Course Structure & Syllabus

of

B.Tech Programme

in

Computer Science & Engineering

(From the Session 2015-16)

VSSUT, BURLA

VISION

To emerge as an internationally acclaimed Technical University to impart futuristic technical education and creation of vibrant research enterprise to create quality engineers and researchers, truly world class leader and unleashes technological innovations to serve the global society and improve the quality of life.

MISSION

The Veer Surendra Sai University of Technology, Odisha, Burla strives to create values and ethics in its products by inculcating depth and intensity in its education standards and need based research through

- Participative learning in a cross-cultural environment that promotes the learning beyond the class room.
- Collaborative partnership with industries and academia within and outside the country in learning and research.
- Encouraging innovative research and consultancy through the active participation and involvement of all faculty members.
- Facilitating technology transfer, innovation and economic development to flow as natural results of research where ever appropriate.
- Expanding curricula to cater broader perspectives.
- Creation of service opportunities for upliftment of the society at large.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To be a recognized leader by imparting quality technical education and thereby facilitating the extensive research environment, equipping students with latest skills in the field of technology supplemented with practical orientation to face challenges in the fast morphing modern computing industry and academia for the betterment of the society.

MISSION

a. To produce best quality computer science / IT professionals and researchers by providing state-of-the-art training, hands on experience and healthy research environment.
b. To collaborate with industry and academia around the globe for achieving quality technical education and excellence in research through active participation of all the stakeholders.
c. To promote academic growth by establishing Center of Excellences and offering inter-disciplinary postgraduate and doctoral programs.
d. To establish and maintain an effective operational environment and deliver quality, prompt cost effective and reliable technology services to the society as well as compliment the local and global economic goals.

GRADUATE ATTRIBUTES:

The Graduate Attributes of NBA for UG Programme are:

- Engineering Knowledge
- Problem Analysis
- Design/Development of solutions
- Conduct investigations of complex problems
- Modern tool usage
- The Engineer and society
- Environment and sustainability
- Ethics
- Individual and Team Work
- Communication
- Project Management & Finance
- Lifelong learning

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
B.TECH IN COMPUTER SCIENCE AND ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES

PEO-1	The graduates will be able to employ their expertise in engineering to resolve various industrial and technological problems.
PEO-2	The graduates will be able to build up an ability to analyze the requirements, understand the technical specification, design and provide novel engineering solutions and produce efficient product design.
PEO-3	The graduates will be able to reveal professionalism, ethical attitude, strong communication skills and maintain good teamwork spirit in their profession.
PEO-4	The graduates will be able to interact with their peers in industry and society as engineering professionals and leaders to set up technical ambience in the society.
PEO-5	The graduates will be able to employ their skill with a strong base to prepare them for higher learning and research activities.
PEO-6	The graduates will emerge as leaders in engineering, management, applied research, and education.

Mapping of Mission statements with program educational objectives

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
To produce best quality computer science / IT professionals and researchers by providing state-of-the-art training, hands on experience and healthy research environment.	✓	✓	✓	✓	✓	✓
To collaborate with industry and academia around the globe for achieving quality technical education and excellence in research through active participation of all the stakeholders.	✓		✓	✓		
To promote academic growth by establishing Center of Excellences and offering inter-disciplinary postgraduate and doctoral programs.		✓			✓	✓
To establish and maintain an effective operational environment and deliver quality, prompt cost effective and reliable technology services to the society as well as compliment the local and global economic goals.	✓	✓		✓		

PROGRAM OUTCOMES: At the end of the program the student will be able to:

a. Required expertise and knowledge of mathematics, computing, science, and fundamentals of engineering.
b. Necessary skill-set to design or conduct scientific and applied experiments, as well as to analyze and interpret any data set.
c. Necessary skill-set for designing of hardware/software system, components, or processes to meet desired needs, within realistic constraints.
d. An ability to function or lead multi-disciplinary teams, work cohesively and produce results.
e. An ability to identify and formulate engineering problems coupled with the required expertise to look for sustainable innovative solutions.
f. An understanding of professional, social and ethical responsibility.
g. An ability of clear and effective communication.
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i. An ability to recognize the current trends, use modern tools and techniques to engage in life-long learning and professional development.
j. Knowledge of contemporary issues and the ability to use that knowledge in ongoing work.
k. Graduates are able to participate and succeed in numerous competitive examinations like GATE, CAT, PSU, GRE, TOEFL, IELTS etc.
l. An interest to investigate complex problems, deriving joy from learning and discovering new things.
m. An ability to lead by example, motivate others, while remaining self-motivated.
n. The knowledge of building, testing, operation and maintenance techniques of networks, databases, security and computer systems (both hardware and software).

Mapping of program outcomes with program educational objectives:

PEOs	Program Outcomes													
	a	b	c	d	e	F	g	h	i	j	k	l	m	N
The graduates will be able to employ their expertise in engineering to resolve various industrial and technological problems.	X	X	X		X			X	X	X	X	X		X
The graduates will be able to build up an ability to analyze the requirements, understand the technical specification, design and provide novel engineering solutions and produce efficient product design	X	X	X		X			X	X	X	X	X		X
The graduates will be able to reveal professionalism, ethical attitude, strong communication skills and maintain good teamwork spirit in their profession.		X		X		X	X						X	
The graduates will be able to interact with their peers in industry and society as engineering professionals and leaders to set up technical ambience in the society.				X		X	X		X			X		X
The graduates will be able to employ their skill with a strong base to prepare them for higher learning and research activities.	X	X	X		X			X	X	X	X			X
The graduates will emerge as leaders in engineering, management, applied research, and education.	X		X		X	X	X				X	X	X	

FIRST YEAR
(COMMON TO ALL BRANCHES)

FIRST SEMESTER				SECOND SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	Subject	L .T .P		Course Code	Subject	L. T. P	
	Mathematics-I	3 - 1 – 0	4		Mathematics-II	3 - 1 - 0	4
	Physics/Chemistry	3 - 1 – 0	4		Chemistry/ Physics	3 - 1 - 0	4
/CS15-008	Engineering Mechanics/Computer Programming	3 - 1 – 0	4	CS15-008/	Computer Programming/Engineering Mechanics	3 - 1 - 0	4
	Basic Electrical Engineering/ Basic Electronics	3 - 1 – 0	4		Basic Electronics/Basic Electrical Engineering	3 - 1 - 0	4
	English/Environmental Studies	3 - 1 – 0	4		Environmental Studies/English	3 - 1 - 0	4
Sessionals				**Sessionals**			
	Physics Laboratory/ Chemistry Lab	0 - 0 – 3	2		Chemistry Lab/ Physics Laboratory	0 - 0 - 3	2
	Workshop-I/Engineering Drawing	0 - 0 – 3	2		Engineering Drawing/ Workshop-I	0 - 0 - 3	2
	Basic Electrical Engineering Lab/Basic Electronics Lab	0 - 0 – 3	2		Basic Electronics Lab/Basic Electrical Engineering Lab	0 - 0 - 3	2
/CS15-984	Business Communication and Presentation Skill/ Programming Lab	0 - 0 – 3	2	CS15-984/	Programming Lab/ Business Communication and Presentation Skill	0 - 0 - 3	2
	Total	**15-5-15**	**28**		**Total**	**15-5-15**	**28**

SECOND YEAR

THIRD SEMESTER				FOURTH SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	**Subject**	**L .T .P**		**Course Code**	**Subject**	**L. T. P**	
	Mathematics-III	3 - 1 - 0	4	CS15-007	Computer Organization and Architecture	3 - 1 - 0	4
	Digital Electronics Circuits	3 - 1 - 0	4	CS15-032	Theory of computation	3 - 1 - 0	4
CS15-011	Data Structure and Algorithms	3 - 1 - 0	4	CS15-013	Design and Analysis of Algorithms	3 - 1 - 0	4
CS15-025	Object Oriented Programming	3 - 1 - 0	4	CS15-012	Database management systems	3 - 1 - 0	4
	Engineering Economics	3 - 1 - 0	4		Organisational Behaviour	3 - 1 - 0	4
Sessionals				**Sessionals**			
	Digital Systems lab	0 - 0 - 3	2	CS15-993	Computer Organization and Architecture Lab	0 - 0 - 3	2
CS15-992	Data Structure Lab	0 - 0 - 3	2	CS15-990	Design and Analysis of Algorithms Lab	0 - 0 - 3	2
CS15-998	C++ Programming Lab	0 - 0 - 3	2	CS15-991	Database management systems Lab	0 - 0 - 3	2
IT15-996	Java Programming Lab	0 - 0 - 3	2	CS15-980	Theory of computation Lab	0 - 0 - 3	2
	Total	**15-5-15**	**28**		**Total**	**15-5-15**	**28**

THIRD YEAR

FIFTH SEMESTER				SIXTH SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	Subject	L .T .P		Course Code	Subject	L. T. P	
CS15-026	Operating Systems	3 - 1 – 0	4	CS15-004	Compiler Design	3 - 1 - 0	4
CS15-031	Software Engineering and OOAD	3 - 1 – 0	4	CS15-010	Data Communication and Computer Network	3 - 1 - 0	4
CS15-021	Microprocessor and Micro controller	3 - 1 – 0	4	CS15-029	Simulation & Modeling	3 - 1 - 0	4
CS15-019	Graph Theory	3 - 1 – 0	4	CS15-005	Computer Graphics	3 - 1 - 0	4
IT15-002	Cryptography and Network Security	3 - 1 – 0	4		Core Elective-I	3 - 1 - 0	4
Sessionals				**Sessionals**			
CS15-985	Operating Systems Lab	0 - 0 – 3	2	CS15-997	Compiler Design Lab	0 - 0 - 3	2
CS15-999	Advanced Computing Lab	0 - 0 – 3	2	CS15-994	Computer Network Lab	0 - 0 - 3	2
CS15-986	MP & MC Lab	0 - 0 – 3	2	CS15-982	Simulation and Modeling Lab	0 - 0 - 3	2
CS15-981	Software Engg. Lab	0 - 0 – 3	2	CS15-995	Computer Graphics Lab	0 - 0 - 3	2
	Total	**15-5-15**	**28**		**Total**	**15-5-15**	**28**

FOURTH YEAR

SEVENTH SEMESTER				EIGHTH SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	Subject	L .T .P		Course Code	Subject	L. T. P	
CS15-001	Advanced Computer Architecture	3 - 1 – 0	4	CS15-022	Mobile Computing	3 - 1 - 0	4
IT15-006	Internet and Web Programming	3 - 1 – 0	4	CS15-027	Parallel and Distributed Systems	3 - 1 - 0	4
CS15-017	Embedded and Real-Time System	3 - 1 – 0	4		Open Elective-II	3 - 1 - 0	4
	Core Elective-II	3 - 1 – 0	4				
	Open Elective-I	3 - 1 – 0	4				
Sessionals				**Sessionals**			
CS15-987	Minor Project	0 - 0 – 3	2	CS15-983	Seminar	0 - 0 - 0	2
IT15-997	Internet Web Programming Lab	0 - 0 – 3	2	CS15-996	Comprehensive Viva	0 - 0 - 0	2
				CS15-988	Major Project	0 - 0 - 6	8
	Total	**15-5-6**	**24**		**Total**	**9-3-6**	**24**

Core Electives-I

CS15-015 Distributed Computing Systems
IT15-002 Information Security
CS15-024 Object Oriented Analysis and Design
CS15-006 Computer Graphics and Visualization
CS15-030 Soft Computing
CS15-028 Pattern Recognition
CS15-014 Digital Image Processing
CS15-002 AI and Robotics
IT15-009 Software Testing
CS15-034 Wireless Sensor Network

Core Electives-II

CS15-033	VLSI Algorithms
IT15-005	Information Retrieval
IT15-007	Software Architecture
IT15-003	Data mining
CS15-018	Game Theory
CS15-003	Combinatorial optimization
CS15-009	Computer Vision
IT15-008	Software Project Management
CS15-020	Human Computer Interface
IT15-001	Cloud Computing

Open Electives-I

Entrepreneurship (Mechanical)
Energy Management (EEE)
Mobile Computing (El &TC)
Industrial Management and Operation Research (Production)
Numerical Methods in Engineering (Civil)

Open Electives-II

Project Management (Civil)
Remote Sensing and GIS (Civil)
Alternative Energy Sources (Electrical)
Digital Image Processing (EEE)
Digital Switching and Telecommunication Networking (El &TC)

DETAILED SYLLABUS

PHYSICS (3 – 1 – 0)

Course Objective:
It provides basic understanding of bonding in solids and crystal structure. It helps to understand the behavior of electron in a solid and its applications in engineering like memory devices, transformer core and electromagnetic machinery.

