

DELHI TECHNOLOGICAL UNIVERSITY

SCHEME OF EXAMINATION AND COURSE CURRICULUM

B. Tech. (COMPUTER ENGINEERING)

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SCHEME FOR B.TECH. FIRST SEMESTER (COMPUTER ENGINEERING)

S.No.	Course No.	Subject	L-T-P	Evaluation		Total Marks	Credit Type
				Sessional	End		
TH1	AM 101	Mathematics-1	3 1 0	30	70	100	4H
TH2	HU 102	Communication skills	2 1 0	30	70	100	3H
TH3	AP 103	Applied Physics-I	4 0 0	30	70	100	4H
TH4	AC 104	Applied Chemistry	3 1 0	30	70	100	4H
TH5	EE 105	Electrical Science	3 1 0	30	70	100	4A
TH6	IT 106	Fundamentals of Information Technology	2 1 0	30	70	100	3A
PR1	AP 107	Applied Physics-I Lab	0 0 2	30	70	100	2H
PR2	AC 108	Applied Chemistry Lab	0 0 2	30	70	100	2H
PR3	EE 109	Electrical Science Lab	0 0 2	30	70	100	2A
PR4	IT 110	Fundamental of Information Technology Lab	0 0 2	30	70	100	2A
	TOTAL		30 hrs			1000	30

SCHEME FOR B.TECH. SECOND SEMESTER (COMPUTER ENGINEERING)

S.No.	Course No.	Subject	L-T-P	Evaluation		Total Marks	Credit Type
				Sessional	End		
TH1	AM 111	Mathematics-II	3 1 0	30	70	100	4H
TH2	EN 112	Environmental Sciences	2 0 0	30	70	100	2H
TH3	AP 113	Applied Physics-II	4 0 0	30	70	100	4H
TH4	AP-AC 114	Engineering Materials	4 0 0	30	70	100	4H
TH5	ME 115	Basic Mechanical Engineering	4 0 0	30	70	100	4A
TH6	CO 116	Programming Fundamentals	2 0 0	30	70	100	2A
PR1	AP 117	Applied Physics-II Lab	0 0 2	30	70	100	2A
PR2	CO 118	Programming Lab	0 0 2	30	70	100	2A
PR3	ME 119	Engineering Graphics	0 0 3	30	70	100	3A
PR4	PE 120	Mechanical workshop	0 0 3	30	70	100	3A
	TOTAL		30 hrs			1000	30

- A Allied Engineering
C Core (include major project and practical training also)
H Humanities, Social Studies and Basic Sciences
M Mandatory

THIRD SEMESTER (COMPUTER ENGINEERING)

S.No.	Course No.	Subject	L-T-P	Evaluation		Total Marks	Credit Type
				Sessional	End		
TH-1	COE-201	Object Oriented Programming	3 1 0	30	70	100	4 C
TH-2	COE-202	Analog Electronics	3 1 0	30	70	100	4 A
TH-3	COE-203	Data Structures	3 1 0	30	70	100	4 C
TH-4	COE-204	Digital Systems Design	3 1 0	30	70	100	4 A
TH-5	COE-205	Discrete Mathematics	3 1 0	30	70	100	4 A
TH-6	COE-206	Information Theory and Coding	3 0 0	30	70	100	3 C
PR-1	COE-207	Object Oriented Programming Lab	0 0 2	30	70	100	2 C
PR-2	COE-208	Analog Electronics Lab	0 0 2	30	70	100	2 A
PR-3	COE-209	Data Structures Lab	0 0 2	30	70	100	2 C
	COE-210	Self study Seminar-I	0 0 1	0	100	100	1 C
	TOTAL		30 hrs			1000	30

FOURTH SEMESTER (COMPUTER ENGINEERING)

S.No.	Course No.	Subject	L-T-P	Evaluation		Total Marks	Credit Type
				Sessional	End		
TH-1	COE-211	Data Base Management Systems	3 1 0	30	70	100	4 C
TH-2	COE-212	Computer System Organization	3 1 0	30	70	100	4 C
TH-3	COE-213	Operating Systems Design	3 1 0	30	70	100	4 C
TH-4	COE-214	Algorithms Design and Analysis	3 1 0	30	70	100	4 C
TH-5	COE-215	Software Engineering	3 1 0	30	70	100	4 C
TH-6	COE-216	Engineering Economics	3 0 0	30	70	100	3 A
PR-1	COE-217	Database Management System Lab	0 0 2	30	70	100	2 C
PR-2	COE-218	Computer System Organization Lab.	0 0 2	30	70	100	2 C
PR-3	COE-219	Operating Systems Lab.	0 0 2	30	70	100	2 C
	COE-220	Self Study Seminar-II	0 0 1	100	0	100	1 C
	TOTAL		30 hrs			1000	30

- A Allied Engineering
C Core (include major project and practical training also)
H Humanities, Social Studies and Basic Sciences
M Mandatory

FIFTH SEMESTER (COMPUTER ENGINEERING)

S.No.	Course No.	Subject	L-T-P	Evaluation		Total Marks	Credit Type
				Sessional	End		
TH-1	COE-301	Computer Graphics	3 1 0	30	70	100	4 C
TH-2	COE-302	Simulation and Modeling	3 1 0	30	70	100	4 C
TH-3	COE-303	Theory of Computation	3 1 0	30	70	100	4 C
TH-4	COE-304	Microprocessors and Interfacing	3 1 0	30	70	100	4 C
TH-5	COE-305	Computer Networks	3 1 0	30	70	100	4 C
PR-1	COE-306	Computer Graphics Lab	0 0 2	30	70	100	2 C
PR-2	COE-307	Networking Lab.	0 0 2	30	70	100	2 C
PR-3	COE-308	Microprocessors Lab.	0 0 2	30	70	100	2 C
	COE-309	Minor Project I		0	200	200	4 M
Industrial Training (Duration of 4 weeks to be carried out after V Semester exam)							
	TOTAL		30 hrs			1000	30

SIXTH SEMESTER (COMPUTER ENGINEERING)

S.No.	Course No.	Subject	L-T-P	Evaluation		Total Marks	Credit Type
				Sessional	End		
TH-1	COE-311	Advanced Computer Architecture	3 1 0	30	70	100	4 C
TH-2	COE-312	Compiler Design	3 1 0	30	70	100	4 C
TH-3	COE-313	Web Technology and Java Programming	3 1 0	30	70	100	4 C
TH-4	COE-314	Information and Network Security	2 0 0	30	70	100	4 C
TH-5	COE-315	Mobile Computing	3 1 0	30	70	100	4 C
PR-1	COE-316	Web Programming Lab.	0 0 2	30	70	100	2 C
PR-2	COE-317	Compiler Design Lab.	0 0 2	30	70	100	2 C
PR-3	COE-318	Minor Project II	0 0 2	60	140	200	4 M
PR-4	COE-319	Industrial Training Viva-Voce (Based on Industrial training of 4 weeks duration carried out after Vth Semester exams)		30	70	100	2 M
Industrial Training (Duration of Six-Eight weeks to be carried out after VI Semester exam.)							
	TOTAL		30 hrs			1000	30

A Allied Engineering

C Core (include major project and practical training also)

H Humanities, Social Studies and Basic Sciences

M Mandatory

Note:

- Industrial training of 4 weeks during winter vacation after 5th Semester and 8 Weeks during summer vacation after 6th Semester.

SEVENTH SEMESTER (COMPUTER ENGINEERING)

S.No.	Course No.	Subject	L-T-P	Evaluation		Total Marks	Credit Type
				Sessional	End		
TH-1	COE-401	Artificial Intelligence	3 1 0	30	70	100	4 C
TH-2	COE-402	Industrial Organization and Managerial Economics	3 1 0	30	70	100	4 A
TH-3	COE-403	Elective I	3 1 0	30	70	100	4 C
TH-4	COE-404	Open Elective I	3 1 0	30	70	100	4 C
PR-1	COE-405	Artificial Intelligence Lab.	0 0 3	30	70	100	2 C
PR-2	COE-406	Elective Lab-I	0 0 3	30	70	100	2 C
PR-3	COE-407	Major Project (Part-1)	0 0 2	90	210	300	6 M
PR-4	COE-408	Industrial Training Viva-Voce –II (Based on Industrial Training of duration Six – Eight weeks, carried out after VI semester exam)	0 0 2	30	70	100	4 M
	TOTAL		30 hrs				

EIGHTH SEMESTER (COMPUTER ENGINEERING)

S.No.	Course No.	Subject	L-T-P	Evaluation		Total Marks	Credit Type
				Sessional	End		
TH-1	COE-411	Data Warehousing and Mining		30	70	100	4 C
TH-2	COE-412	Elective II		30	70	100	4 C
TH-3	COE-413	Open Elective-II		30	70	100	4 C
PR-1	COE-414	Data Mining-Lab		30	70	100	3 C
PR-2	COE-415	Elective Lab-II		30	70	100	3 C
PR-3	COE-417	Self Study Seminar-III		100	-	100	2 C
PR-4	COE-416	Major Project II		-	-	400	10 M
	TOTAL		30 hrs			1000	30

- A Allied Engineering
C Core (include major project and practical training also)
H Humanities, Social Studies and Basic Sciences
M Mandatory

Note:

- Industrial training of 4 weeks during winter vacation after 7th Semester and 8 Weeks during summer vacation after 8th Semester.

Departmental Elective – I	Open Elective – I
COE- 403-1 Distributed Computing Systems COE-403-2 Advanced Data Structures COE-403-3 E-Commerce COE-403-4 Computer Vision COE-403-5 Real Time Systems COE-403-6 Machine Learning COE-403-7 Natural Language Processing COE-403-8 Selected Topics	COE-404-1 Computational Methods COE-404-2 Optimization Techniques COE-404-3 Digital Image Processing COE-404-4 Neural Network and Fuzzy Logic COE-404-5 Data Compression COE-404-6 Digital Signal Processing COE-404-7 Selected Topics
Departmental Elective – II	Open Elective – II
COE-412-1 Advanced Computer Networks COE-412-2 Advanced Database Management Systems COE-412-3 Distributed Algorithms COE-412-4 Grid and Cluster Computing COE-412-5 Bioinformatics COE-412-6 Virtual Reality COE-412-7 Pattern Recognition COE-412-8 Selected Topics	COE-413-1 Quantum Computing COE-413-2 Multimedia Technology and Applications COE-413-3 Robotics COE-413-4 Fault Tolerant and Reliable System Design COE-413-5 Optical Networks COE-413-6 VLSI Design COE-413-7 Embedded Systems COE-413-8 Selected Topics

AM-101 Mathematics – I	L T P	Credits
	3 1 0	4

UNIT I

Infinite series: Tests for convergence of series (comparison, ratio, root, integral, Raabe's, logarithmic), Alternating series, Absolute convergence, Conditional convergence.

UNIT II

Calculus of single variable: Taylor's & Maclaurin's expansion, Radius of curvature, applications of definite integral to area, arc length, surface area and volume (in Cartesian, parametric and polar co-ordinates).

UNIT III

Calculus of several variables: Partial differentiation, Euler's theorem, total differential, Taylor's theorem, Maxima-Minima, Lagrange's method of multipliers, Application in estimation of error and approximation.

UNIT IV

Multiple Integrals: Double integral (Cartesian and polar co-ordinates), change of order of integration, triple integrals (Cartesian, cylindrical and spherical co-ordinates), Gamma and Beta functions. Applications of multiple integration in area, volume, centre of mass, and moment of inertia.

UNIT V

Vector Calculus: Continuity and differentiability of vector functions, Scalar and vector point function, Gradient, Directional derivative, divergence, curl and their applications. Line integral, surface integral and volume integral, applications to work done by the force. Applications of Green's, Stoke's and Gauss divergence theorems.

Text Books/Reference Books:

1. "Advanced Engineering Mathematics" by Alan Jeffery ; Academic Press
2. "Calculus and Analytic Geometry" by Thomas/Finney; Narosa.
3. "Advanced Engineering Mathematics" by Kreyszig; Wiley.
4. "Advanced Engineering Mathematics" by Taneja ; I K international
5. "Advanced Engineering Mathematics" by Jain/Iyenger; Narosa.

HU-102 Communication Skills	L T P	Credits
	2 1 0	3

UNIT I

Functional English:

- (A) Parts of speech; Tense and concord; Conditional clauses; Question tags & short responses; Punctuation; Common errors.
- (B) Vocabulary and Usage: Synonyms & Antonyms; One word substitutions; Words often confused; Idioms / Idiomatic expressions.

UNIT II

Basics of Writing:

- (A) Presentation of Technical Information: Technical description of simple objects, tools, appliances; Processes and operations; Scientific Principles; Definitions ; Interpretation of Visual Data (graph, charts etc)
- (B) Writing of: Paragraph; Summary and Abstract; Taking and Making Notes.
- (C) Comprehension of Unseen Passages based on reading exercises like Skimming, Scanning and Inference making.

UNIT III

Oral Communication: Phonetics: Speech Sounds and their articulation; Phonemes, syllable, Stress, Transcription of Words and Simple Sentences; Presentation and Seminar; Language Lab Practice for Oral Communication.

UNIT IV

Texts for Appreciation and Analysis:

- (A) Wings of Fire by APJ Abdul Kalam
- (B) The Fortune at the Bottom of the Pyramid by C.K. Prahalad.
- (C) The Branded (Uchalya) by Laxman Gaikwad
- (D) Geetanjali by Ravindranath Tagore.

Text Books/Reference Books:

1. Day, Robert A. Scientific English: A Guide for Scientists and Other Professionals. UP.
2. Maison Margaret, Examine Your English, New Delhi: Orient Longman.
3. Tikoo M.L., A.E. Subramaniam and P.R. Subramaniam. Intermediate Grammar Usage and Composition. Delhi: Orient Longman.
4. Weiss, Edmond H. Writing Remedies: Practical Exercises for Technical Writing. University Press.
5. Lesikar and Flatley. Business Communications. New Delhi, Biztantra Press.
6. O'Connor, Better English Pronunciation, Cambridge: Cambridge University Press.
7. Gaikwad, Laxman, The Branded, Delhi: Sahitya Akademi.
8. Kalam, APJ Abdul, Wings of Fire, Delhi: University Press.
9. C.K. Prahalad, The Fortune at the Bottom of the Pyramid, Wharton School Publishing.
10. Rabindranath Tagore, Gitanjali, Filiquarian Publishing, LLC.

AP – 103 Applied Physics - I	L T P	Credits
	3 1 0	4

UNIT I

Relativity : Review of concepts of frames of reference and Galilean transformation equation, Michelson – Morley experiment and its implications, Einstein's special theory of relativity, Lorentz transformation equations, Law of addition of velocities, Mass variation with velocity, Concept of energy and momentum, Mass energy relation.

UNIT II

Oscillations, waves : Damped and forced oscillations, Resonance (amplitude and power), Q – factor, Sharpness of resonance. Equations of longitudinal and transverse waves and their solutions, Impedance, Reflection and transmission of waves at a boundary, Impedance matching between two medium.

UNIT III

Physical optics: Interference by division of wave front and amplitude, Multiple beam interference and Fabry-Perot interferometer, Fresnel diffraction through a straight edge, Fraunhofer diffraction, Zone plate, single slit and N-slit / grating, Resolving power of telescope, prism and grating. Polarization by reflection and by transmission, Brewster's law, Double refraction, elliptically and circularly polarized light, Nicol prism, Quarter and half wave plates.

UNIT IV

Optical Instruments: Cardinal points of co-axial lens systems, spherical and chromatic aberrations and their removal, Huygens and Ramsden's eyepiece.

UNIT V

Laser optics: Coherence and coherent properties of laser beams, Brief working principle of lasers, Spontaneous and stimulated emission, Einstein's co-efficient, Ruby laser, He-Ne laser.

UNIT VI

Optical Fiber: Classification of optical fibers, Refractive index profile, Core cladding refractive index difference, Numerical aperture of optical fiber, Pulse dispersion in optical fiber (ray theory).

Text Books/Reference Books:

1. "Physics of Vibrations and Waves" by H.J. Pain.
2. "Vibrations and Waves" by A.P. French.
3. "Perspective of Modern Physics" by Arthur Beiser.
4. "Optics" by A. Ghatak.
5. Berkley Physics Course Vol – 1.

AC-104 Applied Chemistry	L T P	Credits
	3 1 0	4

UNIT I

(a) **Conventional Analysis**: Volumetric Analysis, Types of titrations, Theory of indicators.

(b) **Spectral Analysis**: Electromagnetic radiation, Lambert-Beer's Law, UV-VIS, IR, instrumentation & applications.

UNIT II

Thermal Methods of Analysis: Principle, working and applications of Thermo-gravimetry, Differential thermal analysis and Differential scanning calorimetry.

UNIT III

(a) **Polymers**: Monomer & polymer, functionality and Degree of Polymerization. Mechanism of polymerization. Molecular weights of polymers. Methods of polymerization. Industrial production of PE and PF resins. Industrial applications of polymers.

(b) **Bio-molecules**: Classification, Structure, physical and chemical properties of Amino-acids, Peptides and Proteins, Carbohydrates, Cellulose and its derivatives, RNA, DNA. Introduction to Bio-degradable Polymers.

UNIT IV

Electrochemistry : Electrochemical cells, components, characteristics of batteries. Primary and Secondary battery systems, Zinc-Carbon cells, Lead storage and lithium batteries. Fuel Cells, Electro-deposition, Electrical and chemical requirements. Electroplating bath and linings. Agitation, Circulation and filtration equipment. Plating of copper, gold and rhodium.

UNIT V

Phase Equilibrium: Definitions of Phase, component and degree of freedom, Gibb's phase rule. One component systems: Water and sulphur. Two component systems: Pb-Ag and Cu-Ni system.

Univ VI

Green Chemistry: Introduction, Goals & Significance of Green Chemistry. Reagents, solvents and catalysts for green synthesis. Principles of Green Chemistry, Evaluation of feedstocks, reaction types and methods. Future trends in Green Chemistry.

Text Books/Reference Books:

1. "Thermal Analysis" by T. Hatakeyama, F.X. Quinn; Wiley.
2. "Inorganic Quantitative Analysis" by A.I. Vogel.
3. "Instrumental Method of Analysis" by Skoog D.A.; HRW International.
4. "Green Chemistry: Theory & Practice" by P.T. Anastas & JC Warner; Oxford Univ Press.
5. "Polymer Science and Technology" by Billmeyer; John Wiley.
6. "Polymer Science and Technology" by Fried; Prentice Hall.

EE – 105 Electrical Science	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Role and importance of circuits in Engineering, concept of fields, charge, current, voltage, energy and there interrelationship. V-I characteristics of ideal voltage and ideal current sources, various types of controlled sources. Passive circuit components: V-I characteristics and ratings of different types of R, L, C elements. Series and parallel circuits, power and energy, Kirchoff's Laws. Delta-star conversion, Superposition Theorem, Thevenin's Theorem,

Norton's theorem, Maximum Power Transfer Theorem, Tellgen Theorem.

