy Systems Handbook, Boston: AP Professional, 1998
5. F.F. Soulie and P. Gallinari (Editors), Industrial Applications of Neural Networks, Singapore; River Edge, NJ: World Scientific, 1998

Course Code	Course Title	L	T	P	C
UIT1832	C# AND .NET ESSENTIALS	3	0	0	3

OBJECTIVES

The student should be made to

- Understand the foundations of CLR execution.
- Learn the technologies of the .NET framework.
- Know the object oriented aspects of C#.
- Learn the database application development in .NET.
- Learn web based applications on .NET (ASP.NET).

UNIT I INTRODUCTION TO .NET FRAMEWORK 9

Introduction to the .NET Platform – Common Language Runtime(CLR) – The Common Type Specification(CTS) – The Common Language Specifications (CLS) – Assemblies - .NET Base Classes – CLR Debugger – Types of JIT Compilers – Security Manager.

UNIT II INTRODUCTION TO C# 9

Introducing C# – Data Types – Operators – Expressions – Branching and, Looping – Methods – Arrays – Array Class, Array List, String – String Builder – Structure and Enumerations, Boxing and Unboxing – Reflection – Interoperability – Attributes – Namespaces.

UNIT III OBJECT-ORIENTED PROGRAMMING IN C# 9

Encapsulation – Inheritance – Types of Inheritance – Polymorphism and Interfaces – Abstract class – Delegates and Events – Programming Threads – Multithreading and Synchronization – Exception Handling – Garbage Collection – Input and Output (Directories, Files, and Streams)

UNIT IV APPLICATION DEVELOPMENT ON .NET 9

ADO.NET for Database Programming with Datasets and Object Model – Windows Applications: Winforms – Winforms Namespace – Creating Winforms Applications –

Distributed applications with .NET - .NET remoting architecture - .NET and .COM – Marshalling - Deployment.

UNIT V WEB BASED APPLICATION DEVELOPMENT ON .NET 9

Programming web application with web forms – ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, – web.config – web services – passing datasets, returning datasets from web services, Building an XML web service – WSDL and SOAP, Web service with complex data types.

TOTAL PERIODS : 45

OUTCOMES

After completing this course, the student will be able to

- List the major elements of the .NET frame work
- Explain how C# fits into the .NET platform.
- Analyze the basic structure of a C# application
- Develop programs using C# on .NET
- Design and develop Web based applications on .NET
- Explain CLR.

TEXT BOOKS

1. Herbert Schildt, The Complete Reference: C# 4.0, Tata Mc Graw Hill, 2012.
2. Christian Nagel et al. Professional C# 2012 with .NET 4.5, Wiley India, 2012.

REFERENCES

1. Andrew Troelsen , Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010
2. Ian Griffiths, Matthew Adams, Jesse Liberty, Programming C# 4.0, Sixth Edition, O'Reilly, 2010.
3. Jesse Liberty, Programming C#, Second Edition, O'Reilly Press, 2002.
4. Robinson et al, Professional C#, Fifth Edition, Wrox Press, 2002.
5. Thuan Thai and Hoang Q. Lam, . NET Framework Essentials, Second Edition, O'Reilly, 2002.
6. Robert J.Oberg, Introduction to C# using .NET , PHI, 2002.

Course Code	Course Title	L	T	P	C
UIT1941	ANDROID APPLICATION DESIGN AND DEVELOPMENT	3	0	0	3

OBJECTIVES

The student should be made to:

- Know how to run an Android application on an emulator and on their own device.
- Learn the basic architecture of Android platform.
- Design and develop sophisticated mobile interfaces.
- Create mobile applications for the Android operating system that use basic and advanced phone features.
- Understand global, economical and societal impact to publish mobile Apps.

UNIT I ANDROID STUDIO ESSENTIALS 9

Setting up an Android Studio Development Environment - Creating an Example Android App - Android Studio User Interface - Creating an Android Virtual Device - Testing Android Studio Apps on a Physical Android Device.

UNIT II ANDROID BUILDING BLOCKS 9

Overview of the Android Architecture - Anatomy of an Android App - Understanding Android Application and Activity Lifecycles - Understanding Android Views, View Groups and Layouts - Designing User Interface using Android Studio Designer Tool.

UNIT III ACCESSING DATA ON ANDROID 9

Overview of Android SQLite Databases – Android TableLayout and TableRow – Android Content Providers – Accessing Cloud Storage using the Android Storage Access Framework.

UNIT IV GRAPHICS AND MULTIMEDIA IN ANDROID 9

Developing Android 2D Graphics Applications - Working with Animation -Developing Android 3D Graphics Applications - Using the Android NDK-Using Android Multimedia APIs.