Module I **(10 Hours)**
Interference: Superposition of waves - coherent and incoherent superposition, Intensity distribution. Two source interference theory, Interference in thin films. Newton's Rings, Determination of wavelength of light and refractive index of liquid.

Diffraction: Introduction, Types of diffraction , Fraunhofer diffraction at a single slit, Plane Diffraction grating, Diffraction spectra, Determination of wavelength of light, angular dispersion, resolving power of grating.
Polarization : Introduction, Types of Polarization, Production of polarized light(elementary idea) Brewster's law, Malu's law, Double refraction(only statement, explanation), Construction and working of :Nicol prism, Half wave plate and Quarter wave plate, Application of polarization (Polarimeter: Construction, Principle,Working).

Module II **(10 Hours)**

Electromagnetism: Vector Calculus : Gradient, Divergence, Curl of vector field, Gauss divergence theorem. Stoke's theorem, Green's theorem, Maxwell's electromagnetic equation in differential form and integral form , Electromagnetic wave equation: in vacuum and conducting medium. Pyonting vector ,Pyonting theorem, preliminary ideas about waveguides.

Module III **(10 Hours)**

Quantum mechanics: Need for Quantum Physics, wave particle duality, Davisson Germer experiment, Schroedinger wave equation (time dependent and time independent), properties of wave function, Operators , eigen value , eigen function, expectation value, probability density, Simple applications: particle in a box, finite well, step potential and tunneling

Module IV (10 Hours)

Lasers : Introduction, Characteristics of lasers, Einstein's coefficients & Relation between them, Lasing action, Population inversion, Different types of Lasers (Ruby Laser,He-Ne Laser), Three and Four level pumping schemes, Applications of LASER(elementary ideas)
Fiber optics: Introduction, Principle of wave propagation in Optical Fiber, Structure of Optical Fiber,Types of Optical Fibers, Acceptance angle and acceptance cone, Numerical aperture, Applications of optical fibers in communications
Nanomaterials: Introduction, Classification, Physical characteristics and applications (fundamentals)

Course Outcome:

CO1: Analyse and understand the basics of electricity and how these basic ideas are used to enhance our current prosperity.
CO2: Understand the differences between classical and quantum mechanics and learn about semiconductor technology.
CO3: Analyse and learn about how materials behave at low temperature, causes for their behaviour and applications.
CO4: Analyse and understand various types of lasers and optical fibers and their applications.
CO5: Understand the fabrication of nanomaterials, carbon nanotubes and their applications in various fields.

Text books:

1. Optics – A.K.Ghatak
2. Concepts of Modern Physics – A. Beiser

Reference Books:

1. Electricity & Magnetism – D. Griffiths
2. Quantum Mechanics – Gascirowicz

3. Lasers,theory and applications - K. Thyagarajan and A.K. Ghatak, New York :Plenum Press.
4. Quantum Mechanics – M. Das and P.K Jena
5. An Introduction to Fiber Optics - A.Ghatak, K.Thyagarajan: Cambridge University Press.
6. .Nano Materials by B.Viswanathan,Narosa Book Distributer

CHEMISTRY(3 – 1 – 0)

Course Objective:
This syllabus aims at bridging the concepts and theory of chemistry with examples from fields of practical application, thus reinforcing the connection between science and engineering. It deals with the basic principles of various branches of chemistry which are fundamental tools necessary for an accomplished engineer.

Module–I **(10 Hours)**
Failure of Classical Mechanics, Schrodinger's Wave Equation (Need not be Derived), Energy for 1-D Potential Box, Interaction of Wave with Matter
Fundamental of Microwave, IR, UV-Vis Spectroscopy: Basic Concept of Spectroscopy, Selection Rule, Numericals, Frank-Condon Principle,

Module – II **(10 Hours)**
Thermodynamics of Chemical Processes: Concept of Entropy, Chemical Potential, Equilibrium Conditions for Closed Systems, Phase and Reaction Equilibria, Maxwell Relations
Definition of Terms: Phase, Components, Degree of Freedom, Phase Rule Equation. Phase Diagrams: One Component Systems – Water and Sulphur, Two Component System – Lead-Silver, Cooling Curves, Iron-Carbon Phase Diagram

Module–III **(10 Hours)**
Electrode Potentials and its Relevance to Oxidation and Reduction, Measurement of EMF, Determination of pH, Hydrogen, Glass, Quinhydrone Electrodes, Dry Cells, Fuel Cells and Corrosion: Concept, Galvanic Corrosion

Module–IV **(10 Hours)**
Kinetics of Chemical Reactions: Reversible, Consecutive and Parallel Reactions, Steady State Approximation, Chain Engineering application of materials: Organometallics and Nanomaterials

Course Outcome:
CO1: Understand various water treatment methods, boiler troubles understand conduction mechanism in conducting polymers.
CO2: Understand construction and the working principle of different electrodes batteries/ sensors and their applicability.
CO3: Understand the types of corrosion and protection methods.
CO4: Understand the instrumental mechanism and its applicability

Textbooks:
P. W. Atkins, Elements of Physical Chemistry, 4th Edition, Oxford University Press
C. N. Banwell and E. M. MacCash, Fundamentals of Molecular Spectroscopy, 5th Edition

P. K. Kar, S. Dash and B. Mishra, B.Tech. Chemistry Vol. I, Kalyani Publications

MATHEMATICS-I

Course Objective:
The objective of this course is to learn types of matrices and their properties, concept of eigen values and eigen vectors of a matrix, multiple integration and its applications, properties of laplace transform and inverse laplace transform, and convolution theorem.

Module 1: **(10 Lectures)**

Open sets, Closed sets, Limit points of a set, Limits, Continuous functions, Functions continuous on closed intervals, The derivative, Increasing and decreasing functions, Statement and applications of Darboux's theorem, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Extremum values; Riemann integral: Definition and existence of the integral, Integral as a limit of sums, some integrable functions, Fundamental theorem of calculus, Mean value theorems for integral calculus.

Module 2: **(10 Lectures)**

Matrices, Vectors: Addition and Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Gauss Elimination, Linear Independence, Rank of a Matrix, Vector Space, Solutions of Linear Systems: Existence, Uniqueness, Determinants, Cramer's Rule, Gauss-Jordan Elimination, Vector Spaces, Inner Product Spaces.

Module 3: **(10 Lectures)**
Eigenvalues, Eigenvectors, Some Applications of Eigenvalue Problems, Symmetric, Skew-Symmetric, and Orthogonal Matrices, Eigenbases, Diagonalization, Quadratic Forms, Complex Matrices and Forms, IncIusion of Matrix Eigenvalues, Power Method for Eigenvalues

Module 4: **(10 Lectures)**

Numerical methods in general, Introduction, Solution of Equations by Iteration, Interpolation, Numerical Integration and Differentiation

Course Outcome:
CO1: Explain the Knowledge of solving System of equations, Eigen value problems.
CO2: Identify the shape of the geometrical figures from the study of quadratic forms
CO3: Discuss the convergence and Divergence of infinite series it is useful in the study of communication systems.
CO4: Determine the solutions for differential equations which are useful in the Study of Circuit theory and oscillatory systems.
CO5: Apply partial differential equations for Electro- magnetic theory, Transmission lines and Vibrating membranes

Text Books:

1) S.C. Malik and S. Arora, Mathematical Analysis, New Age International
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd

Chapters: S.C. Malik - 2(2.1- 2.3), 5(5.1-5.3), 6(6.1, 6.3-6.7), 7(7.1), 9(9.1, 9.6, 9.7, 9.9,9.10) E. Kreyszig - 7(7.1-7.5, 7.7, 7.8,7.9), 8, 20 (20.7, 20.8), 19(19.1, 19.2, 19.3, 19.5) 9th Edition

Reference Books:

1) George B. Thomas , Jr. and Ross L. Finney, Calculus and Analytic Geometry, Addison Wesley Publishing Company
2) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
3) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

Mathematics-II

Course Objective:

The objective of the course is to learn state mean value theorem and apply it in communication systems & to express any differentiable function in Power series in signals and systems. Also, it help students to simplify the complicated integrals by changing variables, provide interpolation technique useful in analyzing data that is in the form of unknown function.

Module 1: **(10 Lectures)**

Basic Concepts, Modeling, Separable ODEs, Modeling, Exact ODEs, Integrating Factors, Linear ODEs, Bernoulli Equation, Population Dynamics, Existence and Uniqueness of Solutions. Homogeneous Linear ODEs of Second Order, Homogeneous Linear ODEs with Constant Coefficients, Euler-Cauchy Equations, Existence and Uniqueness of Solutions, Wronskian, Nonhomogeneous ODEs, Solution by Variation of Parameters.

Module 2: **(10 Lectures)**

General linear differential equations of order n, Differential Operators, Homogeneous Linear ODEs, Homogeneous Linear ODEs with Constant Coefficients, Nonhomogeneous Linear ODEs, Conversion of an nth-Order ODE to a System, Basic Theory of Systems of ODEs.Power Series Method, Theory of the Power Series Method, Frobenius Method, Sturm-Liouville Problems, Orthogonal Functions.

Module 3: **(10 Lectures)**

Laplace Transforms, Laplace Transform, Inverse Transform, Linearity. s-Shifting, Transforms of Derivatives and Integrals, ODEs, Unit Step Function, t-Shifting, Short Impulses, Dirac's Delta Function, Partial Fractions, Convolution, Integral Equations, Differentiation and Integration of Transforms.

Module 4: **(10 Lectures)**

Partial differential equations, Basic Concepts, Modeling: Vibrating String, Wave Equation Solution by Separating Variables, Use of Fourier Series, D' Alembert's Solution of the Wave Equation. Characteristics, Heat Equation: Solution by Fourier Series, Solution of PDEs by Laplace Transforms.