UNIT II

Single Phase AC Circuits: Single phase EMF generation, average and effective values of sinusoids, complex representation of impedance, series and parallel circuits, concept of phasor, phasor diagram, power factor, power in complex notation, real power, reactive power and apparent power. Resonance in series and parallel circuits, Q-factor, bandwidth and their relationship, half power points.

UNIT III

Three-Phase AC Circuits: Three phase EMF generation, delta and Y connection, line and phase quantities. Solution of three phase circuits: balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits.

UNIT IV

Magnetic Circuits & Transformers: Amperes circuital law, B-H curve, concept of reluctance, flux, MMF, analogies between electrical and magnetic quantities solution of magnetic circuits. Hysteresis and eddy current losses, application of magnetic force, mutual inductance and dot convention. Single phase Transformer construction, principle of working, auto transformer and their applications.

UNIT V

Measuring Instruments : Analog indicating instruments, devices, Damping devices, PMMC ammeters and voltmeters, shunt and multipliers, Moving iron ammeter and voltmeters, dynamometer type wattmeters, multimeters, AC watt-hour meters. Digital voltmeters, ammeters and wattmeters.

Text Books/Reference Books:

1. "Basic electrical Engineering" by C.L. Wadhwa, 4th Edition; New Age International.
2. "Basic Electrical Engineering" by Fitzereld, Higgenbotham & Grabel; McGraw Hill International.
3. "Electrical Engineering Fundamentals" by Vincent Deltoro; Prentice Hall International (EEI).
4. Relevant Indian Electricity Supply rules & BIS codes.

IT – 106 Fundamentals of Information Technology	L T P	Credits
	2 1 0	3

UNIT I

Fundamental Concepts of Information: Definition of information, Data Vs Information, Introduction to Information representation in Digital Media, Text, image, graphics, Animation, Audio, Video etc., Need, Value and Quality of information

UNIT II

Concepts in Computer & Programming: Definition of Electronic Computer, History, Generations, Characteristic and Application of Computers, Classification of Computers,

Memory, different types of memory, Computer Hardware-CPU, Various I/O devices, Peripherals, Firmware and Humanware.

UNIT III

Programming Language Classification & Program Methodology: Computer Languages, Generation of Languages, Translators, Interpreters, Compilers, Flow Charts, Dataflow Diagram, Assemblers, Introduction to 4GL and 5GL.

UNIT IV

Digital Devices and Basic Network Concepts: Digital Fundamentals: Various codes, decimal, binary, hexa-decimal conversion, floating numbers gates, flip flops, adder, multiplexes, Introduction to Data Transmission.

UNIT V

Data Communication & Networks: Computer Networks-Introduction of LAN, MAN and WAN. Network Topologies, Client-server Architecture.

UNIT VI

Internet and Web Technologies: Hypertext Markup Language, DHTML, WWW, HTTP, Gopher, FTP, Telnet, Web Browsers, Net Surfing, Search Engines, Email, Safety of Business Transaction on web. Elementary Concepts of E-Learning and E-Commerce, Electronic Payment Systems, Digital Signatures, Firewall.

Text Books/Reference Books:

1. "Using Information Technology: A Practical Introduction to Computers & Communications" by William Sawyer & Hutchinson; Publisher: Tata McGraw-Hill.
2. 'Introduction to Computers' by Peter Norton; Tata McGraw-Hill.
3. "Introduction to Computers" by Rajaraman; EPI.
4. "Data Compression" by Nelson; BPB.
5. "Internet, An introduction" by CIS Tems; Tata McGraw Hill.
6. "Information Technology: Breaking News" by Curtin; TMH.
7. "Fundamentals of Information Technology" by Leon & Leon; Vikas.
8. "Internet 101" by Lehngart; Addison Wesley.

AP-107 Applied Physics - I Lab	L T P	Credits
	0 0 2	02

AC-108 Applied Chemistry Lab	L T P	Credits
	0 0 2	02

EE-109 Electrical Science Lab	L T P	Credits
	0 0 2	02

IT-110 Fundamental of IT Lab	L T P	Credits
	0 0 2	02

AM- 111 Mathematics-II	L T P	Credits
	3 1 0	4

UNIT I

Matrices: Rank of a matrix, inverse of a matrix using elementary transformations, consistency of linear system of equations, Eigen-values and eigenvectors of a matrix, Cayley-Hamilton theorem, diagonalization of matrix.

UNIT II

Ordinary Differential Equations: Second & higher order linear differential equations with constant coefficients, General solution of homogenous and non- homogenous equations, method of variation of parameters, Euler-Cauchy equation, simultaneous linear equations.

UNIT III

Special Functions : Power series method, Frobenius method, Legendre equation, Legendre polynomials, Bessel equation, Bessel function of first kind, Orthogonal Property, Rodrigues' Formula.

UNIT IV

Laplace Transforms: Basic properties, Laplace transform of derivatives and integrals, Inverse Laplace transform, Differentiation and Integration of Laplace transform, Convolution theorem, Unit of Step Function, Periodic function, Laplace transform to IVP and boundary value problem Applications system of linear Simultaneous differential equations.

UNIT V

Fourier series: Fourier series, Dirichlet conditions, Even and odd functions, half range series, harmonic analysis.

UNIT VI

Fourier Transforms : Fourier Transforms Sine and Cosine Transforms, Transforms of derivatives and integrals, Applications to boundary value problem in ordinary differential equations (simple cases only).

Text Books/Reference Books:

1. "Advanced Engineering Mathematics" by Greenberg; Pearson Education.
2. "Advanced Engineering Mathematics" by Kreyszig; Wiley.
3. "Advanced Engineering Mathematics" by Taneja; I K international.
4. "Advanced Engineering Mathematics" by Jain/Iyenger; Narosa.

EN – 112 Environmental Science	L T P	Credits
	2 0 0	2

UNIT I

Introduction to Environment: Origin & evolution of earth, segments of environment- lithosphere, hydrosphere, atmosphere & biosphere, Biogeochemical cycles- hydrological, oxygen, nitrogen, carbon & phosphate cycles.

UNIT II

Ecosystems: Concept of ecosystem biotic & abiotic components, types of ecosystems, functional components of ecosystem- biodiversity, productivity, food chains & food webs, material cycling and energy flow, different ecosystems- forest, grassland, desert, aquatic.

UNIT III

Water Pollution: Water quality, physical, chemical & biological characteristics of water & waste water, ground water pollution, water borne diseases.

UNIT IV

Air & Noise Pollution: Primary & secondary air pollutants, sources, effects & control of- carbon monoxide, nitrogen oxides, hydrocarbons, sulphur dioxide & particulates, Air quality standards, global warming, acid rain, El Nino, ozone hole. Classification and measurement of noise, effects of noise pollution on human, control of noise pollution.

UNIT V

Energy & Solid Waste Management: Conventional energy resources- coal, thermal, petroleum, hydroelectricity, nuclear power, wood, non conventional sources- solar, biogas, wind, ocean & tidal energy, geothermal energy. Hazardous and non hazardous solid waste management. Environmental laws and acts.

Text Books/Reference Books:

1. "Environmental Studies" by De Anil Kumar & De Arnab Kumar; New Age International (P) Ltd.
2. "Environmental Studies" by Basak Anindita; Pearson Education South Asia.
3. "A Text Book of Environmental Science" by Subramanian. V; Narosa Publishing House.
4. "Essentials of Ecology & Environment Science" by Rana. S.V.S.; EPI Publications.

AP – 113 Applied Physics - II	L T P	Credits
	4 0 0	4

UNIT I

Quantum Physics : Failure of classical physics ,Compton effect , Pair production de-broglie relation, wave function, Probability density, Schrodinger wave equation, operators, expectation values and eigen-value equation, particle in a box, simple harmonic oscillator problem, concept of degeneracy.

UNIT II

Classical Statistics : Statistical physics : Microscopic-macroscopic systems, concept of phase space, basic postulates of statistical mechanics, Maxwell—Boltzmann distribution law.

UNIT III

Quantum statistics : Quantum Statistics : Fermi—Dirac and Bose –Einstein Distribution, Fermi- Dirac probability function, Fermi energy level.

UNIT IV

Nuclear Physics : Nuclear properties, constituent of the nucleus, binding energy, stable nuclei, radioactive decay law (alpha and beta spectrum), Q-value of nuclear reaction , nuclear models-liquid drop and shell model, nuclear fission and fusion, elementary ideas of nuclear reactors.

UNIT V

Electrodynamics : Maxwell's equations, concept of displacement current, Derivation of wave equation for plane electromagnetic wave, Poynting vector. Poynting theorem, Energy density, wave equation in dielectric & conducting media.

Text Books/Reference Books:

1. "Nuclear Physics" by Erwin Kaplan.
2. "Concept of Nuclear Physics" by Cohen.
3. "Electrodynamics" by Griffith.
4. "Electricity & magnetism" by Rangawala & Mahajan.
5. "Perspective of Modern Physics" by Arthur Beiser.

AP-AC 114 Engineering Materials	L T P	Credits
	4 0 0	4

SECTION – A (PHYSICS)

UNIT I

Crystal Structure: Bravais lattices; Miller indices, simple crystal structures, Different kind of bonding.

UNIT II

Metallic Conduction: Energy distribution of electrons in a metal, Fermi level, Conduction process.

Semi Conductors: Band theory of solids , P and N type of semiconductors , Statistics of holes and electrons, Hall effect , Effect of temperature on conductivity , Life time and recombination, drift and diffusion in PN junction .

UNIT III

Dielectric and Optical properties of Materials: Dielectric polarization and dielectric constant, optical absorption process.

Magnetism and Superconducting Materials: Diapara, Ferro-magnetism, Antiferro, Ferro-magnetism ferrites, Superconducting materials, Properties, Type of

superconducting materials , Meissner effect, High- Tc superconductor, application.

SECTION – B (CHEMISTRY)

UNIT IV

Introduction to engineering materials for mechanical construction. Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminum and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.

UNIT V

Composite materials: Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fiber-reinforced composites, environmental effects on composites, applications of composites.

UNIT VI

Speciality Polymers: Conducting polymers-Introduction, conduction mechanism, polyacetylene, polyparaphenylene and polypyrrole, applications of conducting polymers, Ion-exchange resins and their applications. Ceramic & Refractory Introduction, classification, properties, raw materials, manufacturing and applications.

NOTE: Two hrs per week load for Applied Physics Department.

Two hrs per week load for Applied Chemistry Department.

Text Books/Reference Books (PHYSICS):

1. "Solid State Physics", 7th edition by Kittel; J. W .& Sons Publication.
2. "Solid State Physics" by Wahab M.A.; Narosa Publishing House.
3. "Solid State Physics" by Ali OmerM; Pearson Education (Singapore) pvt. Ltd. India branch, New delhi.
4. "Engineering Materials: Properties and Selection", 7th edition by Kenneth G. Budinski, Budinshi; Pearson Singapor (Prentice Hall).
5. "Solid State Physics" by Pillai S.O.; New Age International Publication.

Text Books/Reference Books (CHEMISTRY)

1. "Essentials of Material Science and Engineering " by Donald R. Askeland, Pradeep P. Phule; Thomson.
2. "Speciality Polymers " by R.W.Dyson; Chapman and Hall, New York, USA.
3. "Polymer Composites " by A.P.Gupta, M.C.Gupta; New Age publication.
4. "Engineering Chemistry " by R.N.Goyal, H.Goel; Ane Books India.
5. "Engineering Chemistry" by S.S.Dara; S.Chand.
6. "Engineering Chemistry" by Raghupati Mukhopadhyay, Sriparna Datta; New Age International.

7. "Engineering Chemistry" by P.C.Jain, Monica Jain; Dhanpat Rai.

ME 115 Basic Mechanical Engineering	L T P	Credits
	4 0 0	4

(PART A)

UNIT I

Introduction to Thermodynamics, Concepts of systems, control volume, state, properties, equilibrium, quasi-static process, reversible & irreversible process, cyclic process. Zeroth Law and Temperature, Ideal Gas. Heat and Work.

UNIT II

First Law of Thermodynamics for closed & open systems. Non Flow Energy Equation. Steady State, Steady Flow Energy Equation.

Second Law of Thermodynamics – Kelvin and Planck's Statements, Clausius inequality, Definition of Heat Engine, Heat pump, Refrigerator. Concept of Entropy and availability. Carnot Cycle; Carnot efficiency, Otto, Diesel, Dual cycle and their efficiencies.

UNIT III

Properties & Classification of Fluids, Ideal & real fluids, Newton's law of viscosity, Pressure at a point, Pascal's law, Pressure variation in a static fluid, Introduction to Bio-fluid Mechanics General description of fluid motion, stream lines, continuity equation, Bernoulli's equation, Steady and unsteady flow. Turbines and pumps.

(PART-B)

UNIT IV

Introduction to Manufacturing processes for various machine elements. Introduction to Casting & Welding processes. Fabrication of large & small components and assemblies- example Nuts and Bolts, Water turbine rotors, Large Electric Generators, introduction to turning, milling, shaping, drilling & boring processes.

UNIT V

Introduction to quality measurement for manufacturing processes; standards of measurements, line standards and, end standards, precision measuring instruments and gauges: vernier calipers, height gauges, micrometers, comparators, dial indicators, and limit gauges.

Text Books/Reference Books

1. "Engineering Thermodynamics" by P. K. Nag.
2. "Fundamentals of Classical Thermodynamics" by G. J. Van Wyle and R. E. Santag.
3. "Introduction to Fluid Mechanics and Fluid Machines" by S. K. Som and G. Biswas.
4. "Fluid Mechanics" by V. L. Streeter and E. B. Wylie.
5. "Fluid Mechanics and Hydraulic Machines" by R. K. Bansal.

6. "Manufacturing Processes" by Kalpakjian.
7. "Workshop Practics" by A. K. Hazara Chowdhary.
8. "Workshop Technology" by W. A. J. Chapman.
9. "Production Engineering" by P.C. Sharma.
10. "Production Engineering" by R. K. Jain.

COE- 116 Programming Fundamentals	L T P	Credits
	2 0 0	2

UNIT I

Introduction: Concepts of algorithm, flow chart, Introduction to different Programming Languages like C, C++, Java etc.

Elementary Programming: Data types, assignment statements, conditional statements and input/output statements. Iterative programs using loops. Concept of subprograms. Coding style: choice of names, indentation, documentation, etc.

UNIT II

Arrays: Array representation, Operations on array elements, using arrays, multidimensional arrays.

Structures & Unions: Declaration and usage of structures and Unions.

Pointers: Pointer and address arithmetic, pointer operations and declarations, using pointers as function argument.

File: Declaration of files, different types of files. File input/output and usage.

UNIT III

Object Oriented Programming: Functional and data decomposition, Characteristics of Object-Oriented Languages: Abstraction, Encapsulation, Information hiding, abstract data types,

Classes and Objects: Concept of Object & classes, attributes, methods, C++ class declaration, private and public memberships, Constructors and destructors, instantiation of objects. Introduction to Class inheritance and operator overloading.

UNIT IV

Files: Streams and files, error handling, over view of Standard Template Library.

Text Books/Reference Books

1. "Problem Solving and Program Design in C" by Jeri R. Hanly, Elliot B. Koffman; Pearson Addison-Wesley, 2006.
2. "A Structured Programming Approach Using C" by Behrouz A. Forouzan, Richard F. Gilberg; Thomson Computer Science- Third Edition [India Edition], 2007.
3. "C++: The Complete Reference" by Schildt Herbert; Wiley DreamTech, 2005.
4. "Object Oriented Programming using C++" E. Balagurusamy, TMH. R. Lafore; BPB Publications, 2004.
5. "Object Oriented Programming with C++" by D. Parsons; BPB Publication, 1999.

6. "The Art of Programming Computer Science with C++"
Steven C. Lawlor; Vikas Publication, 2002.

AP 117 Applied Physics - II Lab	L T P	Credits
Laboratory Practical Based on course work corresponding AP113	0 0 2	2

COE 118 Programming Lab	L T P	Credits
Laboratory Practical Based on course work corresponding COE-116	0 0 2	2

ME- 119 Engineering Graphics	L T P	Credits
	0 0 3	3

General: Importance, Significance and scope of engineering drawing Lettering, Dimensioning, Scales, Sense of Proportioning, Different types of Projections, B.I.S. Specification, line symbols, rules of printing.

Projections of Points and Lines: Introduction of planes of projection, Reference and auxiliary planes, projections of points and lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on auxiliary planes, shortest distance, intersecting and non-intersecting lines.

Planes Other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points lines in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.

Projections of Plane Figures: Different cases of plane figure (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining true shape of the plane figure by projection.

Projection of Solids: Simple cases when solid is placed in different positions, Axis, faces and lines lying in the faces of the solid making given angles.

Isometric and Orthographic: First and Third angle of system of projection sketching of Orthographic views from pictorial views and vice-versa principles and type of sectioning. Development of Surface

Text Books/Reference Books

1. "Engineering Graphics" by Narayana, K.L. and Kannaiah, P.; Tata McGraw Hill, New Delhi
2. "Elementary Engineering Drawing" by Bhatt N.D.; Charotar Book Stall, Anand
3. "Engineering Graphics" by Lakshminarayanan, V. and Vaish Wanar, R.S.; Jain Brothers, New Delhi
4. "Engineering Graphics" by Chandra, A.M. and Chandra Satish; Narosa

PE 120 Mechanical Workshop	L T P	Credits
	0 0 3	3

Fitting shops, Welding shops, Foundry Shops, Sheet Metal Shop, Smithy Shop.

COE-201 Object Oriented Programming	L T P	Credits
	3 1 0	4

UNIT I

Object oriented paradigm & C++ at a glance: Evolution of programming paradigm, structured versus object-oriented development, elements of object-oriented programming, Objects, classes, methods, popular OOP languages, software reuse.

Classes and objects: Introduction, Class revisited, constant objects and constructor, static data members with constructors and destructors, constructor overloading, nested classes, objects as arguments, returning objects, friend functions and friend classes, constant parameters and member functions, static data and member functions.

UNIT II

Dynamic objects: Introduction, pointers to objects, array of objects, pointers to object members, this pointer, self-referential classes

Operator overloading and Inheritance: overloading of new and delete operators, conversion between objects and basic types, conversion between objects of different classes, overloading with friend functions, abstract classes, inheritance types, virtual base classes, virtual functions, pointer to derived class objects, and base class objects, pure virtual functions, virtual destructors.

Generic programming with templates: Introduction, function templates, overloaded function templates, class templates, inheritance of class template, class template containership, class template with overloaded operators.

UNIT III

Introduction to byte code, security and portability, Data Types, variables, operators, arrays, type conversion and casting, type promotion, Control statements, standard input-output, Designing Classes, constructors, methods, access specifies: public, private, protected, inheritance, packages and interfaces, Math, String, Vectors, and Array List classes, polymorphism: function and operator overloading, function overriding, abstract classes.