UNIT V ADVANCED ANDROID APPS 9

Working with Google Maps and Location APIs - Android Telephony APIs - Android Networking - Integrating Web Services - Communicating with Remote Devices - Google Play Services - Distributing Apps on Google Play Store.

TOTAL PERIODS: 45

OUTCOMES

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

- Build their own App for Android devices, and publish applications in the Google Play Store.
- Design an adaptable user interfaces for mobile applications that share a common data model.
- Experiment with database to store data locally, and much more.
- Manage user data and multimedia on a mobile device via the Android framework libraries.

TEXTBOOK

1. Neil Smyth, Android Studio Development Essentials: Android 5 Edition, Second Edition, CreateSpace Independent Publishing Platform, 2014.

REFERENCES

1. Joseph Annuzzi Jr., Lauren Darcey, Shane Conder, Advanced Android Application Development (Developer's Library), Addison-Wesley Professional, Fourth Edition, 2014.
2. Erik Hellman Android Programming: Pushing the Limits, Wiley, First Edition, 2013.
3. Clifton Craig, Adam Gerber, Learn Android Studio: Build Android Apps Quickly and Effectively, First Edition, Apress, 2015.
4. Charlie Collins, Michael Galpin, Matthias Kaeppler ,Android in Practice, Manning Publications; First Edition, 2011.
5. Dawn Griffiths, David Griffiths, Head First Android Development: A Brain-Friendly Guide, Shroff/O'Reilly, 2017.

Course Code	Course Title	L	T	P	C
UIT1942	MUSIC ANALYSIS	3	0	0	3

OBJECTIVES

- Understand the characteristics of the auditory system
- Understand the time domain and frequency domain characteristics of music signals
- Familiarize with techniques for music synthesis and effects processing
- Distinguish the spectral characteristics of musical instruments

UNIT I INTRODUCTION - AUDITORY SYSTEM 9

The Sine Tone. Characteristics of the Auditory System: Duration, Pitch, Amplitude and Sound levels (SIL, SPL, JND), Equal Loudness Curves, Auditory Masking. Sampling and Quantization. Aliasing, Dithering.

UNIT II ANALYSIS - TIME DOMAIN 9

Time Domain Characteristics of Music Signals: Transient, Decay, Echo and Reverberation. Time Domain Processing: ADSR Envelope. Fundamental Frequency Computation (Zero Crossing Rate, Autocorrelation and Cross Correlation), Sampling Rate Conversion, Overlap and Add.

UNIT III ANALYSIS - FREQUENCY DOMAIN 9

Frequency Domain Characteristics of Music Signals: Pitch and Harmonics, Musical intervals. Frequency Domain Processing: Discrete Fourier Transform, Spectrograms, Z Transform, Poles and Zeros, Stability and the Unit Circle, Inverse Z Transform. MFCC: Theory and Application.

UNIT IV MUSIC SYNTHESIS AND EFFECTS PROCESSING 9

Synthesis Techniques: Wavetable Synthesis, Granular Synthesis, Additive Synthesis, Subtractive Synthesis. Time Domain Effects Processing: Dynamic Compressor and Expander, Distortion, Delays.

UNIT V SPECTRAL CHARACTERISTICS OF MUSICAL INSTRUMENTS 9

Dynamic and Spectral Characteristics: Trumpet (Brass Instrument), Clarinet (Woodwind Instrument), Violin and Double Bass (String Instruments), Grand Piano (Lid Open, Closed and Half Open), Drums (Percussion Instrument). Research Topics: Salient Feature Extraction. Music Information Retrieval.

OUTCOMES

Upon completion of the course, the student must be able to

- Interpret and represent the characteristics of the auditory system
- Explain the time domain and frequency domain analysis of music signals
- Analyze the spectral characteristics of musical instruments, and techniques for music synthesis

TEXT BOOKS

1. Tae Hong Park, Introduction to digital signal processing: Computer musically speaking, World Scientific, 2009.
2. Jürgen Meyer, Acoustics and the performance of music: Manual for acousticians, audio engineers, musicians, architects and musical instrument makers. Springer Science & Business Media, 2009.

REFERENCES

1. Meredith David, Computational Music Analysis, Springer, 2016.
2. Claus Weihs, Dietmar Jannach, Igor Vatolkin, Guenter Rudolph, Music Data Analysis: Foundations and Applications, Chapman & Hall/CRC Computer Science & Data Analysis, 2016.

Course Code	Course Title	L	T	P	C
UIT1943	INFORMATION SECURITY	3	0	0	3

OBJECTIVES

- To understand the basics of Information Security.
- To know the legal, ethical and professional issues in Information Security.
- To know the aspects of risk management.
- To know the technological aspects of Information Security.