Course Outcome:

CO1: State Mean value theorems & apply it in communication systems, equilibrium states of physical systems
CO2: State generalized mean value theorems to express any differentiable function in Power series in signals and systems.
CO3: Simplify the complicated integrals by changing variables
CO4: Interpret the divergence (physically), Grad and Curl in electromagnetic fields.
CO5: Provide interpolation techniques which are useful in analyzing the data that is in the form of unknown function.

Text Book:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd, 9th edition.

Chapters: 1(1.1-1.5, 1.7), 2(except 2.4, 2.8, 2.9), 3, 4(4.1, 4.2), 5(5.1, 5.2, 5.4), 6(6.1-6.5), 12(12.1-12.5, 12.11)

Reference Books:

1) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
2) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press
3) J. Sinha Roy and S. Padhy, Ordinary and Partial Differential Equation, Kalyani Publisher.
4) Richard Bronsan and Gabriel Costa, Scahum's Outline of Differential Equations, McGraw Hill
5) Paul Duchateau and D.W. Zachmann, Scahum's Outline of Partial Differential Equations, McGraw Hill
6) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill

English for Communication

Course Objective:
The objective of this course is for developing the ability to communicate effectively in professional environment by enhancing their skills in communication.

Module 1:Fundamentals of Communication **(10 Hours)**

1. Communication: Process, pattern and stages of communication, channels and types of communication and Barriers to Communication.
2. Functions of language: Descriptive, Expressive and Social Functions.
3. Formal and Informal English

4. Plain English (Cross cultural communication)
5. Bias free language

Module 2: Communicative Grammar (10 Hours)

1. Time, Tense and Aspects
2. Verbs of State and Events
3. Use of Modal Verbs
4. Passive and Active Voice
5. Conditionals

Module 3: Sounds of English (10 Hours)

1. The Speech Mechanism and Organs of Speech
2. Consonant Sounds of English
3. Vowel Sounds of English
4. Stress Pattern: Syllable, Stress and Intonation.
5. Problem sounds for Indian Speakers

Module 4: Business and Official Writing (10 Hours)

1. Paragraph writing and Sentence Linker
2. Business and Official Letters
3. Report and Proposal writing,
4. Notice, Circular and Memo writing
5. Résumé (CV) Writing.

Course Outcome:

CO1: aware of the elements of functional English in order to make them authentic users of language in any given academic and/or professional situation
CO2: proficient in making academic presentations
CO3: exposed to the real-time career oriented environment
CO4: Develop felicity of expression and familiarity with technology enabled communication
CO5: exposed to the corporate etiquette and rhetoric

Text Books:

1. Effective Technical Communication by M Ashraf Rizvi (Tata McGraw Hill)
2. Better English Pronunciations By J. D.O Conner (Cambridge University Press)
3. A Communicative Grammar of English by G.N. Leech and Jan Svartik (OUP)

Reference Books:

"Business communication" by Ramachandran, Lakshmi and Krishna (Macmillan)

ENGINEERING MECHANICS

Course Objective:

The objective of the course is to Construct free body diagrams and calculates the reactions necessary to ensure static equilibrium, understand internal forces, locate centroids and determine moment of inertia for composite areas. It also help students to analyze the systems with frictional forces, determine the mass moment of inertia of rigid bodies, and apply Newton's second law of motion and dynamic equilibrium to particle motion.

Module – I **(10 Hours)**

Concurrent forces on a plane: Composition, resolution and equilibrium of concurrent coplanar forces, method of moment, friction (chapter 1). (7)

Parallel forces on a plane: General case of parallel forces, center of parallel forces and center of gravity, centroid of composite plane figure and curves(chapter 2.1 to 2.4) (4)

Module – II **(10 Hours)**

General case of forces on a plane: Composition and equilibrium of forces in a plane, plane trusses, method of joints and method of sections, plane frame, principle of virtual work, equilibrium of ideal systems.(8)

Moments of inertia: Plane figure with respect to an axis in its plane and perpendicular to the plane, parallel axis theorem(chapter 3.1 to3.4, 5.1, appendix A.1 to A.3) (3)

Module - III **(10 Hours)**

Rectilinear translation: Kinematics, principle of dynamics, D Alembert's Principle, momentum and impulse, work and energy, impact (chapter 6). (11)

Module – IV **(10 Hours)**

Curvilinear translation: Kinematics, equation of motion, projectile, D Alembert's principle of curvilinear motion. (4)

Kinematics of rotation of rigid body (Chapter 9.1) (3)

Course Outcome:

CO1: Construct free body diagrams and calculate the reactions necessary to ensure static equilibrium.

CO2:Understand internal forces in members.

CO3:Locate centroids and determine moment of inertia for composite areas.

CO4:Analyze the systems with frictional forces.

CO5:Determine the mass moment of inertia of rigid bodies

CO6:Apply Newton‟s second law of motion and dynamic equilibrium to particle motion.

Text book:

Engineering Mechanics: S Timoshenko & Young; 4th Edition (International Edition) Mc Graw Hill.

Reference books:

Fundamental of Engineering mechanics (2nd Edition):
S Rajesekharan & G Shankara Subramanium; Vikas Pub. House Pvt ltd.

Engineering mechanics: K.L. Kumar; Tata MC Graw Hill.

COMPUTER PROGRAMMING

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective of the course is to illustrate flowchart and algorithm for a given problem, understand basic Structure of the C-PROGRAMMING, declaration and usage of variables,

inscribe C programs using operators, exercise conditional and iterative statements to inscribe C programs, to solve real time problems using functions and inscribe C programs using Pointers to access arrays, strings and functions.

Module I:
Introduction to computing- Block architecture of a computer, bit, bytes, memory, representation of numbers in memory. Introduction to problem solving- Basic concepts of an algorithm, program design methods, flowcharts.C Language Fundamentals- Character set, Identifiers, Keywords, Data Types, Constant and Variables, Statements.Input &Output - Input & Output Assignments, Formatted Outputs. Operatorsand Expressions-Operators, Precedence of operators.

Module II:
Decision Control Structure, Loop Control Structure and Case Control Structure.Functions- Monolithic vs Modular programs, User defined vs standard functions, formal vs Actualarguments, Functions category, function prototypes, parameter passing, Recursion.Arrays- 1D Array, 2D Array & Multi-Dimensional Array. Strings- Declaration &Initialization,String Handling Functions.

Module III:
Pointers- Pointer variable and its importance, Pointer Arithmetic, Passing parameters, pointer to pointer, pointer to function.Dynamic Memory Allocation.Structure- Nested Structure, Array of Structures, Pointer to Structure, Structure & Functions, typedef, Enumerated Data Type, Bit Fields. Union- Array of Union Variables, Union inside Structure.Storage Class.

Module IV:
Preprocessor Directives- Types, Pragma Directives, Conditional Directives.Files- Reading data from Files, Reading data from Files, Writing data to Files, Error Handling during File Operations.Advanced Issues in Input & Output – using *argc*&*argv*.Operation on Bits.

Course Outcome:

CO1: Illustrate flowchart and algorithm for a given problem
CO2: Understand basic Structure of the C-PROGRAMMING, declaration and usage of variables
CO3: Inscribe C programs using operators
CO4: Exercise conditional and iterative statements to inscribe C programs
CO5: Exercise user defined functions to solve real time problems
CO6: Inscribe C programs using Pointers to access arrays, strings and functions.

Text Books:

1. C: The Complete Reference: Herbert Schildt
2. Computer Fundamentals &Programming in C: ReemaThareja, Oxford University Press.

Reference Books:

1. Let us C- Y.Kanetkar, BPB Publications.
2. Programming with ANSI and Turbo C- Kamthane, A.N. Pearson Education

3. C How to Program- Deitel and Deitel, Pearson Education.
4. The C programming Language- Brian W. Kernighan and Dennis M. Ritchie,Prentice-Hall.

BASIC ELECTRICAL ENGINEERING (3-1-0)

Course Objectives:
The course objective is to identify the basic elements of the electrical engineering, write the programs for controlling electrical elements and understand the significance of electrical engineering for software fields.

Module-I **(10 Hours)**
DC Networks: Kirchhoff's laws, node and mesh analysis, Delta-star and star-delta transformations. Superposition, Thevenin's and Norton's theorem. Transients, in R-L, R-C and R-L-C circuits with DC. Excitation.
Single Phase AC Circuits: Single phase EMF generation, average and effective values of sinusoids, j- operations, complex representation of impedances, phasor diagrams, power factor, power in complex notation, solution of series and parallel circuits. Introduction to resonance in series RLC circuit.
Three Phase AC Circuit: Three phase EMF generation, delta and star connection, Line and Phase quantities. Solutions of 3-phase circuits with balanced load. Power in 3-phase balanced circuits.

Module-II **(10 Hours)**
Magnetic Circuits: B-H Curve, Hysteresis, Permeability and reluctance, solution of simple magnetic circuits, Hysteresis and Eddy current losses.
DC Generator: Different types, Principle of Operation of DC generator, EMF equation, methods of excitation. DC Motor: Back e.m.f., speed and torque of a DC Motor, Conditions for maximum Power. Speed control of DC shunt motor.
Transformers: Construction and Principle of operation of single-phase transformer, EMF equation, Single-phase autotransformer.

Module-III **(10 Hours)**
Three phase Induction Motor: Construction and principle of operation, types; Slip-torque characteristics.
Synchronous Machines: Construction & principle of operation of Synchronous generator and motor. EMF equation, Voltage regulation, Applications and starting of Synchronous motor. Introduction to single-phase induction Motor.

Module-IV **(10 Hours)**
Measuring Instruments: DC PMMC instruments, Extension of range by shunts and multipliers. Moving iron ammeters and voltmeters, Dynamometer type Watt meters, Induction type Energy Meter.
Power supply systems: Principle of generation - thermal, hydel and nuclear. Transmission and distribution of electric energy. Introduction to Electric Heating & Welding.

Course Outcome:

CO1: Identify the basic elements of the electrical engineering
CO2: To write the programs for controlling electrical elements
CO3: The significance of electrical engineering for software fields

Text Books:

1. Edward Hughes (revised by Ian McKenzie Smith), "Electrical & Electronics Technology", Pearson Education Limited. Indian Reprint 2002, 10th Edition.
2. D.Kulshreshtha, " Basic Electrical Engineering" TMH, 1st Edition.

Reference Books

1. H.Cotton, "Advanced Electrical Technology", CBS Publishers, New Delhi, 7th Edition.
2. C.L. Wadhwa, "Electrical Engineering", New Age International Publishers, 2nd Edition.
3. S. Parker Smith, "Problems in Electrical Engineering", Asia Publications, 10th Edition.

BASIC ELECTRONICS (3-1-0)

Course Objective:

This course helps students to identify the applications and functions of electronics in Engineering, Recognize basic electronic components and devices used for different electronic functions, and using basic techniques for analyzing analogue and digital electronic circuits.