UNIT IV

Exception Handling: exception types, nested try-catch, throw, throws and finally statements, Multithread Programming: thread creation, synchronization and priorities.

UNIT V

Input-output and file operations: Java.io, stream classes, Byte streams, character streams, serialization. Networking concepts: Client server and socket programming, TCP/IP client and server sockets.

UNIT VI

Applets and Java Swing: Applet design, AWT packages, Applet event handling, parameters to applets, AWT controls, layout manager, Frames, container classes, Introduction to Java Beans, Swing and Servlets.

UNIT VII

Latest Research in OOPS: Static analyzer for finding dynamic programming error, Accurate interprocedural null deference analysis in Java.

Text Books:

1. Patrick Naughton, Herbert Schildt: "The Complete Reference: Java 2", TMH.
2. C Thomas Wu : "An Introduction to OO programming with Java", TMH,
3. Balaguruswami, "Object oriented with C++", TMH.

Reference Books:

1. Budd, "Object Oriented Programming", Addison Wesley
2. Mastering C++ K.R Venugopal Rajkumar, TMH.
3. C++ Primer, "Lip man and Lajole", Addison Wesley.
4. Maria litvin, Gary litvin,"Programming in C++", VPH.
5. D Samantha, "Object oriented Programming in C++ and Java ", PHI.

Reference Papers:

1. D. Hovemeyer, J. Spacco, and W. Pugh, "Evaluating and tuning a static analysis to find null pointer bugs," in PASTE, Sep. 2005, pp. 13–19.
2. M. G. Nanda and S. Sinha, "Accurate Interprocedural Null-Dereference Analysis for Java," in ICSE, May 2009, pp. 16–24.

COE-202 ANALOG ELECTRONICS	L T P	Credits
	4 0 0	4

UNIT I

Semiconductors Diodes and Rectifiers: Review of p-n junction diode, clipping clamping ckts, rectifier ckts, Power supply filters, Zener diode, & Zener regulators. different types of diodes (zener, varator, schottky, power tunnel, photodiode & LED).

Bipolar junction transistor: Introduction, Transistor, Construction, transistor operations, BJT characteristics, load line, operation point, leakage currents, saturation and cut off mode of operations.

UNIT II

Bias stabilization: Need for stabilization, fixed Bias, emitter bias, self bias, bias stability with respects of variations in Ico, Vbe & b, stabilization factors, thermal stability.

UNIT III

Small Signal Amplifiers: CB, CE, CC configurations, hybrid model for transistor at low frequencies, RC coupled amplifiers. Field Effect Transistors: Classification & characteristics, operating point, biasing, enhancement & depletion type MOSFETS, Design of Amplifiers

UNIT IV

Feedback Amplifiers: Introduction, various feedback arrangements & stability, oscillators.

Operational Amplifier: Ideal OPAMP, OPAMP stages, OPAMP Parameters, equivalent circuit, Ideal voltage transfer curve, open loop OPAMP configuration, closed loop OPAMP configuration.

UNIT V

Applications of other analog IC's: timer 555, voltage regulators, PLL and function generators.

UNIT VI

OPAMP applications: comparator, current sources, rectifiers, first and second order filters, summer, integrator, differentiators, voltage to current, current to voltage converter Clipper, clamper, waveform generators, instrumentation amplifier, log, antilog amplifier, As table multi-vibrator, mono-stable multi-vibrator, square & triangular wave generators

Text Books:

1. J. Millman and Halkias, "Electronic devices and circuits" TMH, 1999.
2. Salivahanan, Suresh Kumar, Vallavaraj, "Electronic devices and circuits" TMH, 1999.
3. J. Millman and Halkias, "Integrated Electronics, Analog & Digital Circuits & Systems" TMH – 2000.

References Books:

1. Boylestad & Nashelsky, "Electronic Devices & Circuit Theory" PHI – VIth Edition.
2. Sedra & Smith, "Micro Electronic Circuits" Oxford University Press, 2000.
3. J.B.Gupta, "Electronic Devices & Circuits" S. K. Kataria, IInd Edition.

COE-203 Data Structures	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Introduction to Algorithmic, Complexity-Time-Space Trade off. Introduction to abstract data types, design, implementation and applications. Introduction to List data structure.

Arrays and Strings: Representation of Arrays in Memory: one dimensional, Two dimensional and Multidimensional, Accessing of elements of array, performing operations like Insertion, Deletion and Searching. Sorting elements of arrays. Strings and String Operations.

Stacks and Queues: Introduction to data structures like Stacks and Queues. Operations on Stacks and Queues, Array representation of Stacks , Applications of Stacks : recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression, Operations of Queues, Representations of Queues Applications of Queues, Priority queues.

UNIT II

Linked Lists: Singly linked lists, Representation of linked list, Operations of Linked list such as Traversing, Insertion and Deletion, Searching, Applications of Linked List. Concepts of Circular linked list and Doubly linked list and their Applications. Stacks and Queues as linked list.

UNIT III

Trees: Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing , searching , Insertion and Deletion, Applications of Binary search Trees , Complete Binary trees, Extended binary trees. General trees, AVL trees, Threaded trees, B- trees.

UNIT IV

Sorting: Insertion Sort, Quick sort, Merge sort, Heap sort, sorting on different keys, External sorting.

UNIT V

Graphs: Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs and their Transversal, Spanning trees, shortest path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths.

UNIT VI

File Structure: File Organization, Indexing & Hashing, Hashing Functions, Collision Resolution Techniques.

UNIT VII

Advances in Data Structures: Data Acquisition for Probabilistic Nearest-Neighbor Query, Probabilistic Nearest-Neighbor Query on Uncertain Objects

Text Books:

1. Horowitz and Sahni, "Fundamentals of Data structures", Galgotia publications.
2. Tannenbaum, "Data Structures", PHI
3. An introduction to data structures and application by Jean Paul Tremblay & Pal G. Sorenson (McGraw Hill).

Reference Books:

1. R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C", PHI

Reference Papers:

1. H.-P. Kriegel, P. Kunath, and M. Renz, "Probabilistic Nearest-Neighbor Query on Uncertain Objects," Proc. 12th Int'l Conf. on Database Systems for Advanced Applications (DASFAA), 2007.
2. DOI 10.1109/TKDE.2013.2297916, IEEE Transactions on Knowledge and Data Engineering

COE-204 Digital Systems Design	L T P	Credits
	3 1 0	4

UNIT I

Binary system & Codes : Boolean Algebra, Venn diagram, switching function and minimization o switching functions with don't care terms etc. (Karnaugh's Map Method & Tabulation Techniques)

UNIT II

Introduction Logic Gates, Logic Families TTL, Tristate Logic, ECL, CMOS and T2 L Logic Logic parameters etc.Bistable, Monostable, Astable and Schmitt trigger circuit.

UNIT III

Gated memories, M/S flip flips, Shift Registers Serial & Parallel Counters, Ring counters, Up Down counters. Designing of combinational circuits like code converter, address, comparators, etc.

UNIT IV

Introduction to semiconductor memories: ROM, PROM, EPROM, STATIC & DYNAMIC RAM. Introduction to Encoders, Decoders, Multiplexer, Demultiplexer, Designing Combinational circuits with multiplexers and other digital logic blocks, PROM. Concept of digital to Analog Conversion Ladder Networks, and Concept of Analog to digital conversion: Dual Slope method.

UNIT V

V-F conversion, stair case Ramp-method/counter method successive approximation type of A/D converters etc.

UNIT VI

Introduction to design of synchronous & asynchronous sequential circuit flow table realization from verbal description, ASM charts, minimization of flow table and concept of state assignment

Text Books:

1. Thomas L. Floyd, "Digital Fundamentals".
2. Morris Mano, "Digital Logic and Computer Design", PHI.
3. Roger L. Tokheim, "Schaum's Outline of Digital Principles".

Reference Books:

1. Forrest Mims, "Getting Started in Electronics".

COE-205 Discrete Mathematics	L T P	Credits
	3 1 0	4A

UNIT I

Introduction: Sets, Relations, Equivalence relations. Operations on Relations, Composite Relations, functions, Recursively defined functions. Mathematical Induction, Proof Methods, Proof by counter – example, Proof by contradiction. Counting Techniques, Principle of Pigeonhole.

UNIT II

Algebraic Structures : Definition , Groups , Subgroups and order , Cyclic Groups, Cosets, Lagrange's theorem , Normal Subgroups , Permutation and Symmetric groups, Group, Abelian Group , Homeomorphisms, Introduction of Rings and Fields.

UNIT III

Partially order sets: Partial order sets, Combination of partial order sets, Hassel diagram. Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. Boolean algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions.

UNIT IV

Propositional Logic: Proposition, well formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference. Predicate Logic: First order predicate, well formed formulae.

UNIT V

Trees and Graphs: Terminology, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring,

UNIT VI

Functions: Recurrence Relation & Generating function: Method of solving recurrences.

Text Books:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", TMH, 1999.
2. C.L. Liu, "Elements of Discrete Mathematics", TMH, 2000.
3. Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI, 1996.

Reference Books:

1. Narsingh Deo, "Graph Theory With Application to Engineering and Computer Science", PHI, 2004.

2. J. P. Trembly & P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill, 1997.

COE - 206 Inforamtion Theory And Coding	L T P	Credits
	3 0 0	3

UNIT I

Introduction to Probability, Sample space and events, The axioms of probability Elementary theorems -Conditional Probability and Independence, Baye's theorem. Random variables, discrete probability distribution, discrete functions for random and discrete random variables, continuous random variables.

UNIT II

Uncertainty and Information, Shannon Entropy, Joint and conditional Entropies Mutual Information, Uniquely decipherable and Instantaneous codes, Noiseless coding problem. Source coding Theorem, Block coding, construction of Optimal codes, Huffman's & Shannon – Fano methods.

UNIT III

Discrete memory less channel, channel capacity BSC and other channels.

UNIT IV

Information measure for continuous ensembles capacity of AWGN channel. Error control coding. The channel coding Theorem, Application to BSC, Source Coding with fidelity criteria. Types of codes, error and error control strategies, Linear block codes, syndrome and error detection, Minimum distance, Error detecting and correcting capabilities of a block code, Syndrome decoding , Hamming codes.

UNIT V

Cyclic codes, Generator and parity – check matrices, encoding, syndrome computation and error detection and decoding .BCH codes, decoding, of the BCH codes Introduction to RS codes. Convolution codes, Maximum likelihood decoding The Viterbi algorithm. Introduction to Turbo codes.

UNIT VI

Latest Research: Blind Deconvolution Using Convex Programming, Asynchronous code-division random access using convex optimization.

Text Books:

1. Murray Spiegel, John Schiller, R. Alu Srinivasan, Debasree Goswami, "Probability and Statistics" (Schaum's Outline Series).
2. J.H. van Lint, "Introduction to coding theory", Springer.
3. R. Ash, "Information Theory", Dover Science Publications.
4. Cover and Thomas , "Element of Information Theory", John Wiley & Sons.
5. Simon Haykin, "Communication Systems", Wiley Student Edition

Reference Books:

1. Shulin & Daniel J. Costello Jr, "Error Control coding: Fundamental & Application", Prentice Hall , Inc.
2. Andre Neubauer, Jurgen Freudenberger, Volker Kuhn, "Coding Theory", Wiley.

Reference Papers:

1. Blind Deconvolution Using Convex Programming, IEEE TRANSACTIONS ON INFORMATION THEORY, VOL. 60, NO. 3, MARCH 2014.
2. L. Applebaum, W. Bajwa, M. F. Duarte, and R. Calderbank, "Asynchro-nous code-division random access using convex optimization," Phys.Commun., vol. 5, no. 2, pp. 129–147, Jun. 2011.

COE-207 Object Oriented Programming Lab	L T P	Credits
	0 0 2	2

Programming based on COE 201 using the Java & C++ Languages

COE-208 Electronics Lab	L T P	Credits
	0 0 2	2

Based on course work corresponding COE-202.

COE-209 Data Structures Lab	L T P	Credits
	0 0 2	2

Based on course work corresponding COE-203.

COE-210 Self Study Seminar-I	L T P	Credits
	0 0 1	1

Students are to study latest topic of interest using e-books and journals and give presentation at end.

COE-211 Database Management Systems	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Data base system concepts and its architecture, Data models schema and instances, Data independence and data base language and interface, Data definition languages, DML. Overall data base structure.

Data modeling using Entity Relationship Model: E.R. model concept, notation for ER diagrams mapping constraints, Keys, Concept of super key, candidate key, primary key generalizations, Aggregation, reducing ER diagrams to tables, extended ER model.

UNIT II

Relational Data Model and Language: Relational data model concepts, integrity constraints, Keys domain constraints, referential integrity, assertions, triggers, foreign

key relational algebra, relational calculus, domain and tuple calculus, SQL data definition queries and updates in SQL.

UNIT III

Data Base Design: Functional dependencies, normal forms, 1NF, 2NF, 3NF and BCNF, multi-valued dependencies fourth normal forms, join dependencies and fifth normal forms. Inclusion dependencies, loss less join decompositions, normalization using FD, MVD and JDs, alternatives approaches to database design.

UNIT IV

File Organization, Indexing and Hashing Overview of file organization techniques, Indexing and Hashing- Basic concepts, Static Hashing, Dynamic Hashing, Ordered indices, Multi-level indexes, B-Tree index files, B+- Tree index files, Buffer management

Transaction processing concepts: Transaction processing system, schedule and recoverability, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recovery from transaction failures, deadlock handling.

UNIT V

Concurrency Control Techniques: Locking Techniques for concurrency control, time stamping protocols for concurrency control, concurrency control in distributed systems. multiple granularities and multi-version schemes.

UNIT VI

Advance in DBMS & Case Studies: Commercial databases, Oracle, Postgress, MySQL, Implementation of Projected Clustering based on SQL queries and UDFs in Relational Databases , Efficient Mutation Analysis of Relational Database Structur Using Mutant Schemata and Parallelisation

Text Books:

1. Elmasri, Navathe,"Fundamentals of Database systems", Addison Wesley
2. Korth, Silbertz, Sudarshan,"Data base concepts", McGraw-Hill.
3. Ramakrishna, Gekkre, "Database Management System", McGraw-Hill

Reference Books:

1. Date C.J.,"An Introduction to Database systems"

Reference Papers:

1. Efficient Mutation Analysis of Relational Database StructurUsing Mutant Schemata and Parallelisation in 2013 IEEE Sixth International Conference on Software Testing, Verification, and Validation Workshops.
2. Implementation of Projected Clustering based on SQL queries and UDFs in Relational Databases 2013 IEEE Recent Advances in Intelligent Computational Systems (RAICS)

COE-212 Computer System Organization	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Digital computer generation, computer types and classifications, functional units and their interconnections, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. REGISTER TRANSFER LANGUAGE: Data movement around registers. Data movement from/to memory, arithmetic and logic micro operations. Concept of bus and timing in register transfer.

UNIT II

Central Processing Unit: Addition and subtraction of signed numbers look ahead carry adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Processor organization, general register organization, stack organization and addressing modes.

UNIT III

Control Unit: Instruction types, formats, instruction cycles and sub-cycles (fetch and execute etc), micro-operations, execution of a complete instruction.

Hardwired and microprogrammed control: microprogramme sequencing, wide branch addressing, and micro-instruction with next address field, pre-fetching microinstructions, concept of horizontal and vertical microprogramming.

UNIT IV

Memory: Basic concept and hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memories: concept and design issues, associative mapping, direct mapping, set-associative mapping, cache writing and initialization.

UNIT V

Input/Output organization: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions.

UNIT VI

Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access. I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.

UNIT VII

Advance Topics: An Approach to Balance the Load h Security for Distributed File System in Cloud, ICCI: In-Cache Coherence Information

Text Books:

1. Patterson, Computer Organisation and Design, Elsevier Pub. 2009

2. Morris Mano, Computer System Architecture, PHI
3. William Stalling, Computer Organization, PHI

Reference Books:

1. Vravice, Hamacher & Zaky, Computer Organization, TMH
2. Tannenbaum, Structured Computer Organization, PHI

Reference Papers:

1. An Approach to Balance the Load h Security for Distributed File System in Cloud , 2014 International Conference on Electronic Systems, Signal Processing and Computing Technologies.
2. ICCI: In-Cache Coherence Information, Citation information: DOI 10.1109/TC.2014.2308185, IEEE Transactions on Computers

COE-213 Operating Systems Desgin	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection.

Operating System Structure: System Components, System structure, Operating System Services.

UNIT II

Concurrent Processes: Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling.

CPU Scheduling: Scheduling Concept, Performance Criteria Scheduling Algorithm, Evolution, Multiprocessor Scheduling.

UNIT III

Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.

UNIT IV

Memory Management: Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Organization, Impact on performance.

UNIT V

I/O Management & Disk Scheduling: I/O devices and organization of I/O function, I/O Buffering, DISK I/O, and Operating System Design Issues.

File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues

UNIT VI

Latest Research and Case Studies: Windows, Linux and UNIX, GPU-Accelerated Solutions to Optimal Power Flow Problems, CMOS Startup Charge Pump With Body Bias and Backward Control for Energy Harvesting Step-Up Converters

Text Books

1. Silverschwatz, "Operating System Concepts", Willey .
2. Haldar and Aravind, "Operating Systems", Pearson.
3. Tannenbaum, "Operating system design and implementation", PHI.

Reference Books

1. Milenekovic, "Operating System Concepts", McGraw Hill
2. Dietel, "An introduction to operating system", Addison Wesley

Reference Papers:

1. GPU-Accelerated Solutions to Optimal Power Flow Problems, 2014 47th Hawaii International Conference on System Science.
2. CMOS Startup Charge Pump With Body Bias and Backward Control for Energy Harvesting Step-Up Converters, 1549-8328 © 2014 IEEE. P

COE-214 Algorithms Design and Analysis	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Growth of Functions, Master's Theorem,

UNIT II

Searching and Sorting: Structure of divide-and-conquer algorithms; examples: binary search, quick sort, Stassen Multiplication; merge sort, heap sort and Analysis of divide and conquer run time recurrence relations.

UNIT III

Greedy Method: Overview of the greedy paradigm examples of exact optimization solution: minimum cost spanning tree, approximate solutions: Knapsack problem, Kruskal's algorithm and Prim's algorithm for finding Minimum cost Spanning Trees, Dijkstra's and Bellman Fort Algorithm for finding Single source shortest paths..

UNIT IV

Dynamic programming: Principle of dynamic programming. Applications: Floyd-Wars hall algorithm for all pair shortest

paths. Matrix multiplication, Traveling salesman Problem, longest Common sequence,

Back tracking: Overview, 8-queen problem, and Knapsack problem. Traveling Salesman problem

UNIT V

Branch and bound: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem,

UNIT VI

Computational Complexity: Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples: Circuit Satisfiability, Vertex cover, Subset Sum problem, Randomized Algorithms, String Matching, NP-Hard and NP-Completeness, Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials and FFT, Number Theoretic Algorithms.