UNIT I SECURITY REQUIREMENTS AND SECURE SDLC 9

Introduction to Information Security: CIA requirements- security model, Components of an information system - Securing the components - Balancing security and access - Security in SDLC.

UNIT II THREATS, ATTACKS AND ISSUES 9

Need for security - Business needs - Threats – Attacks – Legal – Ethical and professional issues.

UNIT III RISK MANAGEMENT 9

Planning for Security, Risk management: Identifying and assessing risk - Assessing and mitigating risk.

UNIT IV LOGICAL DESIGN 9

Blueprint for Security, Information Security Policy, Standards and Practices, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

UNIT V PHYSICAL DESIGN 9

Security Technology, IDS, Scanning and Analysis Tools, Access Control Devices, Physical Security, Security and Personnel.

TOTAL PERIODS: 45

OUTCOMES

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

- Explain the basics of Information security.
- Illustrate the legal, ethical and professional issues in Information security.
- Design and implementation of security techniques.
- Choose appropriate security technology for Risk Control.
- Choose appropriate Physical, Personnel and Operational Security.

TEXTBOOK

1. Michael E Whitman and Herbert J Mattord, Principles of Information Security, Sixth Edition, Cengage Learning, 2017.

REFERENCES

1. Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
2. Stuart McClure, et al., Hacking Exposed, Tata McGraw- Hill, Sixth edition2009. 4. Matt Bishop, Computer Security Art and Science, Pearson/PHI, 2002.
3. Kannan and Chithra Selvaraj, Bank of the Future, Minimizing Technological Risks: Maximizing Returns, Wolters Kluwer publications, 2018.

4. Sanjit K. Mitra, Digital Signal Processing – A Computer-based Approach, Third Edition, Tata McGraw-Hill, 2009.
5. Dmitri Tymoczko, A Geometry of Music: Harmony and Counterpoint in the Extended Common Practice, Oxford University Press, 2011.

Course Code	Course Title	L	T	P	C
UIT1041	INTRODUCTION TO QUANTUM COMPUTING	3	0	0	3

OBJECTIVES

The primary objective of this course is to

- Introduce quantum computing
- Introduce quantum algorithms

UNIT I INTRODUCTION TO REVERSIBILITY 9

Toffoli Gate, Fredkin Gate, Building Reversible Gates from Reversible Gates, Analysis of Reversibility, Energy and Reversibility

UNIT II BASIC LINEAR ALGEBRA 9

Vector spaces, Basis and dimension, Inner products, Ortho normality, Gram-Schmidt orthogonalization, Bra-Ket formalization, Hilbert spaces, Products, Tensor products, Matrices, Complex spaces, Hadamard Matrices, Fourier matrices, Pauli matrices, Hermitian, Unitary, and normal operators

UNIT III INTRODUCTION TO QUANTUM COMPUTING 9

Doubly Stochastic Matrices, System of Qubits, Qubits and measurement, Entanglement, Single Qubit gates, controlled gates, Gate decomposition

UNIT IV QUANTUM ALGORITHMS 9

Deutsch algorithm, Deutsch - Jozsa algorithm, Simon algorithm, Shor algorithm, Grover algorithm

UNIT V REALIZATION OF QUBITS 9

ntroduction to Two level Atom Hardware, Introduction to Cavity QED Hardware, Quantum Eraser

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the reversible computing systems
- Explain quantum bits and their behaviour
- Contrast the classical and quantum algorithms
- Experiment with the quantum algorithms

TEXT BOOK

1. Vincent Moret-Bonillo, Adventures in computer science: From classical bits to quantum bits, Springer, 2017

REFERENCE

1. Goong Chen, David Church, Berthold-Georg Englert, Carsten Henkel, Bernd Rohwedder, Marlan Scully, and M Suhail Zubairy, "Quantum Computing Devices", Chappman & Hall, 2007.

2. David McMahon, Quantum computing explained, Wiley-Interscience, John Wiley & Sons, Inc., 2008.
3. Richard Lipton, and Kenneth W Regan, Quantum algorithms via linear algebra, MIT Press, 2014.
4. Scott Anderson, Quantum computing since Democritus, Cambridge university press, 2013.
5. Kalyan S. Perumalla, Introduction to Reversible Computing, CRC Press, 2014.

Course Code	Course Title	L	T	P	C
UIT1042	USER INTERFACE DESIGN	3	0	0	3

OBJECTIVES

The primary objective of this course is to:

- Analyze and model requirements and constraints for the purpose of designing and implementing user interfaces for software applications
- Design and implement a user interface based on modeling or requirements specification
- Participate in a team to design and implement a user interface based on modeling or requirements specification.