UNIT-1 (10 Hours)

Introduction to Electronics: Signals, Frequency Spectrum of Signals, Analog and Digital Signals, Linear Wave Shaping Circuits: RC LPF, Integrator, RC HPF, Differentiator.
Properties of Semiconductors: Intrinsic, Extrinsic Semiconductors, Current Flow in Semiconductors,
Diodes: p-n junction theory, Current-Voltage characteristics, Analysis of Diode circuits, Rectifiers, Clippers, Clampers, Special diodes- LED, Photo diode, Zener Diode.

UNIT-II (14 Hours)

Bipolar junction Transistor (BJTs): Device Structure and Operation, Current-Voltage Characteristics, BJT as an Amplifier and as a Switch, Introduction to Power Amplifiers, A,B and C types.
JFET: Physical Structure, Operation and Characteristics MOSFET: Physical Structure, Operation and Characteristics, Feedback Amplifiers & Oscillators: General Feedback Structure, Properties of Negative Feedback, Four Basic Feedback Topologies (block diagram only), Basic Principles of Sinusoidal Oscillators(Crystal, Hartley & Collpit).
Operational Amplifiers (OP-AMPs): The Ideal OP-AMP, Inverting Configuration, Non-Inverting Configuration. OP-AMP Applications (Adder, Subtractor, Integrator, Differentiator).

UNIT-III (10 Hours)

Digital Fundamentals: Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-to-Decimal Conversion, Binary Addition, Subtraction, Multiplication and Division, Hexadecimal Number Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra, RS Flip flop, JK Flip flop.

UNIT-IV **(10 Hours)**

Introduction to Electronic Instruments: CRO: CRT, Waveform Display, Applications of CRO, Electronic Multimeter, Audio Signal Generator: Block diagram, Front Panel Controls.
Principles of Communication: Fundamentals of AM & FM, Block diagram of Transmitters & Receivers.

Course Outcome:

CO1: Identify the applications and functions of electronics in Engineering.
CO2: Recognise basic electronic components and devices used for different electronic functions.
CO3: Be able to use basic techniques for analysing analogue and digital electronic circuits.

TEXT BOOKS:

1. Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford University Press. Selected portions from chapters 1 to 3, 5, 8, 13.
2. Electronics Fundamentals and Applications, D Chattopadhyay and P.C. Rakshit, NewAge International Publications. Selected portions from chapters 4 to 12,14, 16 to 18,20,21.

REFERENCE BOOKS:

1. Integrated Electronics, Millman and Halkias, TMH Publications.
2. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education.

ENVIRONMENTAL SCIENCE & ENGINEERING

Course Objective

The objective is to understand the importance of environment, identify the environmental problems and issues on local, regional and global scale, identify problems due to human interactions with the environment, encouragement to contribute solutions for the existing environmental issues and understand the enforcement of environmental acts in our constitution.

Module – I **(6 Hours)**

Components of Earth System: Lithosphere, Cryosphere, Atmosphere, Hydrosphere, Biosphere and Outer space.
Ecological concepts and natural Resources: Ecological perspective and value of environment, Environmental auditing, Biotic components, Levels of organizations in environment Ecosystem Process: Energy, Food chain, Environmental gradients, Tolerance levels of environmental factor.
Natural Resources covering Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative).
Hydrological cycle, water balance, energy budget, precipitation, infiltration, evaporation and evapotranspiration.

Module – II **(15 Hours)**

Environmental Pollution: Definition, Causes, effects and control measures of: Water pollution, Air pollution, Noise pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards

Environmental Issues: Climate change, Global warming, Acid rain, Ozone layer depletion, Sustainable development, Bio gas, Natural gas, Biodiversity, Urban problems related to energy, water scarcity, Water conservation, rain water harvesting, artificial recharge, watershed management, carbon trading, carbon foot print
National Ambient Air quality Standards, Noise standards, Vehicle emission standards

Module – III **(12 Hours)**

Drinking water standard (IS 10500), Water Quality Criteria and wastewater effluent standards
Water treatment: Water sources and their quality, Lay out of a water treatment plant and working of each unit/ principles of each process i.e. Screening, Aeration, Sedimentation, coagulation, flocculation, Filtration, Disinfection. Miscellaneous treatment: Removal of color, tastes and odour control, removal of iron and manganese, fluoridation and defloridation. Advanced water treatment: Ion exchange, electro-dialysis, RO, desalination
Working principles of ready-made water filter/purification system commercially available
Lay out of a wastewater treatment plant and working of each unit.

Module – IV **(7 Hours)**

Solid waste management: Source, classification and composition of MSW, Storage and transport of MSW, MSW management, Waste minimization of MSW, Reuse and recycling, Biological & thermal treatment (principles only), land fill
Biomedical Waste management – sources, treatment (principles only) and disposal
Hazardous Waste Management- Introduction, Sources, Classification, treatment (principles only)
Introduction to e-waste management.
Environmental impact Assessment: Project screening for EIA, Scoping studies
Environmental policies and acts (Air, Noise, Water, Forest, E-waste, Hazardous waste acts).

Course Outcome:

CO1: Understand the importance of environment
CO2: Identify the environmental problems and issues on local, regional and global scale
CO3: Identify problems due to human interactions with the environment
CO4: Get encouragement to contribute solutions for the existing environmental issues
CO5: Understand the enforcement of environmental acts in our constitution

Text Book:

1. Environmental Engineering, G. Kiely, TMH, 2007

Reference Books:

1. Environmental Engineering, H.S. Peavy, D.R.Rowe and G. Tchobanoglous, McGraw Hill, 1985.
2. Introduction to Environmental Engineering, M. L. Davis and D. A Cornwell, McGraw Hill International, 2005.

PHYSICS LAB

Course Objective:

The objective of the course is that the student will have exposure to various experimental skills. The experiments are selected from areas of Physics like Physical optics, Lasers, Fiber optics, Electricity & Magnetism.

List of Experiments

1. To Determine the Young's Modulus (Y) of the material of a Wire by Searle's Method.
2. Determination of Surface Tension of water by Capillary rise method.
3. Determination of Acceleration due to gravity by using a Bar Pendulum.
4. To determine thermal conductivity of a bad conductor by using Lee's Apparatus.
5. Determination of Wavelength of monochromatic light with the help of a Newton's Ring Apparatus.
6. Determination of Grating element of a Diffraction grating using spectrometer.
7. To verify the laws of transverse vibration of string by using sonometer.
8. To determine the Rigidity modulus of the material of a wire by using Barton's apparatus.
9. To draw the characteristics of a Bipolar Junction Transistor.
10. To draw the V-I characteristics of a P. N Junction diode.

Course Outcome:

CO1: Elucidate the concepts of physics through involvement in the experiment by applying theoretical knowledge

CO2: Illustrate the basics of electro magnetism, optics, mechanics, semiconductors & quantum theory

CO3: Develop an ability to apply the knowledge of physics experiments in the later studies

CHEMISTRY LAB

Course Objective:

The objective of the course is to expose the students to various experiments of chemistry like Titrimetry, Mineral Analysis, Colorimetry, Potentiometry, Determination of viscosity of sample oil, Preparation of Aspirin &Adsorption of Acetic acid on charcoal.

List of Experiments:

1. Determination of amount of sodium hydroxide and sodium carbonate in a Mixture.
2. Determination of Total hardness of water by EDTA method.
3. Estimation of calcium present in the limestone.
4. Preparation of aspirin.
5. Standardization of KMnO4 using sodium oxalate.
6. Determination of ferrous iron in Mohr's salt by potassium permanganate.
7. Determination of Rate constant of acid catalyzed hydrolysis of ester.
8. Determination of dissolved oxygen in a sample of water.

9. Determination of Viscosity of lubricating oil by red wood Viscometer.
10. Determination of Flash point of given oil by Pensky Marten's Flash point Apparatus.
11. Determination of available chlorine in bleaching powder.

Course Outcome:
CO1: Perform the analytical experiments; improve analytical skills and attitude which help them to apply these skills in their field of engineering.
CO2: Understand the handling maintenance and performance of analytical instruments.
CO3: Understand the practical knowledge of various chemical phenomena by demonstration of experiments.

PROGRAMMING LAB (CS15-984)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:
The objective of this course is to illustrate flowchart and algorithm for a given problem, Understand basic Structure of the C-PROGRAMMING, declaration and usage of variables, inscribe C programs using operators, Exercise conditional and iterative statements to inscribe C programs.

Introduction to OS : Linux/Unix, Dos, Windows, Vi editor, File Handling, Directory Structure, File Permissions, Creating and editing simple c programs, Compilation and Execution

C programming on variables and expression assignment, simple arithmetic loops, If-else, Case statements, Break, Continue, Go to

Single and Multidimensional arrays

Functions, Recursion, File handling in C

Pointers, address operator, Declaring pointers and operators on pointers, Address of an array, Structures, Pointer to structure, Dynamic memory allocation

Fundamental Programs on Data Structures (Stack, Queue, Linked lists, Trees, Graphs)

Course Outcome:

CO1: Illustrate flowchart and algorithm for a given problem
CO2: Understand basic Structure of the C-PROGRAMMING, declaration and usage of variables
CO3: Inscribe C programs using operators
CO4: Exercise conditional and iterative statements to inscribe C programs
CO5: Exercise user defined functions to solve real time problems
CO6: Inscribe C programs using Pointers to access arrays, strings and functions.

BASIC ELECTRICAL ENGINEERING LAB (0-0-3)

Course Objective:
The objective is to have basic understanding of, and ability to apply, techniques for steady-state DC circuit analysis, transient analysis of RLC circuits, familiarity with computer tools and their use in steady-state DC and transient analysis of linear circuits.

List of Experiments:

1. Preliminary: Preparation of symbol chart for various systems & components as per ISS, To study the constructional & operational features for Voltmeter, Ammeter, Wattmeter, Frequency meter, multi-meter and Rheostat, Study of safety rules as per ISS
2. Measurement of the armature & field resistance of D.C. Machine by volt-amp method. & Starting and speed control of a D.C. shunt motor
3. Study of BH Curve
4. Determination of open circuit characteristics (O.C.C) of D.C shunt generator when separately excited at different speeds.
5. Measurement of earth resistance and insulation resistance
6. Starting of Induction motor and measurement of three phase power & power factor by 2-wattmeter method.
7. Calibration of a single phase Energy Meter by directed loading & Phantom loading

Course Outcome:
CO1: A basic understanding of, and ability to apply, techniques for steady-state DC circuit analysis
CO2: A basic understanding of, and ability to apply, techniques for transient analysis of RLC circuits
CO3: Familiarity with computer tools and their use in steady-state DC and transient analysis of linear circuits

BASIC ELECTRONICS LAB

Course Objective:

The objective is to identify the applications and functions of electronics in Engineering, Recognize basic electronic components and devices used for different electronic functions, use basic techniques for analysing analogue and digital electronic circuits, design analogue and digital electronic circuits at block level and manage the tools in a basic electronics laboratory and use electronic simulation tools.

List of Experiments:

1. Familiarity with electronic components and devices(Testing of semiconductor diode, Transistor, IC Pins connection) Digital multimeter should be used.
2. Study and use of CRO to view waveforms and measure its Amplitude and Frequency.
3. V-I Characteristics of a Semiconductor Diode. Determining DC and AC resistance.