UNIT VI

Research Topics in Algorithms:- Semantic Web Search- various models and techniques, query interface mechanism and ontologies, concept matching and natural language queries.

Text Books:

1. T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", PHI.
2. E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galgotia Publication
3. Sara Basse, A. V. Gelder, " Computer Algorithms," Addison Wesley

Reference Books:

1. Aho ,Ullman " Principles of Algorithms "

COE-215-SOFTWARE ENGINEERING	L T P	Credits
	3 0 0	3

UNIT I

Introduction: Introduction to software Engineering, Software characteristics, Software components, Software applications, Software Engineering Principles, Software metrics and measurement, monitoring and control.

Software development life-cycle Models: Software development life-cycle, Water fall model, prototyping model, Incremental model, Iterative enhancement Model, Spiral model.

UNIT II

Software Requirement Specification: Requirements Elicitation Techniques, Requirements analysis, Models for Requirements analysis, requirements specification, requirements validation,

UNIT III

System Design: Design Principles: Problem partitioning, abstraction. Top down and bottom up – design, structured approach. Functional versus object oriented approach of design, design specification, Cohesiveness and Coupling. Overview of SA/SD Methodology, structured analysis, data flow diagrams, extending DFD to structure chart

UNIT IV

Software project Management: Project planning and Project scheduling. Software Metrics: Size Metrics like LOC, Token Count, Function Count. Cost estimation using models like COCOMO. Risk management activities.

UNIT V

Software Reliability and Quality Assurance: Reliability issues, Reliability metrics, reliability models, Software quality, ISO 9000 certification for software industry, SEI capability maturity model.

UNIT VI

Testing: Verification and validation, code inspection, test plan, test case specification. Level of testing: Unit, Integration Testing, Top down and bottom up integration testing, Alpha and Beta testing, System testing and debugging. functional testing, structural testing, Software testing strategies.

Software Maintenance: Structured Vs unstructured maintenance, Maintenance Models, Configuration Management, Reverse Engineering, Software Re-engineering.

UNIT VII

Advanced Research Topics: Object oriented methodologies, quality assurance, quality criteria, extreme programming, object oriented analysis and design, object oriented metrics, software verification techniques, software rejuvenation

Text Books:

1. R. S. Pressman, "Software Engineering – A practitioner's approach", 3rd ed., McGraw Hill Int. Ed., 1992.
2. Sommerville, "Software Engineering", Addison Wesley, 2001.
3. K. K. Aggarwal & Yogesh Singh, "Software Engineering", 2nd Ed., New Age International, 2005.

Reference Books:

1. P. Jalote, "An Integrated approach to Software Engineering", Narosa, 1991.
2. Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, TMH, 1996.
3. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons, 2004.
4. K. Chandrasekhkar, "Software Engineering & Quality Assurance", BPB, 2005.

COE-216 ENGINEERING ECONOMICS	L T P	Credits
	3 0 0	3

UNIT I

Introduction: Nature and significance of economics, Goods and Utility, Basic Concept of Demand and Supply, Elasticity of Demand- Price Elasticity of Demand, Cross Elasticity of Demand, Production – Production Function, Production Process and Factors of Production, Market – Introduction to Monopoly, Perfect Competition, Oligopoly and Monopolistic Competition, Cost Concepts, E-commerce.

UNIT II

Money – its evaluation and function, Bank- Commercial Bank and Central Bank and brief idea about function of banking system. Tax and Subsidy, Type of Tax- Direct and Indirect, Monetary and fiscal policy, Inflation and Business cycle, IPR & WTO, International trade, terms of Trade, Gain from International Trade, Free Trade vs. Protection, Dumping, Balance of Payment

UNIT III

Role of Science, Engineering and Technology in economic development: Some of the burning problems of rural and slum areas in Indian and how engineering and technology may be used to alleviate them, example of Green Revolution and White revolution. Reasons for their success and can we replicate them. Sustainable development.

UNIT IV

Elementary Economics Analysis; Interest formulas and their Applications; Calculations of economic equivalence, Bases for Comparison of Alternatives: Present Worth Method, Future Worth Method, Annual Equivalent, Internal Rate of Return; Evaluating Production Operations, Business Risk Management.

Text Books:

1. G.J. Thuesen, & W.J. Fabrycky, Engineering Economy, Prentice-Hall of India Private Limited, New Delhi.
2. William G. Sullivan, James A. Bontadelli & Elin M. Wicks, Engineering Economy, Pearson Education Asia, First Indian reprint.
3. Donald G. Newnan, Jerome P. Lavelle & ted G. Eschenbach, Engineering Economic Analysis, Engineering press, Austin, Texas.
4. Seema Singh, Economics for Engineering Students, IK International Publishing House Pvt. Ltd.

COE-217 Database Management System Lab	L T P	Credits
	0 0 2	2

Based on course work corresponding COE-211

COE-218 Computer System Organization Lab	L T P	Credits
	0 0 2	2

Based on course work corresponding COE 204 and COE-212.

COE-219 Operating Systems Lab	L T P	Credits
	0 0 2	2

Hands on experience on latest operating System and their and their study based on course work corresponding COE-213.

COE-220 Self study Seminar-II	L T P	Credits
	0 0 1	1

Students are to study latest topic of interest using e-books and journals and give presentation at end.

COE-301 COMPUTER GRAPHICS	L T P	Credits
	3 1 0	4

UNIT I

Overview of Computer Graphics: Usage of Graphics and their applications, Over view of Graphics systems: Refreshing display devices, Random and raster scan display devices, Colour Models: RGB, HSV etc., Tablets, Joysticks, Track balls, Mouse and light pens, plotters, printers, digitizers.

UNIT II

Output primitives: DDA Line drawing algorithm, Bresenham's Line Drawing Algorithm, Mid-point circle algorithm, Mid-point Ellipse algorithms, filling algorithms, boundary fill and flood fill algorithms, scan-line filling, character generation, line attributes, fill styles, anti-aliasing.

UNIT III

Transformations: Basic 2D Transformations, Matrix representations & Homogeneous Coordinates, Matrix Representations for basic 2D and 3D transformations, Composite Transformations, reflection and shear transformations, affine transformation, transformations between coordinate systems.

UNIT IV

Two dimensional viewing: The viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, Barky line clipping algorithm, Algorithm for polygon clipping, Sutherland-Hodgeman polygon clipping, Wailer-Atherton polygon clipping, curve clipping, Text clipping.

UNIT V

Curves and Surfaces: Representation of surfaces, polygon meshes, plane equations, parametric cubic curves, Hermite Curves, Bezier Curves, 4 point and 5 point Bezier curves using Bernstein Polynomials, Conditions for smoothly joining curve segments, Bezier bi-cubic surface patch, B-Spline Curves, Cubic B-Spline curves using uniform knot vectors, Testing for first and second order continuities.

UNIT VI

Projection: Parallel Projection, Oblique Projection on XY plane, Isometric Projection, Perspective Projection, One Vanishing Point (V.P.) projection, Generation of 2 V.P. Projection, planar geometric projections.

Shading and Hidden Surface Removal: Shading, Illumination Model for diffused Reflection, Effect of ambient lighting, distances, Specular Reflection Model, Computing Reflection Vector, Curved Surfaces, Polygonal Approximations, Guard Shading, Phong Model, Hidden Surface Removal, Back Face Detection, Depth Buffer (Z-Buffer, A-Buffer) Method, Scan Line Method, Depth Sorting Method, Area Subdivision Method.

UNIT VII

Latest Research Topics: Identifying computer graphics using HSV color model and statistical moments of characteristic functions, Instrument for Haptic Image Exploration

Text Books:

1. D. Hearn and P. Baker, "Computer Graphics", Prentice Hall, 1986.
2. R. Plastock and G. Kalley, "Theory and Problems of Computer Graphics", Schaum's Series, McGraw Hill, 1986.
3. David F. Rogers, "Procedural Elements for Computer Graphics", McGraw Hill Book Company, 1985.

Reference Books:

1. D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", MacGraw- Hill International Edition, 1989.
2. Foley et al., "Computer Graphics Principles & practice", Addison Wesley, 1999.

Reference Papers:

1. Identifying computer graphics using HSV color model and statistical moments of characteristic functions, ICME,IEEE 2007
2. Instrument for Haptic Image Exploration, IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, VOL. 63, NO. 1, JANUARY 2014

COE 302 Simulation and Modeling	L T P	Credits
	3 1 0	4

UNIT I

THE NATURE OF SIMULATION: Simulation Model - Static, Dynamic, Deterministic Stochastic Continuous, Discrete Models.

UNIT II

DISCRETE ENENT SIMULATION: Time Advance Mechanism, Components and Organization of a Discrete Event Simulation Model, Selected Illustrative Examples of Simulation Application Models.

Unit iii

SIMULATION SOFTWARE: Modeling of Complex Systems, Use of a Simulation Language such as GPSS, SIMSCRIPT, SLAM, GASP, and SIMULA.

Unit IV

EVALUATION OF SIMULATION OUTPUT : Random Variables and their properties Estimation Methods, Goodness of Fit, Confidence Intervals, Variance Reduction Techniques, Validation of Simulation Models.

Unit V

LATEST RESEARCH TOPICS : Switch-filter wavelength selector: simulation and experiment, Identification and Vibration Attenuation for the Parallel Robot Par2

Text Books:

1. Kelton W.D. and Law A.M. -Simulation Modeling and Analysis, II Edition, McGraw Hill.
2. G. A. Korn -Interactive Dynamic System Simulation, McGraw Hill.

Reference Papers:

1. Switch-filter wavelength selector: simulation and experiment Published in IET Optoelectronics Received on 28th June 2013 Revised on 25th September 2013 Accepted on 21st October 2013 doi: 10.1049/iet-opt.2013.0084
2. Identification and Vibration Attenuation for the Parallel Robot Par2, IEEE TRANSACTIONS ON CONTROL SYSTEMS TECHNOLOGY, VOL. 22, NO. 1, JANUARY 2014

COE-303 Theory Of Computation	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.

UNIT II

Regular expression (RE): Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

UNIT III

Context free grammar (CFG) Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF,

UNIT IV

Context Free Languages (CFL): Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

UNIT V

Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.

UNIT VI:

Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

UNIT VII

Latest Research Topics: Design and Analysis of Approximate Compressors for Multiplication, Extended Closed-Form Expressions for the Robust Symmetrical Number System Dynamic Range and an Efficient Algorithm for Its Computation

Text Books:

1. Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education
2. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science Automata, Languages and Computation", PHI.
3. Martin J. C., "Introduction to Languages and Theory of Computations", TMH

Reference Books:

1. Papadimitrou, C. and Lewis, C.L., "Elements of the Theory of Computation", PHI

Reference Papers:

1. Design and Analysis of Approximate Compressors for Multiplication, DOI 10.1109/TC.2014.2308214, IEEE Transactions on Computers
2. Extended Closed-Form Expressions for the Robust Symmetrical Number System Dynamic Range and an Efficient Algorithm for Its Computation, IEEE TRANSACTIONS ON INFORMATION THEORY, VOL. 60, NO. 3, MARCH 2014

COE-304 MICROPROCESSOR AND INTERFACING	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Microprocessor evolution and types, microprocessor architecture and operation of its components, addressing modes, interrupts, and data transfer schemes, instruction and data flow, timer and timing diagram. Interfacing devices. Architectural advancement of microprocessor.

UNIT II

8-bit Microprocessors: Pin diagram and internal architecture of 8085 microprocessor, registers, ALU, interrupt and machine cycle. Instruction sets. Addressing modes. Instruction formats Instruction Classification: data transfer, arithmetic operations, logical operations, branching operations, machine control and assembler directives. Counters and Time Delays.

UNIT III

16-bit Microprocessor: Architecture of 8086 microprocessor: register organization, bus interface unit, execution unit, memory addressing, memory segmentation. Operating modes. Instruction sets, instruction format, Types of instructions. Interrupts: hardware and software interrupts.

UNIT IV

Programming: Assembly language programming based on Intel 8085/8086. Instructions, data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks and subroutines, conditional call and return instructions

UNIT V

Peripheral Interfacing: Peripheral Devices: 8237/8257 DMA Controller, 8255 programmable peripheral interface, 8253/8254 programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.

UNIT VI

Advance research topics: Chip-Level Multiple Quantum Well Modulator-Based Optical Interconnects, A Single-Chip Solution for Interfacing Transducers to Sensor Networks Using FPGAs

Text Books:

1. Gaonkar Ramesh S, "Microprocessor Architecture, Programming and Applications with 8085", Penram International Publishing.
2. Ray A K, Bhurchandi K M, "Advanced Microprocessors and Peripherals, TMH
3. Hall D V, "Microprocessor Interfacing", TMH.

Reference Books:

1. Liu and Gibson G A, Microcomputer System: The 8086/8088 family, PHI

2. Aditya P Mathur, Introduction to Microprocessor, TMH
3. Brey, Barry B, INTEL Microprocessors, PHI
4. Renu Sigh & B.P.Sigh, Microprocessor, Interfacing and Application

Reference Papers:

1. Chip-Level Multiple Quantum Well Modulator-Based Optical Interconnects, JOURNAL OF LIGHTWAVE TECHNOLOGY, VOL. 31, NO. 24, DECEMBER 15, 2013
2. A Single-Chip Solution for Interfacing Transducers to Sensor Networks Using FPGAs, The 8th International Conference on Computer Science & Education (ICCSE 2013) April 26-28, 2013. Colombo, Sri Lanka

COE-305 Computer Networks	L T P	Credits
	3 1 0	4

UNIT I

Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design - Delay Analysis, Physical Layer Transmission Media, Switching methods, ISDN.

UNIT II

Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols -ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.

UNIT III

Network Layer: Network Layer - Point - to Pont Networks, routing, Congestion control, Internetworking -TCP / IP, IP packet, IP address, IPv6.

UNIT IV

Transport Layer: Transport Layer - Design issues, connection management, session Layer-Design issues, remote procedure call.

UNIT V

Presentation Layer- Data compression techniques, cryptography.

UNIT VI

Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Internet and Public Networks.

UNIT VII

Latest Research : Behavior Signature for Big Data Traffic Identification, Clock Synchronization in Wireless Sensor Network With Selective Convergence Rate for Event Driven Measurement Applications

Text Books:

1. S. Tananbaum, "Computer Networks", 3rd Ed, PHI, 1999
2. U. Black, "Computer Networks-Protocols, Standards and Interfaces", PHI, 1996.

- Laura Chappell (ed), "Introduction to Cisco Router Configuration", Techmedia, 1999.

Reference Books:

- W. Stallings, "Computer Communication Networks", PHI, 1999.
- William A. Shay, "Understanding Data Communications & Networks", Vikas Publication, 1999.
- Michael A. Miller, "Data & Network Communications", Vikas Publication, 1998.

Reference Papers:

- Behavior Signature for Big Data Traffic Identification, 978-1-4799-3919-0/14/\$31.00 ©2014 IEEE
- Clock Synchronization in Wireless Sensor Network With Selective Convergence Rate for Event Driven Measurement Applications, IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT

COE-306 Computer Graphics Lab	L T P	Credits
	0 0 2	2

Based on course work corresponding COE-301

COE-307 Networking Lab	L T P	Credits
	0 0 2	2

Experiments based on course work COE305.

COE-308 Microprocessors Lab	L T P	Credits
	0 0 2	2

Hands on experience on Microprocessors and Interfacing and their study based on course work corresponding COE-304.

COE-309 Minor Project I	L T P	Credits
	0 0 4	4

System Development/innovation project Based on course work

Industrial Training	L T P	Credits

(Duration of 4 weeks to be carried out after V Semester exam)

COE-311 Advanced Computer Architecturee	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Introduction to parallel computing, need for parallel computing, parallel architectural classification schemes, Flynn's , Fang's classification, performance of parallel processors, distributed processing, processor and memory hierarchy, bus, cache & shared memory, introduction to super scalar architectures, quantitative evaluation of performance gain using memory, cache miss/hits.

UNIT II

Multi-core Architectures: Introduction to multi-core architectures, issues involved into writing code for multi-core architectures, development of programs for these architectures, program optimizations techniques, building of some of these techniques in compilers, Open MP and other message passing libraries, threads, mutex etc.

UNIT III

Multi-threaded Architectures Parallel computers, Instruction level parallelism (ILP) vs. thread level parallelism (TLP), Performance issues: Brief introduction to cache hierarchy and communication latency, Shared memory multiprocessors, General architectures and the problem of cache coherence, Synchronization primitives: Atomic primitives; locks: TTS, ticket, array; barriers: central and tree; performance implications in shared memory programs; Chip multiprocessors: Why CMP (Moore's law, wire delay); shared L2 vs. tiled CMP; core complexity; power/performance; Snoopy coherence: invalidate vs. update, MSI, MESI, MOESI, MOSI; performance trade-offs; pipelined snoopy bus design; Memory consistency models: SC, PC, TSO, PSO, WO/WC, RC; Chip multiprocessor case studies: Intel Montecito and dual-core, Pentium4, IBM Power4, Sun Niagara

UNIT IV

Compiler Optimization Issues Introduction to optimization, overview of parallelization; Shared memory programming, introduction to Open MP; Dataflow analysis, pointer analysis, alias analysis; Data dependence analysis, solving data dependence equations (integer linear programming problem); Loop optimizations; Memory hierarchy issues in code optimization.

UNIT V

Operating System Issues Operating System issues for multiprocessing Need for pre-emptive OS; Scheduling Techniques, Usual OS scheduling techniques, Threads, Distributed scheduler, Multiprocessor scheduling, Gang scheduling; Communication between processes, Message boxes, Shared memory; Sharing issues and Synchronization, Sharing memory and other structures, Sharing I/O devices, Distributed Semaphores, monitors, spin-locks, Implementation techniques on multi-cores; Open MP, MPI and case studies

UNIT VI

Applications Case studies from Applications: Digital Signal Processing, Image processing, Speech processing.

UNIT VII

Advance Research Topics: A Systematic Design Methodology for Low-Power NoCs, Autonomous Decentralized High-Assurance Surveillance System for Air Traffic Control

Text Books:

1. Kai Hwang, "Advanced computer architecture"; TMH, 2000.
2. J .P.Hayes, "computer Architecture and organization", MGH, 1998.
3. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design", Narosa Publishing, 1998.

Reference Books:

1. D.A.Patterson, J.L.Hennessy, "Computer Architecture :A quantitative approach", Morgan Kauffmann, 2002.
2. Hwang and Briggs, " Computer Architecture and Parallel Processing"; MGH, 2000.