UNIT I INTRODUCTION 9

Introduction – Importance of the user interface – Graphical user interface: Direct manipulation, Graphical system, Characteristics – Web user interface: Popularity, Characteristics, Principles.

UNIT II UI DESIGN PROCESS 9

User interface design process: Obstacles, Usability, Human characteristics in design - Human consideration in design – Develop system menus and navigation schemes: Structures of menus, Functions of menus, Content of menus, Formatting, Phrasing the menu, Selecting menu choice, Navigating menus, Graphical menus.

UNIT III WINDOWS 9

Window characteristics – Components – Presentation Styles – Types – Window managements – Organizing window functions – window operations – Web systems – Characteristics of Device–based controls Characteristics – Screen–based Controls: Operable Controls, Text Boxes, Selection Controls.

UNIT IV MULTIMEDIA 9

Text for web pages – Effective feedback – Guidance and assistance – Internationalization – Accessibility – Icons – Multimedia – Colors.

UNIT V WINDOWS LAYOUT 9

Organizing and Laying out screens – Test: Usability testing, scope of testing, Prototypes, Kinds of tests – Retest.

TOTAL PERIODS : 45

OUTCOMES

After completing this course, students should demonstrate competency in the following topics:

- Make use of software and prototyping tools to design user interfaces that take into account human capabilities and constraints, users' needs and usability goals
- Design functional user interface prototypes based on the design process
- Evaluate the usability of a software application

TEXTBOOK

1. Wilbent. O. Galitz ,The Essential Guide to User Interface Design, John Wiley & Sons, 2001.

REFERENCES

1. Ben Sheiderman, Design The User Interface, Pearson Education, 1998.
2. Alan Cooper, The Essential Of User Interface Design, Wiley – Dream Tech Ltd., 2002.
3. Ben Shneiderman, Designing for Effective Human/Computer Interaction, Pearson, 2010.
4. Jenifer Tidwell, Designing Interfaces, Second Edition, O′Reilly publishers, 2011.
5. Patrick Marchand, Graphics and GUIs with MATLAB, Chapman and Hall/CRC, 2002.

Course Code	Course Title	L	T	P	C
UIT1043	ARTIFICIAL NEURAL NETWORKS	3	0	0	3

OBJECTIVES

To study

- Supervised Learning in ANNs
- Unsupervised Learning in ANNs
- Probabilistic Learning in ANNs
- Deep Learning in ANNs

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

History - artificial and biological neural networks - artificial intelligence and neural networks , Biological neurons, McCulloch-Pitt model of single neuron, Different neural network models

UNIT II ACTIVATION FUNCTIONS AND LEARNING 9

Activation functions (AF) – Need for non-linear AF – Derivative of AF, Least mean square algorithm, Gradient Descent for neural networks - Learning rates, Learning Rules – Hebbian Learning, Oja's rule, PCA, Reinforcement Learning.

UNIT III SINGLE LAYER AND MULTILAYER PERCEPTRONS 9

Perceptron , Multilayer Perceptrons - the XOR problem, Back-propagation algorithm, Radial-Basis Function Networks – Interpolation, Regularisation, Learning strategies

UNIT 1V UNSUPERVISED AND PROBABILISTIC NETWORKS 9

Unsupervised networks - Kohonen's Self-organising map, learning vector quantisation, Adaptive resonance Theory, Probabilistic Networks - Hopfield Net, Boltzman machine, Autoencoders.

UNIT V DEEP NEURAL NETWORKS 9

Why Deep Feed Forward networks?, Regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.

TOTAL PERIODS : 45

OUTCOMES

At the end of the course, the student is expected to

- Compare the differences between networks for supervised and unsupervised learning
- Design single and multi-layer feed-forward neural networks
- Develop and train radial-basis function networks
- Develop an understanding of deep neural networks

TEXT BOOK

1. C. M. Bishop, *Neural Networks and Pattern Recognition*, Oxford University Press (Indian Edition), 2003.

REFERENCES

1. Simon Haykin, *Neural Networks. A Comprehensive Foundation.*, Second Edition, Prentice-Hall, Inc., New Jersey, 1999.
2. R.O.Duda, P. E. Hart and D. G. Stork, *Pattern Classification*, John Wiley, 2002
3. B. Yegnanarayana, *Artificial Neural Networks*, Prentice-Hall India, 2005.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
5. Stuart Russell and Peter Norvig AI – A Modern Approach, 3rd Edition, Pearson Education 2010.