4. Clipper and Clamper Circuit.
5. Half Wave and Full Wave Rectifier without Capacitor filter. Record of Waveforms, Measurement of Average and RMS value.
6. V-I (Output) Characteristics of N-P-N Transistor in CE Configuration.
7. OP-AMP: Inverting and Non-Inverting Configuration. Record of Waveforms.
8. Verification of Truth table of Logic gates (AND, OR,NOT, NAND, NOR, EX-OR)

Course Outcome:

CO1: Identify the applications and functions of electronics in Engineering.
CO2: Recognise basic electronic components and devices used for different electronic functions.
CO3: Be able to use basic techniques for analysing analogue and digital electronic circuits.
CO4: Be able to design analogue and digital electronic circuits at block level.
CO5: Be able to manage the tools in a basic electronics laboratory and use electronic simulation tools.

ENGINEERING DRAWING

Course Objective:

This course focuses on representing various conics and curves, dimensioning to a given drawing, construction of Plain and Diagonal scales, Orthographic projections of Lines, Planes, and Solids, Construction of Isometric Scale, Isometric Projections and Views, and Sectioning of various Solids and their representation.

List of Experiment

1. Introduction to Engineering Drawing: Drawing instruments, lines, lettering and dimensioning.
2. Scales: Plain, Diagonal and Vernier Scales.
3. Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.
4. Orthographic Projections: Concepts, Orthographic projections of points, Lines, Planes and Solids.
5. Sections of solids; Development of surfaces
6. Isometric Projections: Principles, Isometric Scale, Isometric Views, Isometric Views of lines, Planes, Simple and compound Solids,
7. Introduction to Auto-Cad: Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Course Outcome:

CO1: Representing various conics and curves.
CO2: Perform dimensioning to a given drawing.
CO3: Construction of Plain and Diagonal scales.
CO4: Orthographic projections of Lines, Planes, and Solids.
CO5: Construction of Isometric Scale, Isometric Projections and Views.
CO6: Sectioning of various Solids and their representation.

Text Book:
Engineering drawing by N.D. Bhatt and V.M Panchal, Charotar Publishing House, Anand.
Reference Books:
Engineering Drawing by Venugopal, New Age publisher.

Workshop -I

Course Objective:
The objective is to Model and design various basic prototypes in the carpentry trade, basic prototypes in the trade of Welding, basic prototypes in the trade of Tin smithy and perform various basic House Wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch, connecting a fluorescent tube, Series wiring, Go down wiring.
List of experiments:

1. Carpentry Section: Wooden rack/bench/chair/stool (any one)
2. Fitting Section: Paper Wt., Square or Rectangular joint (male and female joint) (any one)
3. Black Smith Section : Weeding hook/Hexagonal headed bolt blank (any one)

Course Outcome:
CO1: Model and design various basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail joint, Mortise & Tenon joint, Cross-Lap joint
CO2: Design and model various basic prototypes in the trade of Welding such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint.
CO3: Make various basic prototypes in the trade of Tin smithy such as plain Cylindrical pipe, Cylindrical pipe one end inclined, Cylindrical pipe both ends inclined, Hexagonal pipe one end inclined, and funnel preparations.
CO4: Perform various basic House Wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch, connecting a fluorescent tube, Series wiring, Go down wiring

ENGLISH COMMUNICATION SKILLS (Credit: 0-0-2)

Course Objective:
The objective is to improve communicational skills by conducting group discussions, to explore one-to-one interaction and to discuss various public issues by creating number of groups.

List of Experiments

1. Giving Introduction (Self and others)
2. Group Discussion
3. Interviews
4. Role Play
5. Listening skill Development
6. Reading skill Development
7. Writing skill Development
8. Speaking skill Development
9. Meeting

10. Presentation

TextBooks:

Soft Skills – By Dr K Alex (S Chand)

Course Outcome:

CO1: To improve communicational skills by conducting group discussions
CO2: To explore one-to-one interaction
CO3: To discuss various public issues by creating number of groups

MATHEMATICS - III

Course Objective:

The course provides the knowledge of solving linear differential equations with constant coefficients, Analyze general periodic functions in the form of an infinite convergent series of sine and cosines useful in digital signal processing, Exercise Fourier transforms in designing the computer storage devices in Circuit theory.

Module 1: (10 Lectures)

Vector and Scalar Functions and Fields, Derivatives, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field; Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Divergence Theorem of Gauss, Further Applications of the Divergence Theorem, Stokes's Theorem.

Module 2: (10 Lectures)

Fourier series and integral, Dirichlet criterion, Parseval's identity, the convolution theorem.

Module 3: (10 Lectures)

Orthogonal curvilinear coordinates, Jacobians, gradient, divergence, curl and Laplacian in curvilinear coordinates, Special curvilinear coordinates.

Module 4: (10 Lectures)

Gama function, The Beta function – Dirichlet integral; Other special functions– Error function, exponential integral, sine and cosine integrals, Bessel's Equation, Bessel Functions $J_\gamma(x)$, Bessel Functions of the Second Kind $Y_\gamma(x)$, Legendre's Equation, Legendre Polynomials $P_n(x)$.

Course Outcome:

CO1: Provide the Knowledge of solving linear differential equations with constant coefficients.
CO2: Analyze general periodic functions in the form of an infinite convergent series of sine and cosines useful in digital signal processing.
CO3: Exercise Fourier transforms in designing the computer storage devices in Circuit theory.
CO4: Apply the numerical methods for transitioning a mathematical model of a problem to an programmable algorithm obtaining solution numerically or graphically
CO5: Afford Mathematical devices through which solutions of numerous boundary value problems of engineering can be obtained.

Text Books:
Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. - 9th Edition
Chapters: 5(5.3, 5.5, 5.6), 9(9.4, 9.7, 9.8, 9.9), 10, 11(11.1-11.3, 11.6, 11.7), A3.4, A3.1

Reference Books:

1. S.C. Mallik and S. Arora, Mathematical Analysis, New Age International
2. Milton Abramowitz and Irene A. Stegun, *Handbook of Mathematical Functions*, National Bureau of Standards, Applied Mathematics Series - 55
3. **Yury A. Brychkov**, Handbook of Special Functions: Derivatives, Integrals, Series and Other Formulas, CRC Press
4. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
5. K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

DIGITAL ELECTRONICS CIRCUIT(3-1-0)

Course Objective:

This course objective is to have an understanding in basic parameters of a logic inverter, analyze and design an NMOS logic inverter with a resistive load, an enhancement NMOS load or a depletion NMOS load, analyze and design a CMOS logic inverter, TTL and ECL logic inverter, Understand the operation of latch circuit and flip-flop circuits.

Module-I **(12 Hours)**
Binary addition and subtraction using 2's complements and 1's complements, Binary codes-BCD codes, Gray codes, Excess-3 code, ASCII Character Code
Gate level Minimization: Boolean functions, Canonical & standard form; min terms & max term, Digital Logic Gates for Multiple inputs. The Map Method, K Map for two, three, four, five input variables, Product of Sum (POS), Sum of product (SOP) simplification, Don't care conditions. NAND & NOR Implementation, AND-OR invert, OR-AND invert implementation, Ex-OR Function

Module-II **(8 Hours)**
Combinational Logic: Combinational Circuits, Analysis & Design of Binary Half Adder & Full Adder circuit, Half and Full-subtractor circuit, Binary Multiplier, Magnitude comparator, Decoders, Encoders, Multiplexers, Error detection& correction: Parity Generator and Checker Circuit

Module-III **(12 Hours)**
Synchronous Sequential Logic: Sequential Circuit, Latches, Flip-flop (S-R, J-K, D, T, M/S), Analysis of Clocked Sequential circuits, State Reduction & Assignment, Design procedure. Register &Counters: Shift Register, Synchronous Counter, Modulo-n Counters, Up-Down Counter, Asynchronous Counter, Ripple Counters, Ring Counters

Module-IV **(8 Hours)**

Memory & Programmable Logic: Read only Memory (ROM), Random Access Memory (RAM), Memory Decoding, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Sequential Programmable Devices.
Register Transfer Levels: Register transfer Level (RTL) notation, Algorithmic State machine, Design Example. Digital Integrated logic Circuits: RTL, DTL, TTL, ECL, MOS & C-MOS Logic circuits

Course Outcome:
CO1: An ability to understand basic parameters of a logic inverter.
CO2: An ability to analyze and design an NMOS logic inverter with a resistive load, an enhancement NMOS load or a depletion NMOS load.
CO3: An ability to analyze and design a CMOS logic inverter.
CO4: An ability to analyze a TTL and ECL logic inverter.
CO5: An ability to understand the operation of latch circuit and flip-flop circuits.
CO6: An ability to understand the operation of different types of semiconductor memorie

Text books:
Digital Design, 4th edition by M. Morris Mano, M. D. Ciletti, Pearson Education.

Reference Books:
Digital Fundamentals – Floyd & Jain, Pearson education
Switching Theory & Digital Electronics – V. K. Jain, Khanna Publishers.
Digital Principles & Applications – Malvino, Leach & Saha, 6th Edition, Tata Mc Graw Hill

DATA STRUCURES AND ALGORITHMS (CS15-011)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of the course is to interpret and compute asymptotic notations of an algorithm to analyze the consumption of resources (time/space), exemplify and implement stack, queue and list ADT to manage the memory using static and dynamic allocations, implement binary search tree to design applications, identify, model, solve and develop code for real life problems like shortest path and MST using graph theory.

MODULE – I Preliminaries and Linear Data Structures (12 lectures)

Introduction to Data Structures and Algorithms, Analysis of Algorithms, Asymptotic notations, Time and space trade-off, ADT. Arrays and Lists, Strings, Row/Column major representation of Arrays, Sparse matrix. Linked List: Singly linked list, circular linked list, doubly linked list, operations on linked list. Stack: Push; Pop, stack representation using array and linked list, Applications of Stack, Recursion. Queue: Representation using array and linked list, Insertion and deletion operations, circular queue, Dequeue, priority queue.

MODULE – II Non-Linear Data Structures (12 lectures)

Tree : General tree; Binary tree - definitions and properties; binary tree traversal algorithms with and without recursion. Binary Search Tree - creation, insertion and deletion operations, Threaded tree (One way and Two way); AVL tree balancing; B-tree; Application of trees, Heaps.
Graph : Representation, Traversals-BFS and DFS, Minimum Spanning Tree – Kruskal and Prim's Algorithms , Shortest Path, All pairs Shortest Path, Dijkshtra Algorithm, Transitive Closure.

MODULE – III Sorting, Searching (8 lectures)

Internal sorting algorithms and Complexities: Insertion, Selection, Bubble, Quick, Heap sort, Radix, Multi way merge sort, External sorting,
Searching : Linear, Binary Search, Search trees traversal, Digital Search trees, Tries.

MODULE – IV Hashing (8 Lectures)

Hashing techniques, Hash function, Address calculation techniques- common hashing functions Collision resolution, Linear probing, quadratic probing, Double hashing, Bucket addressing. Rehashing

Course Outcome:

CO1: Interpret and compute asymptotic notations of an algorithm to analyze the consumption of resources (time/space).
CO2: Exemplify and implement stack, queue and list ADT to manage the memory using static and dynamic allocations
CO3: Implement binary search tree to design applications like expression trees
CO4: Identify, model, solve and develop code for real life problems like shortest path and MST using graph theory.
CO5: Develop and compare the comparison-based search algorithms and sorting algorithms.
CO6: Identify appropriate data structure and algorithm for a given contextual problem and develop in C.