Reference Papers:

1. A Systematic Design Methodology for Low-Power NoCs, IEEE TRANSACTIONS ON VERY LARGE SCALE INTEGRATION (VLSI) SYSTEMS
2. Autonomous Decentralized High-Assurance Surveillance System for Air Traffic Control, 2014 IEEE 15th International Symposium on High-Assurance Systems Engineering

COE- 312 Compiler Design	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Definition, Phases and Passes, FSM & RE's and their application to Lexical Analysis, Implementation of Lexical Analyzers, Lexical- Analyzer Generator, Lex – Compiler.

UNIT II

Syntax Analysis: Formal Grammar and their application to Syntax Analysis, BNF Notation,. The Syntactic specification of Languages: CFG, Derivation and Parse Trees, Shift Reduce Parsing, Operator precedence parsing, top down Parsing, Predictive Parsers. LR Parsers, the canonical collection of LR(0)items, constructing SLR Parsing Tables, Constructing canonical LR Parsing tables and LALR parsing tables , An Automatic Parser Generator, YACC.

UNIT III

Syntax Directed Translation: Syntax directed Translation Schemes, Implementation of Syntax directed translators, Intermediate Code, Postfix notation, Parse Trees and Syntax Trees, Three address Code, Quadruple & Triples, Translation of Assignment Statements, Boolean expressions, Control Statements, Array references in Arithmetic expressions, Procedure Calls , Declarations and Case statements Translations.

UNIT IV

Symbol Tables: Data Structure for Symbol Tables, representing scope information. Run Time Administration: Implementation of simple Stack allocation scheme, storage allocation in block structured language.

UNIT V

Error detection and Recovery: Lexical phase errors, syntax phase errors, semantic errors and Error recovery techniques.

UNIT VI

Code Optimization: Loop optimization, the DAG representation of basic blocks, value numbers and Algebraic Laws, Global Data – Flow Analysis and Code generation.

Text Books:

1. Aho,Ullman & Sethi, "Compiler Design", Addison Wesley.
2. D.M.Dhamdhare, "Compiler Construction – Principles & Practice", Macmillan India

COE-313 Web Technology And Java Programming	L T P	Credits
	3 1 0	4

UNIT I

Emergence of the Internet: Terminology, Accessibility: Language & Connectivity, Services of the Internet: E-Mail, World Wide Web (WWW), Remote Access, Collaboration, File Sharing, Internet Telephony; Use & Culture: Usenet, From gopher to WWW, Search Engines: Wais, Archie, Web Search Engine.

UNIT II

Web Development: Developing Web using HTML, XML, ASP. Concepts of Web Programming: using Scripting Languages such as JavaScript, CGI, PHP etc. Database Connectivity with MySQL and JDBC.

UNIT III

Web Research & Practices: The World Wide Web Impact: Opportunities and Challenges, Evolution of Search Engines.

UNIT IV

Web Search & Mining Framework: Supporting Technologies, concepts, applications, types & tools, Quantifying the Web, Crawling Techniques: The task of a web crawler, Crawler algorithms, Indexing techniques, Ranking in Web.

UNIT V

JAVA PROGRAMMING: Introduction to Java Applications, The Java Programming Environment, Fundamental Programming Structures in Java, Objects and Classes in Java, Inheritance, Interfaces and Inner Classes, Exceptions and Exception Handling in Java, Streams and Files, Applets, Swing, Graphical User Interface Components, Multithreading, Java Database Connectivity, Servlets, Networking, Collections.

UNIT VI

Advanced Topics: Duplicate Detection, Contextual Search, Image Mining, Web Mining Technology in Competitive Intelligence System Research, Enhancing Web Technology through Wiki-shell Architecture

Text Books:

1. Internet and Web Technologies by Raj Kamal, Tata McGraw Hill edition.
2. An Introduction to Search Engines and Web Navigation, Mark Levene, Pearson Education.
3. Modeling the Internet and the Web, Pierre Baldi, Paolo Frasconi, Padhraic Smyth, John Wiley and Sons Ltd.

Reference Books:

1. HTML: A Beginner's Guide by Wendy Willard, Tata McGraw-Hill
2. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dreamtech
3. Programming World Wide Web, Sebastia, Pearson
4. PHP and MySQL for Dynamic Web Sites, Ullman, Larry, Peachpit Press.

Reference Papers:

1. Web Mining Technology in Competitive Intelligence System Research, 2009 International Symposium on Information Engineering and Electronic Commerce
2. Enhancing Web Technology through Wiki-shell Architecture , 978-1-4673-0126-8/11/\$26.00 _2011 IEEE

COE-314 Information And Network Security	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Need for security, Introduction to security attacks, services and mechanism, introduction to cryptography, Conventional Encryption: Conventional encryption model, classical encryption techniques-substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers, Intruders, Viruses and related threads.

UNIT II

Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, key distribution.

UNIT III

Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primarily testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms, Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffe-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption.

UNIT IV

Message Authentication and Hash Function: Authentication requirements, authentication functions, message

authentication code (MAC), hash functions, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA), Public Key Infrastructure(PKI): Digital Certificate, private key management, Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.

Authentication Applications: Kerberos and X.509, directory authentication service, password, challenge-response, biometric authentication, electronic mail security-pretty good privacy (PGP), S/MIME.

UNIT V

IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management.

Web Security: Secure Socket Layer(SSL) and transport layer security, TSP, Secure Electronic Transaction (SET), Electronic money, WAP security, firewall design principals, Virtual Private Network (VPN) security.

UNIT VI

Impossible Differential cryptanalysis[1], Attribute-based signatures from RSA[2], Security of SSL/TLS enabled applications[3], ECC for wireless security[4], Error propagation property and application in DES cryptography[5], Certificate Legitimation[6]

Text Books:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersey.
2. Atul Kahate, "Cryptography and Network Security", TMH.
3. Behrouz A. Forouzan, "Cryptography and Network Security", TMH.

Reference Books:

1. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.
2. Bruce Schneier, "Applied Cryptography".

Reference Publications:

1. Mohsen Shakibaa, Mohammad Dakhilaliana, Hamid Malab, "On computational complexity of impossible differential cryptanalysis", Information Processing Letters 114,252-255, Elsevier, 2014
2. Javier Herranz, "Attribute-based signatures from RSA", Theoretical Computer Science 527, 73-82, Elsevier, 2014
3. Das, ML , Samdaria, N., "On the security of SSL/TLS-enabled applications", Applied Computing and Informatics, Science Direct, 2014
4. Kristin Lauter, Microsoft Corporation, "The Advantages Of Elliptic Curve Cryptography For Wireless Security", IEEE Wireless Communications, 1536-1284, 2004
5. J.P. Pieprzyk, "Error propagation property and application in cryptography", IEE Proceedings, Vol. 136, Pt. E, No. 4,1989

6. Oppliger, Rolf, "Certification Authorities Under Attack: A Plea for Certificate Legitimation", IEEE Computer Society, 1089-7801, 2014

COE – 315 Mobile Computing	L T P	Credits
	3 1 0	4

UNIT I

Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR,VLR, hierarchical, handoffs, channel allocation in cellular systems, Cellular telephone, Digital Cellular Standards, Call Routing in GSM , Satellite Technology, FDMA, TDMA, CDMA and GPRS.

UNIT II

Wireless Networking, Wireless LAN Overview: MAC issues, PCF, DCF , Frame types, addressing, IEEE 802.11 standards, Blue Tooth: Architecture , Layers and protocols, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications, WAP application environment(WAE), WML, WSP, WTP and WTLS.

UNIT III

Data management issues, data replication for mobile computers, Replication through data allocation, User profile replication scheme, optimistic replication and active replication, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

UNIT IV

Mobile Agents computing: Introduction, Advantages, Application Domains; security and fault tolerance: Protecting server, code signaling, Firewall approach; security techniques and algorithms: DES, 3DES, AES, Diffie Hellman, RSA and Elliptic curve; transaction processing in mobile computing environment: Structure, properties, Data consistency, Transaction relation, Recovery and wireless data Dissemination.

UNIT V

Ad Hoc networks, localization, Routing protocols: Global state routing (GSR), Destination sequenced distance vector routing (DSDV), Fisheye state routing(FSR), Dynamic source routing (DSR), ABR, Route Discovery, Route Repair/ Reconstruction, Establishment, Maintenance ; Ad Hoc on demand distance vector routing (AODV). Temporary ordered routing algorithm (TORA), Quality of Service in Ad Hoc Networks, and applications.

UNIT VI

Recent trends in mobile computing and Fourth generation (4G) platform for different wireless networks.

Text Books :

1. J. Schiller, Mobile Communications, Addison Wesley.
2. A.K.Talukder and R.R.Yavagal, Mobile Computing, TMH
3. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.

Reference Books:

1. Charles Perkins, Mobile IP, Addison Wesley.
2. Charles Perkins, Ad hoc Networks, Addison Wesley.

COE-316 Web Programming Lab	L T P	Credits
	0 0 2	2

Based on course work corresponding COE-313

COE-317 Compiler Design Lab	L T P	Credits
	0 0 2	2

Based on course work corresponding COE-312

COE-318 Minor Project II	L T P	Credits
	0 0 2	2

System Development/innovation project Based on course work.

COE-319 Industrial Training Viva-Voce	L T P	Credits
	0 0 2	2

Evaluation of Industrial Training undergone at end of Vth Semester

Industrial Training	L T P	Credits

(Duration of 4 weeks to be carried out after V Semester exam)

COE-401 ARTIFICIAL INTELLIGENCE	L T P	Credits
	3 1 0	4

UNIT I

Introduction: AI Problems, Task Domains of AI, AI Techniques: search knowledge, abstraction. Introduction to Intelligent program and Intelligent agents

Problem Solving: Basic Problem solving Method: state space search, problem characteristics, Production systems characteristics, issues in design of Intelligent search algorithm.

UNIT II

Heuristic search Techniques: Hill climbing techniques, Best First search, A* Search, Problem Reduction: AO* Search, Constraint Satisfaction, Means-End Analysis.

Game Playing: Game Tree, Searching procedure Minimax, alpha-beta pruning

UNIT III

Knowledge Representation: Knowledge Representation issues. Knowledge Representation using Predicate Logic: Unification, resolution. Rule based Systems : Forward versus backward reasoning, conflict resolution. Structured Knowledge Representation: Semantic Nets, Frames, conceptual dependency, scripts.

UNIT IV

Programming Languages: Fundamental and concepts of Programming languages like Prolog or Lisp. Relationship of languages with Knowledge representation and inferences

UNIT V

Handling uncertainty Non-Monotonic Reasoning, Probabilistic reasoning, use of certainty factors, fuzzy logic. Learning Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.

UNIT VI

Applications: Expert Systems: Architecture, Domain Knowledge, Knowledge Acquisition, Case Studies: MYCIN, RI, Natural language Processing: Syntactic, Semantic and Pragmatic Analysis, Robotics etc.

UNIT VII

Latest trends in AI: AI in Computer Science Teaching and Research, AI as a Positive and Negative Factor in Global Risk.

Text Books:

1. Artificial Intelligence, E. Rich and K. Knight, TMH, 2nd ed., 1992.
2. Principles of AI, N.J. Nilsson, , Narosa Publ. House, 1990
3. Artificial Intelligence - an Engineering Approach, R.J. Schalkoff, McGraw Hill Int Ed., Singapore, 1992.

Reference Books:

1. Artificial Intelligence: Structures and Strategies for Complex Problem Solving (5th Edition), George F. Luger, 2005. Addison-Wesley.
2. Artificial Intelligence: A Guide to Intelligent Systems (2nd Edition).Michael Negnevitsky, 2005. Addison-Wesley.
3. "Neural Networks in Computer Intelligence" by KM Fu, McGraw Hill
4. "AI: A modern approach" by Russel and Norvig, Pearson Education
5. "Introduction to AI and Expert Systems", D.W. Patterson,, PHI, 1992

Reference Papers:

1. Nelishia Pillay, "Artificial Intelligence in Computer Science Teaching and Research", IEEE conf., 2004
2. Yudkowsky, "Artificial Intelligence as a Positive and Negative Factor in Global Risk", Eliezer, 2008.

COE-402 INDUSTRIAL ORGANIZATION AND MANAGERIAL ECONOMICS	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Production Function types of manufacturing systems productivity and quality management, ISO-9000 systems, CMM System.

Management concepts – development of management principles, scientific management, human relations aspects.

UNIT II

Industrial psychology, personnel management, and labour relations, methods of remuneration.

Plant Organization: Organization, Principles of organization, organization structure – line and staff organizations.

UNIT III

Plant location, layout: Process layout, Product layout and combination layout – methods of layout, economic of layout.

UNIT IV

Production planning and control: Types of Product, Demand, Demand Forecasting, marketing strategies, Scheduling and control of scheduling; production control.

UNIT V

Work and method study: Definition and concepts: method study-procedures, symbols, advantages. Flow process charts. Motion study-micro motion, SIMO charts, procedures system concepts value and ABC analysis: system concepts, classification, analysis, techniques.

UNIT VI

Industrial maintenance – types, organization of maintenance department. Breakdown and preventive maintenance.

Inventory control and replacement analysis: Introduction, replacement policy and methods adopted. Project Management – CPM and PERT

UNIT VII

Latest trend: Modelling and simulation in engineering marketing

Text Books:

1. Industrial Organization: Theory and Practice by Joan M. A. Woodward
2. Industrial Organization and Management by Prof SA Sherlekar, Prin C Mallikharjuna Rao.

Reference Papers:

2. Williams, L.A., "Modelling and simulation in engineering marketing", Physical Science, Measurement and Instrumentation, Management and Education - Reviews, IEE Proceedings A (Volume:127 , Issue: 1), 2008

Elective – I

403.1 Distributed Computing Systems	L T P	Credits
	3 1 0	4

UNIT I

Introduction to Distributed Systems, Design Goals, Types of Distributed systems, system architectures and fundamental models, middleware, Threads, virtualization, client-Server Model, Code migration

UNIT II

Communication fundamentals, Remote Procedure Call, message oriented communication, and stream oriented communication, multicast communication.

UNIT III

Synchronization: clock synchronization, logical clocks, mutual exclusion algorithms: centralized, decentralized, distributed and token ring algorithms, election algorithms.

UNIT IV

Replication management: need for replication, consistency models: data centric and client centric consistency models, replica management, consistency protocols: continuous, primary-based, replicated-write and cache-coherence protocols.

UNIT V

Fault tolerance: basic concepts and failure models, process resilience, reliable client-server and group communication, distributed commit recovery mechanisms.

UNIT VI

Security in distributed systems, secure channels, authentication, integrity and confidentiality, access control, security management.

Naming: Flat naming approaches, structured naming, name space and resolution, attribute-based naming, directory services, LDAP, decentralized implementations.

UNIT VII

Latest trend: Grid Computing: An Introduction, Data Security Management in Distributed Computer Systems, A Gentle Introduction to Grid Computing and Technologies.

Text Books:

1. Distributed Systems, Principles and Paradigms by Andrew S. Tanenbaum and Maarten Van Steen, Pearson Education.
2. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Ed.

Reference Papers:

1. Poonam Dabas and Anoop Arya, "Grid Computing: An Introduction", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 3, March 2013

2. Adi Armoni, "Data Security Management in Distributed Computer Systems", Informing Science Data Security Volume 5 No 1, 2002

3. Rajkumar Buyya and Srikumar Venugopal, "A Gentle Introduction to Grid Computing and Technologies", Computer Society of India, July 2005

COE403.2 Advanced Data Structures	L T P	Credits
	3 1 0	4

UNIT I

ADVANCED TREES: Definitions Operations on Weight Balanced Trees (Huffman Trees), 2-3 Trees and Red-Black Trees. Augmenting Red-Black Trees to Dynamic Order Statistics and Interval Tree Applications. Operations on Disjoint sets and its union find problem Implementing Sets. Dictionaries, Priority Queues and Concatenable Queues using 2-3 Trees.

UNIT II

MERGEABLE HEAPS: Mergeable Heap Operations, Binomial Trees Implementing Binomial Heaps and its Operations, 2-3-4. Trees and 2-3-4 Heaps. Structure and Potential Function of Fibonacci Heap Implementing Fibonacci Heap.

UNIT III

GRAPH THEORY DEFINITIONS: Definitions of Isomorphism Components. Circuits, Fundamental Circuits, Cut-sets. Cut-Vertices Planer and Dual graphs, Spanning Trees, Kuratovski's two Graphs.

UNIT IV

GRAPH THEORY ALGORITHMS : Algorithms for Connectedness, Finding all Spanning Trees in a Weighted Graph and Planarity Testing Breadth First and Depth First Search, Topological Sort, Strongly Connected Components and Articulation Point. Single source shortest path and all pair shortest path algorithms. Min-Cut Max-Flow theorem of Network Flows. Ford-Fulkerson Max Flow Algorithms.

UNIT V

Recent topics in advanced data structures: Analysis of data structures for admission control of advance reservation requests.

Text Books:

1. Narsingh Deo-Graph Theory with Application to Engineering and Computer Science, Prentice Hall of India.
2. Baase-Computer Algorithms, Pearson Education.
3. Cormen-Introduction to Algorithms, Prentice Hall of India.

Reference Books:

1. Aho A.V., Hopcroft J.E. and Ullman J.D.-The Design and Analysis of Computer Algorithms, Pearson Education.
2. Horowitz and Sahni-Fundamentals of Data Structures Galgotia Book Source.

Reference Papers:

1. Burchard L.-O., "Analysis of data structures for admission control of advance reservation requests", IEEE Transactions on Knowledge and Data Engineering, Volume:17, Issue: 3, 2005

COE403.3 E-Commerce	L T P	Credits
	3 1 0	4

UNIT I

INTRODUCTION: Scope of electronic commerce, trade cycle, electronic markets, electronic data interchange, Internet commerce and e-commerce in perspective.

UNIT II

BUSINESS STRATEGY IN AN ELECTRONIC AGE: Value chain– supply chains, Porter’s value chain model and inter– organizational value chains. Competitive Advantage– Competitive strategy, Porter’s Model, First Mover advantage and competitive advantage using e-commerce Business strategy-Introduction to Business Strategy, Strategic Implications of it of IT Technology, e-commerce Implementation and evaluation.

UNIT III

CASE STUDY: e-commerce in passenger-Air Transport, choices, Airline booking systems, competition and customer loyalty, Web booking systems and competitive outcomes.

Unit IV

BUSINESS TO BUSINESS ELECTRONIC COMMERCE: Inter organizational Transactions, The credit Transaction Trade cycle. A variety of transactions, Electronic markets – markets and electronic markets, usage of electronic markets, Advantages and disadvantages of electronic markets.

UNIT V

ELECTRONIC DATA INTERCHANGE (EDI): Definition and benefits of EDI. EDI technology, standards, communications, implementation, agreements and securities. EDI trading patterns and transactions.

UNIT VI

BUILDING AN E-COMMERCE SITE: Introduction to object behavior, components, active scripting. Object models, Infrastructure objects, service objects and data objects, choosing the objects. Building a scalable application, Adding the configure method, connecting to the database. Accessing and versioning the database. Building the catalog object with example. Creating shopping basket-Holding state, creating the tables for a shopping basket, modifying the object model and making the basket accessible.

J2EE ARCHITECTURE OVERVIEW : Enterprise components. Information technology in the enterprises. Introduction to enterprise objects and enterprise component model.

The J2EE model features J2EE components – container architecture. Enterprises Java and J2EE architecture.

Unit VII

Latest trends in E-Commerce: Advanced SWOT Analysis of E-Commerce, implications and impacts Of Web Services to Electronic Commerce Research and Practices.

Text Books:

1. David Whiteley - E-Commerce Strategy,Technology and Application, Tata McGraw Hill.
2. Mathew Reynolds - Beginning E-commerce with Visual Basic ASP, SQL Server 7.0 and MTS, Shroff Publishers & Distributors Pvt. Ltd.

Reference Books:

3. Perrone & Chaganti - Building Java Enterprises System with J2EE, Techmedia.

Reference Papers:

1. Muhammad Awais and Tanzila Samin, "Advanced SWOT Analysis of E-Commerce", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 2, No 2, March 2012
2. Minder Chen, Andrew N. K. Chen and Benjamin B. M. Shao, "The Implications And Impacts Of Web Services To Electronic Commerce Research And Practices", Journal Of Electronic Commerce Research, Vol. 4, No. 4, 2003

COE403.4 Computer Vision	L T P	Credits
	3 1 0	4

UNIT I

Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Cameras – lenses, projections, sensors, Radiometry –Measuring Light, light and surfaces Representation – color spaces, Camera model and Camera calibration, Binocular imaging systems, Sources, Shadows and Shading.

UNIT II

2D/3D Vision: Filters, Binary Images, Features, Edge Detection, Texture, Shape, Segmentation, Clustering, Model Fitting, Probabilistic, 3D Vision: Multiview geometry, Stereo, Shape from X, 3D data.

UNIT III

Image Processing and Feature Extraction: Image representations (continuous and discrete), Linear Filters, Texture, Edge detection.

UNIT IV

Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

UNIT V

Shape Representation and Segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis.

UNIT VI

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition

UNIT VII

Latest trends in computer vision: Computer Vision Interaction For People With Severe Movement Restrictions, DARWIN: A Framework for Machine Learning and Computer Vision Research and Development, Computer Vision Face Tracking For Use in a Perceptual User Interface.

Text Books:

1. Computer Vision: A Modern Approach by D. A. Forsyth and J. Ponce, Prentice Hall, 2003.
2. Robot Vision, by B. K. P. Horn, McGraw-Hill.
3. Computer Vision by Linda Shapiro and George Stockman, Prentice-Hall, 2001.

Reference Papers:

1. César Mauri, Toni Granollers, Jesús Lorés and Mabel García, "Computer Vision Interaction For People With Severe Movement Restrictions", An Interdisciplinary Journal on Humans in ICT Environments, Volume 2 (1), 38–54, April 2006
2. Stephen Gould, "DARWIN: A Framework for Machine Learning and Computer Vision Research and Development", Journal of Machine Learning Research 13 (2012) 3533-3537, 2012
3. Gary R. Bradski, Microcomputer Research Lab, Santa Clara, CA, Intel Corporation, "Computer Vision Face Tracking For Use in a Perceptual User Interface", Intel Technology Journal Q2, 1998

COE 403.5 Real Time Systems	L T P	Credits
	3 1 0	4

UNIT I

Introduction : Definition, Typical Real Time Applications; Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT II

Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and

Least-Slack-Time-First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling A periodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT III

Resources Access Control: Effect of Resource Contention and Resource Access Control (RAC), Non preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

UNIT IV

Multiprocessor System Environment : Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol, Schedulability of Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems, Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks with Temporal Distance Constraints.

UNIT V

Real Time Communication : Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real Time Protocols, Communication in Multicomputer System, An Overview of Real Time Operating Systems.

UNIT VI

Latest trends in Real time system: MDARTS, Real-time concurrency control in a multiprocessor environment.

Text Books:

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
2. H. Kopetz, "Real time systems for distributed embedded applications, Kluwer Academic
3. Douglass, Real Time UML: Advances in the UML for Real-Time Systems, 3/e, Addison-Wesley

Reference Books:

1. Awad, Kuusela & Ziegler, Object-Oriented Technology for Real Time Systems: A Practical Approach Using OMT and Fusion, 1/e, ©1996, Prentice Hall
2. Ward & Mellor Structured Development for Real-Time Systems, Vol. III: Implementation Modeling Techniques, 1e, ©1986, Prentice Hall

Reference Papers:

1. Lortz, V.B., Shin, K.G. and Jinho Kim, "MDARTS: a multiprocessor database architecture for hard real-time systems", IEEE Transactions on Knowledge and Data Engineering, Volume:12, Issue: 4, 2002
2. Tei-Wei Kuo, ; Jun Wu, ; Hsin-Chia Hsieh, "Real-time concurrency control in a multiprocessor environment", IEEE Transactions on Parallel and Distributed Systems, Volume.13, Issue.6, pp.659,ISSN: 10459219, 2002

COE 403.6 Machine Learning	L T P	Credits
	3 1 0	4

UNIT I

Introduction to Machine Learning: Overview of different tasks: classification, regression, clustering, control, Concept learning, information theory and decision trees

UNIT II

Supervised Learning: Decision trees, nearest neighbors, linear classifiers and kernels, neural networks, linear regression; learning theory; bagging and boosting; feature selection.

UNIT III

Unsupervised Learning: Clustering, graphical models, EM, PCA, factor analysis, manifold learning.

UNIT IV

Reinforcement Learning: Value iteration; policy iteration; TD learning; Q learning; actor-critic.

UNIT V

Other Topics: Bayesian learning, online learning and recent trends.

UNIT VI

Recent applications & Research Topics

UNIT VII

Latest trends in machine learning: Machine Learning that Matters, The Interplay of Optimization and Machine Learning Research, Data Mining: Practical Machine Learning Tools and Techniques.

Text Books:

1. Introduction to Machine Learning, Alpaydin, E., MIT Press, 2004
2. Machine Learning, Tom Mitchell, McGraw Hill, 1997.
3. Elements of Machine Learning, Pat Langley Morgan Kaufmann Publishers, Inc. 1995. ISBN 1-55860-301-8

Reference Books:

1. Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani and Jerome Friedman
2. Machine Learning: A probabilistic approach, by David Barber.

Reference Papers:

1. Kiri L. Wagstaff, "Machine Learning that Matters", Proceedings of the 29th International Conference on Machine Learning, 2012.
2. Kristin P. Bennett and Emilio Parrado-Hernández, "The Interplay of Optimization and Machine Learning Research", Journal of Machine Learning Research 7 (2006) 1265–1281, 2006

3. I. Witten, E. Frank, and M. Hall. ,“Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann, San Mateo, CA, 3rd edition, 2011.

COE 403.7 Natural Language Processing	L T P	Credits
	3 1 0	4

UNIT I

Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems,

UNIT II

Language processors: recognizers, transducers, parsers, generators Linguistic Background: An outline of English syntax.

Elements of formal language theory: alphabet, string, language, grammar, productions, symbol vocabulary, generator, recognizer, procedure.

UNIT III

Introduction to semantics and knowledge representation, Network Logic and inference. Pragmatics, Graph Models and Optimization. Prolog for natural semantic. Some applications like machine translation, database interface.

UNIT IV

Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

UNIT V

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars, Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.

UNIT VI

Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing, Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

UNIT VII

Latest trends in natural language processing: Automated classification of NASA anomalies using natural language processing techniques, A Field Theoretical Approach to Medical Natural Language Processing.

Text Books:

1. Allen, Natural Language Understanding Pearson Education.
2. D. Jurafsky & J. H. Martin – “Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition”, Pearson Education
3. Manning, Christopher and Heinrich Schutze. 1999. “Foundations of Statistical Natural Language Processing”. MIT Press.

Reference Books:

1. .L.M. Iivansca, S. C. Shapiro, Natural Language Processing and Language Representation.

Reference Papers:

1. Falessi, D.; Layman, L. "Automated classification of NASA anomalies using natural language processing techniques", Software Reliability Engineering Workshops (ISSREW), IEEE International Symposium on, On page(s): 5–6, 2013
2. Taira, R.K, Bashyam, V. and Kangarloo, H., “A Field Theoretical Approach to Medical Natural Language Processing”, IEEE Transactions on Information Technology in Biomedicine, Volume:11, Issue: 4, 2007

COE 403.8 Selected Topics	L T P	Credits
	3 1 0	4

Advanced Topics in Computer Science and Engineering

Open Elective - I

COE404.1 Computational Methods	L T P	Credits
	3 1 0	4

UNIT I

Errors in computation, Review of Taylor Series, Mean Value Theorem. Representation of numbers (integers and Floating Point). Loss of Significance in Computation.

Location of Roots of functions and their minimization:

Bisection method (convergence analysis and implementation), Newton Method (convergence analysis and implementation), Secant Method (convergence analysis and implementation). Unconstrained one variable function minimization by Fibonacci search, Golden Section Search and Newton’s method. Multivariate function minimization by the method of steepest descent, Nelder- Mead Algorithm.

UNIT II

Interpolation and Numerical Differentiation: Interpolating Polynomial, Lagrange Form, Newton Form, Nested Form, Inverse Interpolation, Neville’s Algorithm, Errors in interpolation, Estimating Derivatives and Richardson Extrapolation.

Numerical Integration: Definite Integral, Riemann – Integrable Functions, Traezoid Rule, Romberg Algorithm, Simpson’s Scheme, Gaussian Quadrature Rule.

UNIT III

Linear System of Equations: Conditioning, Gauss Elimination, Pivoting, Cholesky Factorization, Iterative Methods, Power Method

Approximation by Spline Function: 1st and 2nd Degree Splines, Natural Cubic Splines, B Splines, Interpolation and Approximation.

UNIT IV

Differential Equations: Euler method, Taylor series method of higher orders, Rubge – Kutta method of order 2 and 4, Runge – Kutta – Fehlberg method, Adas – Bashforth – Moulton Formula. Solution of Parabolic, Hyperbolic and Elliptic PDEs.

Implementation to be done in C/C++.

Text Books:

1. D. Kincaid and W. Cheney, “Numerical Analysis: Mathematics of Scientific Computing”, Thomson / Brooks-Cole., 1991.

Reference:

1. D. Kincaid and W. Cheney, “Numerical Analysis”, Thomson/ Brooks-Cole., 2002.
2. R. L. Burden and J. D. Faires, “Numerical Analysis”, Thomson/Brooks-Cole, 2001.
3. W. Y. Yang, W. Cao, T-S. Chung and J. Morris, “Applied Numerical Methods Using Matlab”, Wiley, 2005.
4. J. H. Mathews and K. D. Fink, “Numerical Methods Using Matlab”, Prentice Hall, 1999.
5. S. D. Conte and C. de Boor, “Elementary Numerical Analysis: An Algorithmic Approach”, McGraw Hill, 1980.

COE 404.2: Optimization techniques	L T P	Credits
	3 1 0	4

UNIT I

Introduction to Linear Programming: Prototype Example, the Linear Programming Model, Assumptions of Linear Programming, Additional Examples, Some Classic Case Studies. Graphical method, The Simplex Method: The Essence of the Simplex Method, Setting up the Simplex Method, The Algebra of the Simplex Method, The Simplex Method in Tabular Form, Tie Breaking in the Simplex Method, Adapting to Other Model Forms, Post optimality Analysis.

UNIT II

Duality Theory And Sensitivity Analysis: The Essence of Duality Theory, Economic Interpretation of Duality, Primal-Dual relationships, Adapting to Other Primal Forms, The Role of Duality Theory in Sensitivity Analysis. Other Algorithms for Linear Programming: The Dual Simplex Method, Parametric Linear Programming, the Upper Bound Techniques, An Interior-Point Algorithm.

UNIT III

Dynamic Programming: A prototype example for Dynamic Programming, Characteristics of Dynamic Programming Problems, Deterministic Dynamic Programming, Probabilistic Dynamic Programming.

UNIT IV

Integer Programming: Prototype Example, Some BIP Applications, Innovative Uses of Binary Variables in Model Formulation, Some Formulation examples, Some Perspectives on Solving Integer Programming Problems, The Branch-and-Bound Technique and Its application to Binary Integer Programming, A Branch-and-Bound Algorithm for Mixed Integer.

UNIT V

Nonlinear Programming: Sample Applications, Graphical Illustration of Nonlinear Programming Problems, Types of Nonlinear Programming Problems, One-Variable Unconstrained Optimization, Multivariable Unconstrained Optimization, The Karush-Kuhn-Tucker (KKT) Conditions for Constrained Optimization, Quadratic Programming, Separable Programming, Convex Programming.

UNIT VI

Queuing Theory: Prototype Example, Basic Structure of queuing Models, Examples of Real Queuing Systems, The role of the Exponential Distribution, The Birth-and-Death Process, Queuing Models Based on the Birth-and-Death Process, Queuing Models involving non exponential distributions.

UNIT VII

Latest trends in optimization techniques: Optimization Techniques for Semi-Supervised Support Vector Machines, Predicting the Impact of Optimizations for Embedded Systems.

Text Books:

1. H.A.Taha – Operations Research, 8/e, Pearson Education, New Delhi-2007.
2. J.K. Sharma – Operations Research, 3/e, Mcmillan, India Ltd, 2007.
3. S. Hiller & G.J. Lieberman – Operations Research, 8th Edn, TMH, New Delhi – 2006.

Reference Books:

1. Kanti Swarup, Gupta Pk, Man Mohan, Operations Research, Sultan Chand & Sons

Reference Papers:

1. Olivier Chapelle, Vikas Sindhvani and Sathiya S. Keerthi, “Optimization Techniques for Semi-Supervised Support Vector Machines”, Journal of Machine Learning Research 9 (2008) 203-233, 2008

2. M. Zhao, B. Childers and M.L. Soffa., “Predicting the Impact of Optimizations for Embedded Systems”, ACM Conference on Languages, Compilers, and Tools for Embedded Systems, June 2003.

COE404.3 Digital Image Processing	L T P	Credits
	3 1 0	4

UNIT I

Introduction And Digital Image Fundamentals: Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital image processing systems, Sampling and quantization, some basic relationships like neighbors, connectivity, Distance measure between pixels, Imaging Geometry.

UNIT II

Image Transforms: Discrete Fourier Transform, Some properties of the two-dimensional Fourier transform, Fast Fourier transform, Inverse FFT.

Image Enhancement: Spatial domain methods, Frequency domain methods, Enhancement by point processing, Spatial filtering, Low pass filtering, High pass filtering, Homomorphic filtering, Colour Image Processing.

UNIT III

Image Restoration: Degradation model, Diagonalization of Circulant and Block-Circulant Matrices, Algebraic Approach to Restoration, Inverse filtering, Wiener filter, Constrained Least Square Restoration, Interactive Restoration, Restoration in Spatial Domain.

Image Compression: Coding, Inter-pixel and Psycho visual Redundancy, Image Compression models, Error free comparison, Lossy compression, Image compression standards.

UNIT IV

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

UNIT V

Representation and Description: Representation schemes like chain coding, Polygonal Approximation, Signatures, Boundary Segments, Skeleton of region, Boundary description, Regional descriptors, Morphology.

UNIT VI

Recognition and Interpretation: Elements of Image Analysis, Pattern and Pattern Classes, Decision-Theoretic Methods, Structural Methods, Interpretation.

UNIT VI

Latest trends in Digital image processing: Dental X-Ray Image Analysis by Using Image Processing Techniques, Image Processing Based Approach to Cancer Cell Prediction In Blood Samples, Application of three-dimensional digital image processing for dynamic pore structure characterization.

Text Books:

1. Rafael C. Conzalez & Richard E. Woods,-Digital Image Processing, AWL.
2. A.K. Jain,-Fundamental of Digital Image Processing, PHI.
3. Computer Imaging: Digital Image Analysis and Processing, SE Umbaugh, CRC Press, 2005.

Reference Books:

1. Digital Image Processing Algorithms, Pitas, I., Prentice Hall, 1993.

Reference Papers:

1. M.V.Bramhananda Reddy, Varadala.Sridhar and M.Nagendra, "Dental X-Ray Image Analysis by Using Image Processing Techniques", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 6, June 2012
2. S.Jagadeesh, Dr.E.Nagabhooshanam and Dr.S.Venkatachalam, "Image Processing Based Approach To Cancer Cell Prediction In Blood Samples", International Journal of Technology and Engineering Sciences Vol.1 (1), ISSN: 2320-8007
3. Mashia Mohammad Foghi, Saeed M. Golmohammadi, Hamed Yazdanpanah, HosseinYaghmaei and Ata Tavakoli, "Application of three-dimensional digital image processing for dynamic pore structure characterization", Global Journal of Science, Engineering and Technology (ISSN : 2322-2441) Issue 5, pp. 203-208, 2013

COE 404.4 Neural Networks & Fuzzy Logic	L T P	Credits
	3 1 0	4

UNIT I

Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

UNIT II

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.

UNIT III

Single Layer Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous

Perceptron Networks, Limitation of the Perceptron model. Multilayer Feed forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT V

Radial-Basis Function Networks: Cover's Theorem on the separability of Patterns, Radial-Basis Function Network, Approximation properties of RBF Networks, Comparison of RBF networks and multilayered Perceptrons. Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis.

UNIT VI

Classical & Fuzzy Sets: Introduction to classical sets-properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzy Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Applications: Neural network applications: Process identification, control, fault diagnosis; Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

UNIT VII

Latest trends in neural network: Practical application of fuzzy logic and neural networks to fractured reservoir characterization, Fuzzy Logic, Neural Networks, and Soft Computing, Neural-Network-Based Fuzzy Logic Control and Decision System.

Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications, S. Rajasekharan and G. A. Vijayalakshmi Pai, PHI Publication.
2. Neural networks and fuzzy Logic, Rao, Vallinu B.,and Rao, Hayagriva, second edition, BPB Publication.
3. Fuzzy Logic: Intelligence, Control and Information, John Yen and Reza Langan, Pearson Education.

Reference Books:

1. Neural Networks- A comprehensive foundation, Simon Haykin, Pearson Education.
2. S.N.Sivanandam, S.Sumathi, et al, Introduction to Neural Networks using MATLAB 6.0, TMH.
3. James A Freeman and Davis Skapura, Neural Networks Pearson Education.
4. Timothy J. Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill Inc.