Text Books :

1. Data Structures Using C – A.M. Tenenbaum (PHI)
2. Introduction to Data Structures with Applications by J. Tremblay and P. G. Sorenson (TMH)

Reference Books :

1. Data Structures and algorithm Analysis in C – M. A. Weiss (Pearson Education)
2. Data Structures using C++ - E. Horowich, S. Sahni

OBJECT ORIENTED PROGRAMMING (CS15-025)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of the course is to map real world problems into the Programming language, solve the problems in systematic way, and efficiently implement linear, nonlinear data structures and various searching and sorting techniques.

.

Module – I ***(10 Lectures)***
Introduction to object oriented programming, user-defined types, polymorphism, and encapsulation. Getting started with C++ syntax, data-type, type conversions, functions, exceptions and statement, namespaces, exceptions, explicit and mutable, operators, flow control, functions, recursion. Arrays, pointers, this pointer, generic pointer and structures.

Module – II **(10 Lectures)**
Abstraction mechanisms: Classes, private, public construction, member functions, static members, references etc. class hierarchy, derived classes. Inheritance: simple inheritance, polymorphism, aggregation, object slicing, base initialization virtual functions.

Module – III **(12 Lectures)**
Prototypes, linkages, operator overloading, ambiguity, friends, member operators, operator function, I/O operator etc. Memory management: new delete, object copying copy constructors, assignment operator, this input/output. Exception handling: Exceptions and derived classes, function exception declarations, Unexpected exceptions, Exceptions when handling exceptions, resource capture and release etc.

Module – IV **(08 Lectures)**
Templates and standard Template library: template classes, declaration, template functions, containers, algorithms, iterators, manipulating string objects, hashes, iostreams and other type.

Projects design and development using C++.

Course Outcome:
CO1: Familiar to map real world problems into the Programming language.
CO2: Can solve the problems in systematic way
CO3: Efficiently implement linear, nonlinear data structures and various searching and sorting techniques

Text Books:

1. Ashok N. Kamthane- Object oriented programming with ANSI & Turbo C ++.,Pearson Education.
2. E. Balguru Swamy – C ++, TMH publication.

Reference Books:

1. Programming with ANSI C++, 2/e, Bhushan Trivedi, Oxford University Press
2. H. Schildt – C++, The Complete Reference, TMH.

3. Robort Lafore-Object-oriented programming in Microsoft C ++
4. The C++ Programming Language (4th Edition), Bjarne Stroustrup, Addison-Wesley Publications.
5. Object-Oriented Programming Using C++, 4/e, Farrell Joyce, CENGAGE Publications.

DATA STRUCTURE LABORATORY (CS15-992)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:
The objective is to develop linear and non-linear data structure, express different operation on AVL tree, evaluate infix to postfix expression, and apply searching and sorting algorithms in real life applications.

1. (a) Write a C Program to create a stack using an array and perform – i) Push operation, ii) Pop operation

   (b) Write a C Program to create a queue and perform – i) Push, ii) Pop, iii) Traversal

2. Write a C Program that uses Stack Operations to perform the following:-
   i) Converting an infix expression into postfix expression
   ii) Evaluating the postfix expression
3. (a) Write a C Program that uses functions to perform the following operations on a single linked list : i)Creation, ii) Insertion, iii) Deletion, iv) Traversal

   (b) Write a C Program that uses functions to perform the following operations on a double linked list: i)Creation, ii) Insertion, iii) Deletion
4. Write a C Program that uses functions to perform the following operations on a Binary Tree : i) Creation, ii) Insertion, iii) Deletion
5. Write a C Program to construct an AVL-Tree and delete the selective nodes.
6. C Programs on : i) Bubble sort, ii) Selection sort, iii) Insertion sort, iv) Quick sort, v) Radix sort vi) Heap sort, vii) 2 Way Merge Sort
7. C Programs on : i) Sequential Search, ii) Binary Search

Course Outcome:

CO1: Develop linear and non-linear data structure
CO2: Express different operation on AVL tree
CO3: Evaluate infix to postfix expression
CO4: Apply searching and sorting algorithms in real life applications

C++ PROGRAMMING LABORATORY (CS15-998)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:
The objective is to analyze basic system information, perform troubleshooting and optimize the system performance, configure a Linux distribution to perform common system administrator tasks, develop shell scripts and programming and employ these principles in solving technical problems, examine the differences and similarities of Linux GUI's and select the appropriate Linux GUI.

1. Programs on concepts of class and objects (1 class)
2. Programs using Inheritance (1 class)
3. Programs using Polymorphism (1 class)
4. Programs on use of Operator overloading (1 class)
5. Programs on use of memory management (1 class)
6. Programs on exception handling and use of templates (1 class)
7. Programs on file handling in C++ (1 class)
8. Design a problem on stock and accounting of a small organization, railway reservation, payroll preparation and optimization problem (3 classes)

Course Outcome:

CO1: Analyze basic system information, perform troubleshooting and optimize the system performance.
CO2: Configure a Linux distribution to perform common system administrator tasks.
CO3: Develop shell scripts and programming and employ these principles in solving technical problems.
CO4: Examine the differences and similarities of Linux GUI's and select the appropriate Linux GUI.
CO5: Generate local or domain users accounts and implement security policies.
CO6: Design FTP servers and Web servers to deploy services for the clients.

JAVA PROGRAMMING LABORATORY (IT15-996)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:
The objective of the course is to implement object oriented principles for reusability, assign priorities and resolve run-time errors with Multithreading and Exception Handling techniques, interpret Events handling techniques for interaction of the user with GUI, analyze JDBC drivers to connect Java applications with relational databases, and develop client/server applications using socket programming.

1. Introduction, Compiling & executing a java program.
2. Data types & variables, decision control structures: if, nested if etc.
3. Loop control structures: do, while, for etc.

4. Classes and objects.
5. Data abstraction & data hiding, inheritance, polymorphism.
6. Threads, exception handlings and applet programs
7. Interfaces and inner classes, wrapper classes, generics
8. Developing a simple paint like program using applet
9. Developing a scientific calculator
10. Develop a multi threaded producer consumer Application
11. Generating prime numbers and Fibonacci series
12. Multithreaded GUI application

Course Outcome:

CO1: Implement object oriented principles for reusability
CO2: Assign priorities and resolve run-time errors with Multithreading and Exception Handling techniques
CO3: Interpret Events handling techniques for interaction of the user with GUI
CO4: Analyze JDBC drivers to connect Java applications with relational databases
CO5: Develop client/server applications using socket programming

ENGINEERING ECONOMICS (4-0-0)

Course Objective:
The objective is to understand Henri Fayol's principles of management, appreciate the functions of a Personnel Department and m evaluate a job for wage determination, apply Law of diminishing Utility and Law of equimarginal utility for any market condition, understand Factors influencing demand, and Elasticity of demand, the relations between ATC and MC and relations between AC and MC.

MODULE- 1
Theory of Demand- Modern Utility Theory, The Neumann- Morgenstern approach, The Friedman-Savage Hypothesis, Uncertainty and Consumer Behaviour, Expected value of Perfect Information, Revealed Preference Theory, Intertemporal Choice- Slutsky equation, Annual Economic Worth, Present Value, Discount rate IRR and NPV

MODULE- 2
Profit Maximisation: Theory of Production- Laws of Production, Returns to scale and variable proportions, Equilibrium of firm, and Choice of optimal combination of factors, Cost Minimisation- Calculus analysis of cost minimisation, Algebric approach to cost minimisation, average and marginal costs- the short run Cobb- Douglas cost function, constant returns to scale and cost functions, Long run and short run curves- factor prices and cost functions , The envelop theorem for constrained optimisation , Cost control techniques, Critique of the principle of profit maximisation and Modern theories of firms- Baumol's sales maximisation hypothesis, Morris Model of Managerial Enterprise, Hall and Hitch Report and the full cost pricing principle, Bain's limit pricing theory

MODULE- 3

Analysis of Public Projects: Benefit cost analysis, Public goods, Common Property, Free Rider Problem, market failure and externalities, private and social cost, Social Welfare Functions- Welfare maximisation and pare to optimality, market responses to externalities- Mergers, social conventions, property right and bargaining case theorem

MODULE- 4
Linear models: simple regression model -the problem and estimation, classical normal linear regression model, Two- Variable regression- Internal estimation and hypothesis testing, Multiple Regression analysis- The problem of estimation, Dummy Variable Regression Models, Multiple parameter sensitivity analysis, linear Programming- graphic and simplex method; Game theory- the pay off matrix of game, Nash Equilibrium, the mixed strategies and the prisoner's dilemma

Course Outcome:
CO1: Understand Henri Fayol's principles of management,
CO2: Appreciate the functions of a Personnel Department and evaluate a job for wage determination.
CO3: Apply Law of diminishing Utility and Law of equimarginal utility for any market condition
CO4: Understand Factors influencing demand, and Elasticity of demand, the relations between ATC and MC and relations between AC and MC.
CO5: Understand how to maximize profit under competition.
CO6: Apply various work study techniques to reduce work content and ineffective time

Textbook:
Varian, H.R. (1992). Introduction to Micro Economic Analysis, Norton and company, New York
Woolridge, J.M. (2009). Introductory Econometrics- A Modern Approach, South Western CENGAGE learning
Pearce, D.W. and Turner.(1990). Economics of Environment and Natural Resources, Harvester Wheatsheaf. New York
Koutsoyiannis, A.(1979). Modern Micro Economics, Macmillan, London
Damodaran, S. (2012). Managerial Economics, second Edition, OUP
Gujrati and Sangeeta. (2007). Basic Econometrics, TMH, New Delhi
Kolstad, C.D. (2000). Environmental Economics, OUP

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Objective:
The objective is to analyze the designing process of combinational and sequential circuits, express arithmetic logic and shift micro operations in symbolic form at a register transfer level, identify the addressing modes used in macro instructions, apply algorithms for arithmetic operations and implementation for ALU design, and develop micro code for typical instructions in symbolic form.

Module-I **(10 Period)**
Introduction:

Basic Organization of Computers, Classification Micro, Mini, Mainframe and Super Computer. System Bus and Interconnection: Single and multi-bus, Computer FunctionVon-Neumann M/c: Structure of IAS.
Computer Arithmatic:
Data Representation:Fixed Point Representation,Floating Point Representation. Addition and Substraction, Multiplication (Booth Algorithm), Division Algorithm, Floating Point Arithmatic Operation, Decimal Arithmatic Operation.

Module-II **(10 Period)**

Instruction Set Architecture:
Instruction Format: Three Address, Two Address, One Address and Zero Address Instruction, Addressing Modes: Types of Addressing modes, Numerical Examples, Program Relocation, Compaction, Data Transfer & Manipulation: Data transfer, Data Manipulation, Arithmetic, Logical & Bit Manipulation Instruction, Program Control: Conditional Branch Instruction,
CPU Organization:
Fundamental Concepts: Instruction-cycle, Fetching and storing a word in Memory, Register Transfer, Performing an Arithmetic & Logic Operation, Branching. Control word, Stack Organisation, Register Stack, Memory Stack, RPN, Ecaluation of Arithmetic Expression using RPN, Subroutine,Control Unit Operation: Hardware Control & Micro Programmed Control.