Reference Papers:

1. Ahmed Ouenes, "Practical application of fuzzy logic and neural networks to fractured reservoir characterization", Computers & Geosciences 26, 953±962, 2000
2. Lofti A. Zadeh, "Fuzzy Logic, Neural Networks, and Soft Computing", Communication of the ACM, Vol. 37, No.3, 1994
3. Chin-Teng Lin and C. S. George Lee, "Neural-Network-Based Fuzzy Logic Control and Decision System ", IEEE Transactions on Computers, Vol. 40, No. 12, December 1991

COE 404.5 Data Compression	L T P	Credits
	3 1 0	4

UNIT I

Introduction: Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.

UNIT II

Huffman coding: The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, encoding procedure, decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.

UNIT III

Arithmetic Coding: Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress.

UNIT IV

Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows- Wheeler Transform: Move-to-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markov Compression.

UNIT V

Mathematical Preliminaries for Lossy Coding: Distortion criteria, Models, Scalar Quantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.

UNIT VI

Vector Quantization: Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo- Gray Algorithm, Tree structured Vector Quantizers. Structured Vector Quantizers.

UNIT VII

Latest trends in data compression: A Novel Joint Data-Hiding and Compression Scheme Based on SMVQ and Image Inpainting.

Text Books:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers

Reference Papers:

Chuan Qin, Chin-Chen Chang and Yi-Ping Chiu, "A Novel Joint Data-Hiding and Compression Scheme Based on SMVQ and Image Inpainting", Image Processing, IEEE Transactions on (Volume:23 , Issue: 3), 2014

COE 404.6 Digital Signal Processing	L T P	Credits
	3 1 0	4

UNIT I

INTRODUCTION: Signal-continuous time and Discrete time systems, Properties of systems. Linear time invariant systems-continuous time and discrete time. Properties of LTI systems and their block diagrams

UNIT II

FREQUENCY DOMAIN REPRESENTATION OF SYSTEMS: The continuous time Fourier transform for periodic and aperiodic signals properties of CTFT. Discrete time Fourier transform for periodic and aperiodic signals. Properties of DTFT. The convolution and modulation property.

UNIT III

SAMPLING: Sampling theorem, Aliasing, Sampling in frequency domain. Sampling of Discrete time signals.

UNIT IV

Z-TRANSFORM: Introduction The region of convergence for the Z-transform. The Inverse Z-transform. The Inverse Z-transform. Two dimensional Z-transform. Properties of Z-transform.

UNIT V

DISCRETE AND FAST FOURIER TRANSFORM: Introduction Properties of DFT & DFS. Linear convolution using the DFT Decimation in time & frequency FFT Algorithms.

UNIT VI

REPRESENTATION OF DIGITAL FILTERS: Introduction, Signal flow graph representation of digital networks. Basic structure for IIR & FIR systems.

UNIT VII

Latest trends in DSP: Reproducible Research in Signal Processing, Social signal processing: Survey of an emerging domain.

Text Books:

1. Salivahanan and Vallavaraj-Digital Signal Processing, Tata Mc-Graw Hill.
2. Nagrath-Signals and Systems, Tata Mc-Graw Hill.
3. Oppenheim A.V.-Signals and Systems, PHI.

Reference Books:

1. Oppenheim A.V.-Digital Signal Processing, PHI.
2. Lathi-Signals and Linear System, Oxford.

Reference Papers:

1. Patrick Vandewalle, Jelena Kovac evic, and Martin Vetterli, "Reproducible Research in Signal Processing", IEEE Signal Processing Magazine, 1053-5888, 2009
2. Alessandro Vinciarelli, Maja Pantic and Hervé Bourlard, "Social signal processing: Survey of an emerging domain", Image and Vision Computing 27, 1743–1759, 2009

COE 404.7 Selected Topics	L T P	Credits
	3 1 0	4

Advanced Topics in Computer Science and Engineering

COE-405 Artificial Intelligence Lab	L T P	Credits
	0 0 3	3

Based on course work corresponding COE-401

COE-406 Elective Lab – I	L T P	Credits
	0 0 3	3

Based on course work corresponding COE-403.

COE-407 Major Project (Part-1)	L T P	Credits
	0 0 2	4

COE-408 Industrial Training Viva-Voce -II	L T P	Credits
	0 0 4	4

Based on Industrial Training of duration Six – Eight weeks, carried out after VI semester exam.

COE-411 Data Warehousing and Mining	L T P	Credits
	3 1 0	4

UNIT I

Data Warehousing: - Basic concepts in data warehousing, Collecting the requirements of data warehouse, Data Warehouse Architecture, Design, Implementation & Maintenance, OLAP in data warehouse, Data warehousing and the web, Data Cube Technology, From Data Warehousing to Data Mining.

UNIT II

Data Mining Concepts: Data mining primitives, Basics of data mining, Query language, Architectures of data mining systems

UNIT III

Mining Association Rules in Large Databases: Association Rule Mining, Mining Single Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint Based Association Mining.

UNIT IV

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.

UNIT V

Cluster Analysis in Data Mining: Types of Data in Cluster Analysis. A Categorization of Major Clustering Methods, Partitioning Methods, Density Based Methods, Grid Based Methods; Model Based Clustering Methods, Outlier Analysis.

UNIT VI

Mining Complex Types of Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time Series and Sequence Data, Mining Text Databases.

Applications and trends in Data Mining: - Applications, Systems products and research prototypes, Additional themes in data mining, Trends in Data mining, spatial mining, and Web Mining.

UNIT VII

Latest trends in Data Warehousing and Mining: Temporal data warehousing, Data warehouse and OLAP technology.

Text Books:

1. Data Warehousing Fundamentals, P. Ponnian, John Wiley.
2. Data Mining Introductory & Advanced Topics, M.H. Dunham, Pearson Education.
3. Data Mining Concepts & Techniques, Han Kamber, M. Kaufman.

Reference Books:

1. The Data Warehouse Lifecycle Tool Kit, Ralph Kimball, John Wiley

2. Master in Data Mining, M. Berry , G. Linoff, John Wiley
3. Building the Data Ware houses, W.H. Inmon, Wiley Dreamtech

Reference Papers:

1. Matteo Golfarelli, Stefano Rizzi, “A Survey on Temporal Data Warehousing”, International Journal of Data Warehousing & Mining, 5(1), 1-17, January-March 2009
2. Youssef Bassil, “A Data Warehouse Design for A Typical University Information System”, Journal of Computer Science & Research (JCSR), Vol. 1, No. 6, Pages. 12-17, December 2012
3. Manya Sethi, “Data Warehousing And Olap Technology”, International Journal of Engineering Research and Applications (IJERA), Vol. 2, Issue 2, pp.955-960, Mar-Apr 2012

Elective –II

COE 412.1: Advanced Computer Networks	L T P	Credits
	3 1 0	4

UNIT I

Review of Basic Network Architectures: OSI reference model, TCP/IP reference model, ATM reference model; Applications(WWW, Audio/Video Streaming, Video conference, Networked Games, Client/Server); Traffic Characterization (CBR, VBR);

UNIT II

Switching Paradigms; Multiplexing; Error Control; Flow Control, FTH, DTH, PON, ISDN, DSL, CATV, SONET, Optical Networks.

UNIT III

Local Area Network Technologies: Fast Ethernet, Gigabit Ethernet, IEEE 802.11 WLAN, Bluetooth, Connecting LANs, VLANs.

UNIT IV

Internetworking: Interdomain Routing, BGP, IPv6, Multicast Routing Protocols, Multi Protocol Label Switching, Virtual Private Networks, High speed transport protocols, Quality of Service Mechanisms, Improving QoS in Internet, DiffServ and IntServ Architectures, RSVP.

UNIT V

Distributed Systems: Naming, DNS, DDNS, Paradigms for Communication in Internet, Caching, Issues of Scaling in Internet and Distributed Systems, Caching Techniques for Web, Protocols to Support Streaming Media, Multimedia Transport Protocols, Content Delivery Networks, Overlay and P2P Networks.

UNIT VI

Applications and Other Networking Technologies: RTP, RTSP, SIP, VoIP, Security Systems, SSH, PGP, TLS, IPSEC, DoS

Attack, Mitigation in Internet, Security in MPLS; Introduction to Cellular, Satellite and Ad hoc Networks.

UNIT VII

Latest trends in Advanced computer network: Performance of Computer Networks with Advance Reservation Mechanisms, congestion control.

Text Books:

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Ed., Tata McGraw Hill, 2006.
2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, FourthEd, Morgan Kaufmann, 2007.
3. Jean Walrand and Pravin Varaiya, High Performance Communication Networks, 2nd Ed., Morgan Kauffman, 1999.

Reference Books

1. Markus Hoffmann and Leland R. Beaumont, Content Networking: Architecture, Protocols, and Practice, Morgan Kauffman, 2005.

Publication:

1. U.S. Congress, Office of Technology Assessment, Advanced Network Technology--Background Paper, OTA-BP-TCT-101 (Washington, DC:U.S. Government printing Office, June 1993).
2. Lars-Olof Burchard, “On the Performance of Computer Networks with Advance Reservation Mechanisms”, Networks, the 11th IEEE international conference, 449-454, 2003
3. Raj Jain, “CONGESTION CONTROL IN COMPUTER NETWORKS: ISSUES AND TRENDS”, IEEE Network Magazine, May 1990, pp. 24-30.

COE 412.2: Advanced Database Management Systems	L T P	Credits
	3 1 0	4

UNIT I

Advanced data-models: Introduction and Architecture of distributed systems, federated database systems, multidatabase systems, Client/Server systems. Advanced transaction models suitable for different types of distributed database systems. Advanced data models and data structuring approaches such as object-orientation databases and XML. Object Oriented databases: Approaches - Modeling and Design - Persistence - Transaction -- Database Administration, object relational model and peer-to-peer models

UNIT II

Distributed databases: Management of Data that is distributed over multiple locations, data model partitioning, fragmentation, replication issues, Query processing, Concurrency, Recovery for distributed database

UNIT III

Data Warehousing and Data Mining: On-Line Analytical Processing (OLAP) Design issues: Security - Integrity - Consistency - Database Tuning -Optimization and Research Issues, Query optimization, concurrency control, restart and recovery, transaction management, distributed design.

UNIT IV

Information and multimedia retrieval: To search for non-tabular data, such as text, images, audio, video, etc. Content Based Retrieval.

UNIT V

Web Databases: Web and semi structured data, search engines, Case studies: middleware technology (Enterprise Java Beans), Mobile Databases

UNIT VI

Applications: The role of databases in information system architectures.

UNIT VII

Latest trends in advanced DBMS: Relational Approach to Database Management, Transaction Management in the R*Distributed Database Management System.

Text Books:

1. R. G. G. Cattell, Object Data Management: Object Oriented and Extended Relational Systems, revised edition, Addison Wesley, .
2. F. Bancilhon, C. Delobel, P. Kannelakis (Eds.), Building an OODB System, the Story of O2, Morgan Kaufmann.
3. M. Tamer Ozsu, Patrick Valduriez, Principles of Distributed Database

Reference Papers:

1. IBM Research Laboratory, "System R: Relational Approach to Database Management", ACM Transactions on Database Systems, Vol. 1, No. 2., Pages 97-137, June 1976
2. C. MOHAN, B. LINDSAY, and R. OBERMARCK, "Transaction Management in the R*Distributed Database Management System", ACM Transactions on Database Systems, Vol. 11, No. 4, December 1966, Pages 373-396.

COE 412.3 Distributed Algorithms	L T P	Credits
	3 1 0	4

Unit I

Formal models of distributed computing: shared memory versus message passing, determinism versus randomization, concepts of synchronism, asynchrony and real-time.

Unit II

Design and analysis of distributed algorithms and impossibility/improbability results for fundamental problems such as mutual exclusion, consensus, synchronization, leader election, construction of minimum spanning trees.

Unit III

Fault tolerance: Byzantine generals, wait-free algorithms, fault degrees. Formal methods for proving correctness of distributed algorithms.

Unit IV

Advanced topics. Special emphasis throughout the course on lower and upper bounds on time and memory.

Unit V

Latest trends in distributed algorithms: Evolving Distributed Algorithms With Genetic Programming, Weighted Sum Rate Optimization for Downlink Multiuser MIMO Coordinated Base Station Systems: Centralized and Distributed Algorithms.

Text Books:

1. Gerald Tel, "Distributed Algorithms", Cambridge University Press.
2. Aho A.V., Hopcrptt J.E. and Ullman J.D, "The Design and Analysis of Computer Algorithms", Pearson Education.

Reference Papers:

1. Weise, Thomas and Ke Tang, "Evolving Distributed Algorithms With Genetic Programming", IEEE Transactions on Evolutionary Computation, (Volume:16, Issue: 2), 2012
2. Bogale, T.E. and Vandendorpe, L., "Weighted Sum Rate Optimization for Downlink Multiuser MIMO Coordinated Base Station Systems: Centralized and Distributed Algorithms", IEEE Transactions on Signal Processing, Volume:60, Issue: 4, 2012

COE 412.4 Grid and Cluster Computing	L T P	Credits
	3 1 0	4

UNIT I

Cluster Computing Introduction to concepts in Cluster based distributed computing Hardware technologies for cluster computing and software for cluster computing, and different Software Architecture for Cluster Computing.

UNIT II

Programming; Programming Models and Paradigms, features and performance of standard MPI variants, Derived data types, communicators.

UNIT III

Resource management and scheduling Managing, cluster resources: single system images, system level middleware, distributed task scheduling, monitoring and administering system resources Parallel I/O and Parallel Virtual File System. Scheduling: Condor, Maui Scheduler, Portable Batch System (PBS).

UNIT IV

Grid Computing: Grids and Grid Technologies, Programming models and Parallelization Techniques, Grid Security

Infrastructure, Setting up Grid, deployment of Grid software and tools, and application execution.

UNIT V

Standard application development tools and paradigms
Performance evaluation tools, HINT, netperf, netpipe, ttcp, lperf.message

UNIT VI

Data Management Application Case Study: Molecular Modeling for Drug Design and Brain Activity Analysis, Resource management and scheduling.

UNIT VII

Latest trends in Grid and Cluster Computing: GridFlow: Workflow Management for Grid Computing, Security Issues in On-Demand Grid and Cluster Computing, Market-Oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities.

Text Books:

1. Beowulf Cluster Computing with Linux, 2nd edition, William Gropp, Ewing Lusk, Thomas Sterling, MIT Press.
2. Introduction to grid computing - Bart Jacob, Michael Brown
3. In Search of Clusters: The ongoing battle in lowly parallel computing, Second Edition, by Gregory F. Pfister, Prentice Hall Publishing Company, 1998.

Reference Books:

1. MPI The Complete Reference - 2nd Ed by Marc Snir, et. al., The MIT Press, 1998.
2. Parallel Programming with MPI by Peter Pacheco, Morgan Kaufmann, 1998.
3. Using MPI-2, Advanced Features of the Message Passing Interface, William Gropp, Ewing Lusk, Rajeev Thakur, The MIT Press, 1999.
4. How to Build a Beowulf – A Guide to the Implementation and Application of PC Clusters, by Thomas Sterling, John Salmon, Donald J. Becker and Daniel F. Savarese, MIT Press, 1999

Reference Papers:

1. Junwei Cao, Stephen A. Jarvis, Subhash Saini and Graham R. Nudd, "GridFlow: Workflow Management for Grid Computing", Proceedings of the 3rd IEEE/ACM International Symposium on Cluster Computing and the Grid (CCGRID.03), 2003
2. Matthew Smith, Michael Engel, Thomas Friese, Bernd Freisleben, "Security Issues in On-Demand Grid and Cluster Computing", Proceedings of the Sixth IEEE International Symposium on Cluster Computing and the Grid Workshops (CCGRIDW'06), 2006
3. Rajkumar Buyya^{1,2}, Chee Shin Yeo¹, and Srikumar Venugopal¹, "Market-Oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities", 10th IEEE International Conference on High Performance Computing and Communications, 2008

COE 412.5: Bioinformatics	L T P	Credits
	3 1 0	4

UNIT I

The Biologist & Internet: Internet basics, FTP, World Wide Web, and Introduction to Primary & Secondary database, GenBank, GCG, and ACDEB. Structure Databases: Introduction to structures, PDB, MMDB, Structure file formats, Visualizing structural information, Database structure viewers, Introduction to the NCBI database, SeqIDS, Seq. Annot: Annotating the sequence, Seqdiscr: Describing the sequence.

UNIT II

Information Retrieval from Biological Databases & submission of DNA Sequences to the Databases: Retrieving database entries, Integrated information retrieval: The ENTREZ system, sequence databases beyond NCBI, Medical Databases; Where to submit nucleotide sequences, How to submit on the World Wide Web, How to submit with sequin, Molecular modeling.

UNIT III

Sequence Alignment and Database Searching: Introduction, Evolutionary basis of sequence alignment, Optimal alignment methods, Substitution scores & gap penalties, Statistical significance of alignments, Database similarity searching, FASTA, BLAST, Low complexity regions, Repetitive elements.

UNIT IV

Multiple Sequence Alignment & Genome Mapping : Progressive alignment methods, Motifs and patterns, Probe, Presentation methods, Abscript; Different types of maps: physical, genetical, etc. Synteny, Human genome project, Application of genome mapping, Chromosome maps.

UNIT V

Predictive Methods Using Nucleotide & protein Sequences Framework, marking repetitive DNA, Database search, Codon bias detection, Detecting function sites in the DM, Protein identity based on composition.

UNIT VI

Latest trends in Bioinformatics: Guest Editorial: Data Mining in Bioinformatics, Biomedicine, and Healthcare Informatics.

Text Books:

1. Bioinformatics: A practical guide to the analysis of genes and proteins A.D. axevanis and B.F.F. Ouellette (Eds). 2002 John Wiley and Sons.
2. Bioinformatics: Sequence and Genome Analysis by D.W. Mount, 2001, Cold Spring Harbor Laboratory Press.
3. Rastogi, S.C., Mendiratta, N. and Rastogi, P. 2004 Bioinformatics: Concepts, Skills & Applications. CBS Publishers & Distributors, New Delhi.

Reference Papers:

1. Gao, J.X. and Dubitzky, W., "Guest Editorial: Data Mining in Bioinformatics, Biomedicine, and Healthcare Informatics", IEEE Journal of Biomedical and Health Informatics, (Volume:18, Issue: 2), 2014

COE 412.6 Virtual Reality	L T P	Credits
	3 1 0	4

UNIT I

Virtual reality & Virtual reality systems Real-time computer graphics, Overview of application areas.

UNIT II

Virtual Reality Hardware Sensor hardware, display systems, acoustic hardware, integrated VR systems

UNIT III

3D Computer Graphics The virtual world space, Perspective projection, Stereo vision, 3D clipping, Color theory, 3D modeling, illumination models, shading algorithms, Hidden surface removal, realism.

UNIT IV

Geometrical transforms Frames of reference, 3D transforms, instances, picking, flying, scaling the VE, Collision detection.

UNIT V

Animating the Virtual Environment Animation basics, Using MAYA.

UNIT VI

Human Factors Perception, Persistence of vision, Stereopsis, Sound perception, Equilibrium, Physical Simulation Simulation of physical systems, mathematical modeling, collisions, projectiles, introduction to dynamics, motion kinematics.

UNIT VII

Latest trends in Virtual reality: Change Blindness Phenomena for Virtual Reality Display Systems

Text Books:

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc.
2. Understanding Virtual Reality, interface, Application and Design, William R. Sherman, Alan Craig, Elsevier (Morgan Kaufmann).
3. 3D Modeling and surfacing, Bill Fleming, Elsevier(Morgan Kauffman).

Reference Books:

1. 3D Game Engine Design, David H. Eberly, Elsevier.
2. Virtual Reality Systems, John Vince, Pearson Education.

Reference Papers:

1. Steinicke F., Bruder G., Hinrichs K. and Willemsen P., "Change Blindness Phenomena for Virtual Reality Display Systems", IEEE Transactions on Visualization and Computer Graphics, (Volume:17, Issue: 9), 2011.

COE 412.7 Pattern Recognition	L T P	Credits
	3 1 0	4

UNIT I

Pattern recognition fundamentals: Basic concepts of pattern recognition, fundamental problems in pattern recognition system, design concepts and methodologies, example of automatic pattern recognition systems, a simple automatic pattern recognition model.

UNIT II

Bayesian decision theory: Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, Discrete features, Missing and noisy features, Bayesian networks (Graphical models) and inferencing.

UNIT III

Maximum-likelihood and Bayesian parameter estimation: Maximum-Likelihood estimation: Gaussian case, Maximum a Posteriori estimation, Bayesian estimation: Gaussian case, Problems of dimensionality, Dimensionality reduction: Fisher Discriminant analysis, PCA Expectation-Maximization method: Missing features

UNIT IV

Sequential Models: State Space, Hidden Markov models, Dynamic Bayesian. Non-parametric techniques for density estimation: Parzen-window method, K-Nearest Neighbor method

UNIT V

Linear Discriminant functions: Gradient descent procedures, Perceptron criterion function, Minimum-squared-error procedures, Ho-Kashyap procedures, Support vector machines

UNIT VI

Unsupervised learning and clustering: Unsupervised maximum-likelihood estimates, Unsupervised Bayesian learning, Criterion functions for clustering, Algorithms for clustering: K-means, Hierarchical and other methods, Cluster validation, Low-dimensional representation and multidimensional scaling (MDS).

UNIT VII

Latest trends in Pattern Recognition: Speed-up Template Matching through Integral Image based Weak Classifiers, Statistical Pattern Recognition: A Review.

Text Books:

1. Pattern Classification, R.O. Duda, P.E. Hart and D.G. Stork, John Wiley.
2. Pattern Recognition principles: Julius T. Tou and Rafael C. Gonzalez, Addison –Wesley.
3. Pattern recognition and machine learning, Christopher M. Bishop, Springer 2006.

Reference Books:

1. A probabilistic theory of pattern recognition, Luc Devroye, László Györfi, Gábor Lugosi, Springer, 1996.
2. Pattern classification, Richard O. Duda, Peter E. Hart and David G. Stork, Wiley, 2001.

Reference Papers:

1. Tirui Wu and Alexander Toet, “Speed-up Template Matching through Integral Image based Weak Classifiers”, Journal of Pattern Recognition Research 1 (2014) 1-12, 2014
2. Anil K. Jain, Robert P.W. Duin and Jianchang Mao, “Statistical Pattern Recognition: A Review”, IEEE Transactions On Pattern Analysis And Machine Intelligence, VOL. 22, NO. 1, January 2000.

COE 412.8 Selected Topics	L T P	Credits
	3 1 0	4

Advanced Topics in Computer Science and Engineering

COE 413.1 Quantum Computing	L T P	Credits
	3 1 0	4

UNIT-I

Overview of quantum computing: history, qubits, qubit gates, quantum circuits, quantum algorithms.

UNIT-II

Introduction to computer science: Models for computation, Turing machines and circuits, analysis of computational problems, computational complexity, complexity classes, energy and computation.

UNIT-III

Quantum circuits: quantum algorithms, qubit operations, measurement, qubit gates, universal gates and operations, quantum computational complexity, quantum circuit models, simulation of quantum systems.

UNIT-IV

Quantum Algorithms: Introduction to quantum algorithms, Deutsch’s algorithm, Quantum Fourier transform, Shor’s algorithm and Grover’s search Algorithm, Physical implementation of simple quantum gates.

UNIT-V

Quantum computer: physical realization, conditions for quantum computation, introduction to various types of quantum computers: Harmonic oscillator quantum computer, optical photon quantum computer, optical cavity quantum electrodynamics, Ion traps, Nuclear magnetic resonance.

UNIT-VI

Quantum search algorithms and their performance, quantum search as quantum simulation, counting, speeding up the solution of NP –complete problems, optimality of search algorithms.

UNIT VII

Latest trends in Quantum computing: Quantum Information Transmission Over a Partially Degradable Channel

Text Books:

1. Quantum Computation and Quantum Information by Michael A. Nielsen and Isaac L. Chuang, Cambridge Press.
2. Quantum Computing by Vishal Sahni, Tata McGraw Hill.

Reference Papers:

1. Gyongyosi L., “Quantum Information Transmission Over a Partially Degradable Channel”, IEEE Access, Volume:2, 2014

COE 413.2: Multimedia Technology and Applications	L T P	Credits
	3 1 0	4

UNIT I

Introduction : Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work. Convergence of Computer, Communication and Entertainment Products ,Stages of Multimedia Projects: Multimedia hardware, Memory & storage devices, Communication devices, Multimedia software’s, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

UNIT II

Multimedia Building Blocks: Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment Audio & Video Capture.

UNIT III

Data Compression: Huffman Coding, Shannon Fano Algorithm, Huffman Algorithms, Adaptive Coding, Arithmetic Coding Higher Order Modeling. Finite Context Modeling, Dictionary based Compression, Sliding Window Compression, LZ77, LZW compression, Compression, Compression ratio loss less & lossy compression.

UNIT IV

Speech Compression & Synthesis : Digital Audio concepts, Sampling Variables, Loss less compression of sound, loss compression & silence compression.

UNIT V

Images: Multiple monitors, bitmaps, Vector drawing, lossy graphic compression, image file format animations Images standards, JPEG Compression, Zigzag Coding,

UNIT VI

Multimedia Database. Content based retrieval for text and images, Video: Video representation, Colors, Video Compression, MPEG standards, MHEG Standard Video Streaming on net, Video Conferencing, Multimedia Broadcast Services, Indexing and retrieval of Video Database, recent development in Multimedia.

UNIT VII

Latest trends in Multimedia: Cross-Layer Dynamic Admission Control for Cloud-Based Multimedia Sensor Networks

Text Books:

1. Tay Vaughan "Multimedia, Making IT Work" Osborne McGraw Hill.
2. Buford "Multimedia Systems" Addison Wesley.
3. Agarwal & Tiwari "Multimedia Systems" Excel.

Reference Books:

1. Mark Nelson "Data Compression Book" BPB.
2. David Hillman "Multimedia technology and Applications" Galgotia Publications.
3. Rosch "Multimedia Bible" Sams Publishing.
4. Sleinreitz "Multimedia System" Addison Wesley.
5. James E Skuman "Multimedia in Action" Vikas.

Reference Papers:

1. Mendes, L.D.P., Rodrigues, J.J.P.C., Lloret, J. and Sendra, S., "Cross-Layer Dynamic Admission Control for Cloud-Based Multimedia Sensor Networks", IEEE Systems Journal, (Volume:8, Issue: 1), 2014

COE 413.3 Robotics	L T P	Credits
	3 1 0	4

UNIT I

Robot Anatomy Arm Geometry-Direct & Inverse Kinematics Problem, Arm Dynamics, D Alembert Equations of Motion, Synthesis of elements with mobility constraints, manipulations-trajectory planning, joint interpolated trajectories.

Unit II

Control of Robot Manipulation-computed torque technique sequencing & adaptive control, resolved motion control Moliue Robots.

Unit III

Robot sensing-Range & Proximity & Higher-Level vision, illumination techniques, Imaging Geometry, Segmentation Recognition & Interpretation.

Unit IV

Robot Programming Language Characteristics of Robot Level & Task Level languages. Robot intelligence-State Space search, Robot learning, Robot Task Planning, Knowledge Engineering.

UNIT V

Latest trends in Robotics: Medical Robotics in Computer-Integrated Surgery, A New Technique for Fully Autonomous and Efficient 3D Robotics Hand/Eye Calibration, A New Approach to Visual Servoing in Robotics.

Text Books:

1. K.S Fu R.C. CSG Lee-Robotics Control, Sensing, Vision & Intelligence, McGraw-Hill.
2. M.P. Groover, M.Weins, R.N. Nagel, N.C. Odrey-Industrial Robotics, McGraw Hill
3. Andrew C. Straugard-Robotics & AI, PHI.

Reference Books:

1. S. Sitharama Iyengar, Alberto Elefes-Autonomous Mobile Robots Control, Planning & Architecture, IEEE Computer Society Press

Reference Papers:

1. Russell H. Taylor and Dan Stoianovici, "Medical Robotics in Computer-Integrated Surgery", IEEE Transactions On Robotics And Automation, Vol. 19, No. 5, October 2003
2. Roger Y. Tsai and Reimar K. Lenz, "A New Technique for Fully Autonomous and Efficient 3D Robotics Hand/Eye Calibration", IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 5, NO. 3, JUNE 1989
3. Bernard Espiau, Member, IEEE, Francois Chaumette, and Patrick Rives, "A New Approach to Visual Servoing in Robotics", IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 8, NO. 3, JUNE 1992

COE 413.4 Fault Tolerant and Reliable System Design	L T P	Credits
	3 1 0	4

UNIT I

Fundamental Concepts: Definitions of fault tolerance, fault classification, fault tolerant attributes and system structure.

UNIT II

Fault-Tolerant Design Techniques: Information redundancy, hardware redundancy, and time redundancy.

UNIT III

Dependability Evaluation Techniques : Reliability and availability models: (Combinatorial techniques, Fault-Tree models, Markov models), Performance Models.

UNIT IV**Architecture of Fault-Tolerant Computers (case study)**

General-purpose systems, high-availability systems, long-life systems, critical systems.

UNIT V

Software Fault Tolerance : Software faults and their manifestation, design techniques, reliability models.

UNIT VI

Fault Tolerant Parallel/Distributed Architectures : Shared bus and shared memory architectures, fault tolerant networks.

Recent topics in fault tolerant systems : Security, fault tolerance in wireless/mobile networks.

UNIT VII

Latest trends in fault tolerance: Designing Reliable Systems From Unreliable Components: The Challenges Of Transistor Variability And Degradation, Robust System Design with Built-In Soft-Error Resilience, Toward Systematic Design of Fault-Tolerant Systems.

Text Books:

1. Fault-Tolerant Computer System Design D.K. Pradhan, 2003.
2. Design and Analysis of Fault-Tolerant Digital Systems, B.W. Johnson, Addison-Wesley
3. Fault-Tolerant Computing, Theory and Techniques, Volumes I and II, D.K. Pradhan, Prentice Hall.

Reference Books:

1. Reliable Computer Systems: Design and Evaluation, D.P. Siewiorek and R.S. Swartz, Digital Press, 1992
2. Probability and Statistics with Reliability, Queuing and Computer Science Application K.S. Trivedi, Prentice Hall, 1982

Reference Papers:

1. Shekhar Borkar, "Designing Reliable Systems From Unreliable Components: The Challenges Of Transistor Variability And Degradation", Published by the IEEE Computer Society 0272-1732, 2005
2. Subhasish Mitra, Norbert Seifert, Ming Zhang, Quan Shi and Kee Sup Kim, "Robust System Design with Built-In Soft-Error Resilience", Published by the IEEE Computer Society, 2005
3. Algirdas Avizienis, "Toward Systematic Design of Fault-Tolerant Systems", IEEE, 0018-9162, 1997

COE 413.5: OPTICAL NETWORKS	L T P	Credits
	3 1 0	4

UNIT I

Introduction to Optical Networking: Introduction to SONET/SDH, SONET/SDH, Dense Wavelength-Division Multiplexing, The Future of SONET/SDH and DWDM.

UNIT II

Time-Division Multiplexing: An Introduction to Time-Division Multiplexing, Analog Signal Processing, Analog Signal Processing, Circuit-Switched Networks, The T-Carrier, The E-Carrier, ISDN, TDM Network Elements

UNIT III

Fiber-Optic Technologies: A Brief History of Fiber-Optic Communications, Fiber-Optic Applications, The Physics Behind Fiber Optics, Optical-Cable Construction, Propagation Modes, Fiber-Optic Characteristics, Fiber Types, Fiber-Optic Cable Termination, Splicing, Physical-Design Considerations, Fiber-Optic Communications System, Fiber Span Analysis.

UNIT IV

Wavelength-Division Multiplexing: The Need for Wavelength-Division Multiplexing, Wavelength-Division Multiplexing, Coarse Wavelength-Division Multiplexing, Dense Wavelength-Division Multiplexing, The ITU Grid, Wavelength-Division Multiplexing Systems, WDM Characteristics and Impairments to Transmission, Dispersion and Compensation in WDM.

UNIT V

SONET Architectures: SONET Integration of TDM Signals, SONET Electrical and Optical Signals, SONET Layers, SONET Framing, SONET Transport Overhead, SONET Alarms, Virtual Tributaries, SONET Multiplexing, SONET Network Elements, SONET Topologies, SONET Protection Architectures, SONET Ring Architectures, SONET Network Management.

UNIT VI

SDH Architectures: SDH Integration of TDM Signals, SDH Layers, SDH Multiplexing, SDH Framing, SDH Transport Overhead, SDH Alarms, SDH Higher-Level Framing, SDH Network Elements, SDH Topologies, SDH Protection Architectures, SDH Ring Architectures, SDH Network Management.

UNIT VII

Latest trends in optical network: Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network, Wavelength-Convertible Optical Network

Text Books:

1. Optical Network Design and Implementation, Vivek Always

Reference Papers:

1. Glen Kramer and Gerry Pesavento, "Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network", IEEE Communications Magazine, February 2002
2. Kuo-Chun Lee and Victor O. K. Li, "A Wavelength-Convertible Optical Network", Journal Of Lightwave Technology, VOL. 11, NO. 5/6, 1993

COE 413.6 VLSI Design	L T P	Credits
	3 1 0	4

Unit I

Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers.

Unit II

Processing Technology: Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, circuit elements, 3-D CMOS. Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule

Unit III

Power Dissipation: Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reprogrammable Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioral Synthesis, RTL synthesis

Unit IV

Placement: placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays.

Unit V

Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability.

Unit VI

Overview of VHDL

Text Book:

1. "Digital Integrated Circuit", J.M. Rabaey, Chandrasan, Nicolic, Pearson
2. "CMOS Digital Integrated Circuit", S.M. Kang & Y. Leblebici, TMH
3. "Modern VLSI Design", Wayne Wolf, Pearson

Reference Books:

1. "Algorithm for VLSI Design & Automation", N. Sherwani, Kluwer
2. "VHDL", Bhaskar, PHI
3. "Digital Integrated Circuits" Demassa & Ciccone, Willey Pub.
4. "Modern VLSI Design: system on silicon" Wayne Wolf; Addison Wesley Longman Publisher.
5. "Basic VLSI Design" Douglas A. Pucknell & Kamran Eshraghian; PHI
6. "CMOS Circuit Design, Layout & Simulation", R.J. Baker, H.W. Lee, D.E. Boyee, PHI.

Reference Papers:

1. Alioto, M., "Ultra-Low Power VLSI Circuit Design Demystified and Explained: A Tutorial", IEEE Transactions on Circuits and Systems I: Regular Papers, Volume:59, Issue: 1, 2012

2. Gang Qu, "Publicly detectable watermarking for intellectual property authentication in VLSI design", IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, Volume:21, Issue: 11, 2002

COE-413.7 Embedded Systems	L T P	Credits
	3 1 0	4

UNIT I

Introduction Evolution of embedded systems & their applications, architectural diversity for embedded system development.

UNIT II

Techniques and tools for embedded software development

Embedded Programming principles, Instruction Set Architectures for embedded software development: arithmetic and logical, program control, string instructions, special or privileged instructions, Interrupt system, Input-output programming, Memory management, Using High level languages for embedded programming, structured and Object Oriented Programming

UNIT III

Re-configurable FPGA for embedded computing

R-FPGA and hardware software development, issues in Reconfigurable computing, placement and scheduling techniques, Design of digital systems on FPGAs, fault tolerant design on FPGAs, Re-targetable assembling and compilation.

UNIT IV

Applications Specific applications. Emerging trends.

UNIT V

Latest trends in embedded system: On-chip networks: scalable, communication-centric embedded system design paradigm, Systematic Approach to Exploring Embedded System Architectures at Multiple Abstraction Levels, Selective Instruction Compression For Memory Energy Reduction in Embedded Systems

Text Books:

1. Advanced FPGA Design: Architecture, Implementation, and Optimization by Steve Kilts, Wiley.
2. Practical FPGA Programming in C by David Pellerin, Prentice Hall.
3. Synthesis of Arithmetic Circuits: FPGA, ASIC and Embedded Systems, by Jean-Pierre Deschamps, Gery J.A. Bioul, Gustavo D. Sutter, Wiley.

Reference Books:

1. Rapid Prototyping of Digital Systems, By James O. Hamblen, Tyson S. Hall, Michael D. Furman, Springer.
2. Embedded Software Development with eCos (Bruce Perens' Open Source Series), Anthony J. Massa.

Reference Papers:

1. Jorg Henkely, Wayne Wolfz and Srimat Chakradhary, "On-chip networks: A scalable, communication-centric embedded system design paradigm", Proceedings of the 17th International Conference on VLSI Design (VLSID'04) 1063-9667, 2004
2. Andy D. Pimentel and Cagkan Erbas, "A Systematic Approach to Exploring Embedded System Architectures at Multiple Abstraction Levels", IEEE Transactions On Computers, Vol. 55, No. 2, February 2006
3. L. Benini, A. Macii, E. Macii, M. Poncino, "Selective Instruction Compression For Memory Energy Reduction in Embedded Systems", IEEE/ACM Proc. of International Symposium on Low Power Electronics and Design (ISLPED'99), pp. 206-211,1999.

COE 413.8 Selected Topics	L T P	Credits
	3 1 0	4

Advanced Topics in Computer Science and Engineering

COE-414 Data Mining-Lab	L T P	Credits
	0 0 3	3

Based on course work corresponding COE-411

COE-415 Elective –II Lab	L T P	Credits
	0 0 3	3

Based on course work corresponding COE-412

COE-416 Seminar	L T P	Credits
	0 0 2	2

COE-417 Major Project II	L T P	Credits
	0 0 6	10

COE-418 Advanced Topics Computer Science and Engineering	L T P	Credits
	3 1 0	4