Module-III **(10 Period)**

Memory Organization:
Computers Memory System Overview, Characteristics of Memory System, The Memory Hierarchy, Semi Conductor Main Memory types, Organisation, Memory cell Operation. Cache Memory: Cache Principles, Elements of Cache Design, Cache Size, Cache Mapping function, Replacement Algorithm, LRU, FIFO, LFU, Write policy. Number of Caches: Single versus two level caches, Pentium Cache Organisation. Associative Memory: Hardware Organisation, Match Logic. Read Operation, Write Operation, Auxiliary Memory: Magnetic Disks, Magnetic Tape. Virtual Memory: Paging, Paging h/w, Address Mapping using pages, Segmentation h/w, Demand Paging, Memory Management h/w.

Module-IV **(10 Period)**

Input/Output Organization:
Peripheral Devices, Input – output Interface, I/O Bus, Interface Module, Asynchronous Data Transfer, Strobe Control, Handshaking, Asynchronous Serial Transfer, Asynchronous Communication Interface, Modes of Transfer: Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA), DMA Controller, I/O Channel & Processor.
Interrupt:
Class of interrupt, Priority Interrupt: Daisy Chaining Priority, Parallel Priority Interrupt. Program Interrupt, Types of Interrupt, RISC & CISC Characteristic.
Parallel Processing:
Flynn's Classification, Introduction to Pipelining and hazards, Speedup, Efficiency, Throughput.

Course Outcome:

CO1: Analyze the designing process of combinational and sequential circuits
CO2: Express arithmetic logic and shift micro operations in symbolic form at a register transfer level.

CO3: Identify the addressing modes used in macro instructions.
CO4: Apply algorithms for arithmetic operations and implementation for ALU design
CO5: Develop micro code for typical instructions in symbolic form

Text Books:
1.Computer Organization & Architecture – William Stallings, 7th Edition, PHI
2. Computer Organization – by V.Carl Hamacher, Z.G.Vranesic, and S.G.Zaky, 5th Edition. McGraw Hill.

Reference Books:
1. Computer System Architecture : Morris Mano, 3rd Edition, PHI
2. Computer Architecture and Organization, by - John P. Hayes, 3rd Edition, Mc Graw Hill International Editions.
3. Computer Organization & Design, (3rd Edition) by – D.A.Patterson & J.L.Hennessy – Morgan Kaufmann Publishers (Elseviers).

DATABASE MANAGEMENT SYSTEMS (CS15-012)

Course Objective:
The objective is to analyze the basic concepts and architecture associated with DBMS, apply normalization steps in database design and removal of data anomalies, describe the characteristics of database transactions, create, maintain and manipulate a relational database using SQL, and employ the conceptual and relational models to design large database systems.

Module – I (10 Lectures)
Database System Architecture–Introduction to Database Systems, Data Abstraction, Data Independence, Three-Schema Architecture, Data Definitionsand Data Manipulation Languages.
Data Models -Hierarchical, Network, Relational Model and Object Oriented Data models, Entity-Relationship (E-R) Model, Mapping E-R Model to Relational Model.

Module – II (10 Lectures)
Relation Query Languages:Relational Algebra, SQL, Integrity Constraints, Tuple and Domain Relational Calculusand QBE.
Relational Database Design: Functional dependencies, Armstrong's Axioms,Dependency Preservation, Lossless design, Normal Forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF.

Module – III (12 Lectures)
Query processing and Optimization: Evaluation of Relational Algebra Expression, QueryEquivalence, Join strategies, Query optimization Algorithms. Transaction Processing:Transaction concept, Transaction state, Concurrent executions, Serializability. Concurrency Control and Recovery: Concurrency control, Locking and Time-stampbased schedules, Multi-version and Optimistic Concurrency control schemes, Recovery System.

Module – IV (08 Lectures)

Advanced Topics**: (**Introduction to concepts only)Object- Oriented and object Relational databases, Temporal Data Base, Spatial Data Base, Logical Database,Web databases, Distributed Databases, Data Mining and Warehousing, Semantic Web and Ontology.

Course Outcome:

CO1: Analyze the basic concepts and architecture associated with DBMS
CO2: Apply normalization steps in database design and removal of data anomalies
CO3: Describe the characteristics of database transactions and how they affect database integrity and consistency.
CO4: Create, maintain and manipulate a relational database using SQL
CO5: Employ the conceptual and relational models to design large database systems

Text Books:

1. Elmaski & Navathe- Fundamentals of Database systems, 4thEdition, PearsonEducation
2. A. Silberschatz, H. F. Korth, S. Sudarshan-Database System Concepts, 5th Edition, McGraw Hill International Edition.

Reference Books:

1. Bipin Desai- An introduction to Database System, Galgotia publication.
2. G.W.Hansen and J.V.Hansen, Database Management and Design, 2ndEdition, PHI

DESIGN AND ANALYSIS OF ALGORITHMS (CS15-013)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective is to understand asymptotic notations to analyze the performance of algorithms, identify the differences in design techniques and apply to solve optimization problems, apply algorithms for performing operations on graphs and trees, solve novel problems, by choosing the appropriate algorithm design technique for their solution and justify their selection, and analyze deterministic and nondeterministic algorithms to solve complex problems.

MODULE – I

Introduction to Design and analysis of algorithms, Growth of Functions (Asymptotic notations), Recurrences, Solution of Recurrences by substitution, Recursion tree method, Master Method, Analysis of Searching and Sorting Techniques: Brute Force Technique, Divide and Conquer Algorithms, Decrease and Conquer, Heaps and Heap sort, Lower Bounds for Sorting.

MODULE –II

Dynamic Programming algorithms: Matrix Chain Multiplication, Elements of Dynamic Programming, Longest Common Subsequence, Greedy Algorithms: Activity Selection Problem, Elements of Greedy Strategy, Fractional Knapsack Problem, Huffman Codes, Data Structure for Disjoint Sets, Disjoint Set Operations, Linked list Representation, Graph Algorithm - BFS and DFS, Minimum Spanning Trees, Kruskal algorithm, Prim's Algorithm, Single Source Shortest paths, Bellmen Ford Algorithm, Dijkstra's Algorithm.

MODULE -III
Polynomial Evaluation and Interpolation, Fast Fourier Transform, Strassen's Matrix multiplication, String matching, Convolution, Rabin-Karp Algorithm, KMP Algorithms, Boyer-Moore Algorithm, and Computational Geometry: Properties of Line segments, Convex Hull

MODULE -IV
NP-Completeness, Polynomial time verification, Reducibility, Proof of NP-Completeness (NCDP, CDP, CNDP, Hamiltonian cycle), Approximation Algorithms, Traveling Salesman Problem.

Course Outcome:

CO1: Understand asymptotic notations to analyze the performance of algorithms
CO2: Identify the differences in design techniques and apply to solve optimization problems.
CO3: Apply algorithms for performing operations on graphs and trees.
CO4: Solve novel problems, by choosing the appropriate algorithm design technique for their solution and justify their selection
CO5: Analyze deterministic and nondeterministic algorithms to solve complex problems

Text Books

1. M.R.Kabat "Design and Analysis of Algorithms", PHI Learning (p) Ltd
2. T.H.Coreman et.al. "Introduction to Algorithms" Pearson Education

Reference Books

1. S. Sridhar ""Design and Analysis of Algorithms", Oxford University Press
2. A.V.Aho et.al., "The Design and Analysis of Algorithms" Pearson Education, NewDelhi
3. K, Louden " Mastering Algorithms", O' Reily Media Inc

THEORY OF COMPUTATION (CS15-032)

Course Objectives:
Finite automata are useful models for many important kinds of hardware and software. Here are the most important kinds:

- Software for designing and checking the behaviour of digital circuits;
- The "lexical analyzer" of a typical complier, that is, the compiler component that breaks the input text into logical units, such as identifiers, keywords, and punctuation;
- Software for scanning large bodies of text, such as collections of Web pages, to find occurrences of words, phrases, or other patterns;
- Software for verifying systems of all types that have a finite number of distinct states, such as communication protocols or protocols for secure exchange of information.

Module I: Fundamentals& Finite Automata: 10 Hours:
Alphabet,Strings, Language, Operations, Mathematical proving techniques, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, Deterministic Finite Automaton (DFA) and Non deterministic Finite Automaton (NFA), transition diagrams and Language recognizers.Equivalence of DFA and NFA, NFA to DFA conversion,NFA with e - transitions - Significance, acceptance of languages. Equivalence between NFA with and without e - transitions, minimisation of FSM, Finite Automata with output- Moore and Mealy machines and conversion of Mealy to Moore and vice-versa.

Module II: Regular Expression and Languages: 10 Hours:
Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Regular grammars-right linear and left linear grammars, conversion of right linear grammar to left linear and vice-versa, equivalence between regular grammar, regular expression and FA, Pumping lemma of regular sets, closure properties of regular sets.

Module III: Context Free Grammars and Push Down Automata: 10 Hours:
Context free grammar, derivation trees, sentential forms. Right most and leftmost derivation of strings.Ambiguity in context free grammars. Reduction of Context Free Grammars. Chomsky normal form, Greiback normal form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL.Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFG and PDA, interconversion. Introduction to DCFL and DPDA. DPDA Vs NPDA.

Module IV: Turing Machine and its Computational Complexity: 10 Hours:
Chomsky hierarchy of languages, Context sensitive language, Context sensitive grammar,Turing Machine, definition, model, design of TM, Variants of TM, linear bounded automata,Computable functions, recursively enumerable languages. Church's hypothesis. Decidable, Undecidable and reducible problems, Efficiency of computation, Turing Machine and complexity, Language family and complexity classes, the complexity classes P and NP.

Course Outcome:
CO1: Understand the implementation of DFA, NFA and ∈-NFA
CO2: Convert regular expression to DFA
CO3: Differentiate context-free grammar and context-sensitive grammar
CO4: Identify the expressive power of an automata.
CO5: Understand normal forms and pumping lemma

TEXT BOOKS:

1. "Introduction to Automata Theory Languages and Computation". Hopcroft H.E. and Ullman J. D. Pearson Education
2. Introduction to Theory of Computation –Sipser 2nd edition Thomson

REFERENCE BOOKS:

1. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
2. Introduction to languages and the Theory of Computation ,John C Martin, TM
3. "Elements of Theory of Computation", Lewis H.P. & Papadimition C.H. Pearson PHI.

4. Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekaran, 2nd edition, PHI
5. "An introduction to Formal Languages and Automata", Peter Linz, Narosa.
6. Formal Language and automata theory- H.S. Behera, J. Nayak and H. Pattnayak, Vikas Publishing House Pvt. Ltd.

ORGANISATIONAL BEHAVIOUR

Course objective:
The objective of the course is to know the new challenges of organizational manager, learn leadership and managerial skills, and learn how to become an effective leader, and know the organizational culture and discipline.

Module-1
OB: Learning objectives, Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager
LEARNING: Nature of learning, How learning occurs, Learning & OB
Case Study Analysis

Module-2
PERSONALITY: Meaning & Definition, Determinants of Personality, Personality Traits, Personality & OB
PERCEPTION: Meaning & Definition, Perceptual process, Importance of Perception in OB
MOTIVATION: Nature & Importance, Herzberg's Two Factor theory, Maslow's Need Hierarchy theory, Alderfer's ERG theory
Case Study Analysis

Module-3
COMMUNICATION: Importance, Types, Barriers to communication, Communication as a tool for improving Interpersonal Effectiveness
GROUPS IN ORGANISATION: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building
LEADERSHIP: Leadership & management, Theories of leadership- Trait theory, Behavioural Theory, Contingency Theory, Leadership & Followership, How to be an Effective Leader
CONFLICT: Nature of Conflict & Conflict Resolution
TRANSACTIONALANALYSIS: An Introduction to Transactional Analysis
Case Study Analysis

Module-4
ORGANISATIONAL CULTURE: Meaning & Definition, Culture &Organisational Effectiveness
HUMAN RESOURCE MANAGEMENT: Introduction to HRM, Selection,Orientation, Training& Development, Performance Appraisal, Incentives
ORGANISATIONAL CHANGE: Importance of Change, Planned Change & OB Techniques
INTERNATIONAL OB: An Introduction to Individual & Interpersonal Behaviour in Global Perspectives

Case Study Analysis

Course Outcome:
CO1: To know the new challenges of organizational manager
CO2: To learn leadership and managerial skills
CO3: To learn how to become an effective leader
CO4: To know the organizational culture and discipline

COMPUTER ORGANIZATION AND ARCHITECTURE LAB

Course Objective:

The objective is to learn simulation of fast multiplication and division algorithms, disassemble and assemble of personal computer and familiar with different components of motherboard.

1. Simulation and design of Fast Multiplication and Division Programs.
2. Some experiments using hardware training kits for floppy drive, dot matrix printer etc.
3. Dismantling and Assembling a PC along with study of connections, ports, chipsets, SMPS etc. Draw a block diagram of motherboard and other board.
4. A Study Project on some hardware technologies (memory, serial bus, parallel bus, microprocessor, i/o devices, motherboard etc.)

Course Outcome:

CO1: Simulation of fast multiplication and division algorithms
CO2: Disassemble and assemble of personal computer
CO3: Be familiar with different components of motherboard

DESIGN AND ANALYSIS OF ALGORITHMS LAB (CS15-990)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective of this course is to implement polynomial addition, heap sort, DFS and BFS, estimate time and space complexity of an algorithm, and learn NP complete and NP hard problem and their solutions.

Elementary Problems
1. Implement polynomial addition using a single linked list.
2. Implement insertion routine in an AVL tree using rotation .
3. Implement heap sort using a max heap.
4. Implement DFS/BFS routine in a connected graph.

Divide and Conquer Algorithm

1. write a quick sort routine,run it for a different input sizes and calculate the time of running . Plot a graph input size vs time.
2. Implement two way merge sort and calculate the time of sorting .

Greedy Algorithm :

1. Given a set of weights,form a Huffman tree from the weight and also find out the code corresponding to each weight .
2. Take a weighted graph as an input ,find out one MST using Kruskal/Prim's algorithm .

Dynamic Programming :

1. Find out a solution for 0/1 Knapsack problem .
2. Given two sequences of character, find out their longest common subsequence using dynamic programming.

NP complete and NP hard problems :

1. Find out a solution to graph colorability problem of an input graph.
2. Find out a solution to sum of subset problems.

Course Outcome:

CO1: Implement polynomial addition, heap sort, DFS and BFS
CO2: Estimate time and space complexity of an algorithm
CO3: Learn NP complete and NP hard problem and their solutions

DATABASE MANAGEMENT SYSTEMS LAB (CS15-991)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective of the course is to be familiar with SQL syntax, distinguish different join operations, creation and manipulation of SQL views, and use of package.

1. Use of SQL Syntax for creation, insertion, updation, and deletion operation.
2. Use of SQL for Single table retrieval and group by clauses.
3. Use of SQL for sub-queries, set operations, and date manipulations.
4. Use of SQL for multiple table retrieval using join.
5. Use of Creation and Manipulation of SQL Views.
6. Programming approach using PL/SQL.
7. Use of PL/SQL Cursors(implicit, explicit, and parameterized).
8. Concurrency control using LOCK.
9. Data Redundancy using ROLLBACK, SAVEPOINT, and COMMIT
10. Use of Package (ORACLE)

Course Outcome:

CO1: Be familiar with SQL syntax
CO2: Distinguish different join operations
CO3: Creation and manipulation of SQL views
CO4: Use of package

THEORY OF COMPUTATION LABORATORY (CS15-980)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective is to implement Deterministic Finite Automata and Non-Deterministic Finite Automata, study of NPDA and DPDA, and implement Turing Machine for various applications.

1. Implementation of Type 3 automaton(DFA, NFA, Regular expression)
2. Conversion of NFA to DFA
3. Conversion of RE to Regular Grammar and Vice versa
4. Implementation of Type 2 automaton (PDA, CFG)
5. Implementation of Type 0 automaton (TM)

Course Outcome:

CO1: Implement DFA and NFA
CO2: Study of NPDA and DPDA
CO3: Implement TM

CRYPTOGRAPHY AND NETWORK SECURITY (IT15-002)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of the course is to learn the importance of security in network, various types of attacks, different cryptographic techniques, learn symmetric and asymmetric key cryptography based algorithms, digital certificates, and public key management.

Module I **(12 LECTURES)**
Introduction to the Concepts of Security: The need for security, Security Approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks.

Module II **(8 LECTURES)**
Computer-based Symmetric Key Cryptographic Algorithms: Algorithm Types and Modes,
An overview of Symmetric Key Cryptography, DES, International Data Encryption Algorithm (IDEA), RC5, Blowfish, AES, Differential and Linear Cryptanalysis.

Module III **(8 LECTURES)**

Computer-based Asymmetric Key Cryptography: Brief History of Asymmetric Key Cryptography, An overview of Asymmetric Key Cryptography, The RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm, Some other Algorithms.

Module IV (12 LECTURES)

Public Key Infrastructure: Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography Standards, XML, PKI and Security. Internet Security Protocols: Basic Concepts, Secure Socket Layer, SHTTP, Time Stamping Protocol, Secure Electronic Transaction, SSL versus SET, 3-D Secure Protocol, Electronic Money, E-mail Security, Wireless Application Protocol (WAP) Security, Security in GSM.

Course Outcome:

CO1: Introduction to the Concepts of Security, cryptographic techniques
CO2: Computer-based Symmetric Key Cryptographic Algorithms: DES, RC5, Blowfish, AES, and Differential and Linear Cryptanalysis.
CO3: Understand Computer-based Asymmetric Key Cryptography: RSA, Digital Signatures, and Knapsack Problem.
CO4: Learn Public Key Infrastructure, Private Key Management, Internet Security Protocols, Wireless Application Protocol (WAP) Security, and Security in GSM.

Text Books:

1. Cryptography and Network Security – by Atul Kahate – TMH.
2. Data Communications and Networking- by Behourz A Forouzan

Reference Book:

1. Cyber Security Operations Handbook – by J.W. Rittiaghouse and William M.Hancok – Elseviers.

GRAPH THEORY (CS15-019)

L-T-P: 3-1-0 Cr.-4

Course Objective:

The objective of this course is to learn fundamental concepts of graphs, paths, cycles, trails, trees, understand Ramsey's Theorem Graph isomorphism, special graphs, decomposition, Connection, Characterizing bipartite graphs Hamiltonian cycles, Dirac's Theorem, Eulerian circuits, vertex and edge connectivity, Berge's Theorem, Hall's Theorem, learn vertex coloring, edge coloring and list coloring.

Module-I (9 lectures)

Fundamental Concepts : Graphs, Paths, Cycles, Trails, Vertex Degrees,
Counting, directed graphs.

Trees and Distance : Basic Properties, Spanning Trees and Enumeration, Optimization and Trees.
Ramsey's Theorem Graph isomorphism, special graphs, decomposition, Connection.
Characterizing bipartite graphs Hamiltonian cycles: Dirac's Theorem

Module-II(9 lectures)
Eulerian circuits: characterization of Eulerian graphs Cut-vertices, edges.
Trees: equivalent conditions for trees, and related results.
Vertex and edge connectivity : Whitney's inequality, cubic graphs, expansion.
2- and 3-connected graphs: Whitney's theorem
in Testing Center, Thomassen's 3-connectivity theorem Menger's theorem with applications.

Module-III (9 lectures)
Introduction to matchings : Berge's theorem.
Bipartite matching: Hall's Theorem, Konig-Egervary theorem.
General matchings: Tutte's theorem, Berge-Tutte formula, Petersen's 1-factor theorem, Petersen's 2-factor theorem

Module-IV (9 lectures)
Vertex-coloring, chromatic number, constructions of Mycielski and Zykov,
Brooks' theorem. Turan's Theorem.
Edge-coloring, chromatic index of bipartite graphs, Vizing's Theorem.
List coloring, Kernel lemma and Galvin's Theorem.
Plnarity : Planar and plane graphs, Euler's Formula, Kuratowski graphs, Kuratowski's Theorem
List coloring of planar graphs: Thomassen's Theorem, planar duals
Lower bound for Ramsey's Theorem.

Module-V (4 Lectures)
Advanced Topics on: Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.

Course Outcome:
CO1: Learn fundamental Concepts: Graphs, Paths, Cycles, Trails, Vertex Degrees, Counting, and directed graphs.
CO2: Understand Eulerian circuits, Trees, equivalent conditions for trees, Vertex and edge connectivity, Whitney's inequality, cubic graphs, 2- and 3-connected graphs, Whitney's theorem Thomassen's 3-connectivity theorem and Menger's theorem.
CO3: Introduction to Berge's theorem, Hall's theorem, Konig-Egervary theorem, Tutte's theorem, Berge-Tutte formula, Petersen's 1-factor theorem, Petersen's 2-factor theorem.
CO4: Determine vertex coloring, edge coloring, list coloring, and planarity.

Text Book –

1. Introduction to Graph Theory – Douglas B. West, PHI.

MICROPROCESSORS AND MICROCONTROLLERS (CS15-021)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of the course is to understand 8086/8088 pin and timing diagram analyze role of microprocessor and microcontroller in computer systems, distinguish between maskable and non-maskable interrupt, and role of DMA in microprocessor.

Module I: Architecture of Microprocessors
General definitions of mini computers, microprocessors, micro controllers and digital signal processors.Overview of 8085 microprocessor.Overview of 8086 microprocessor. Signals and pins of 8086 microprocessor

Module II: Assembly language of 8086
Description of Instructions.Assembly directives. Assembly software programs with algorithms, Interfacing with RAMs, ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255 etc.Interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc.

Module III: Architecture of Micro controllers
Overview of the architecture of 8051 microcontroller.Overview of the architecture of 8096 16 bit microcontroller.Description of Instructions.Assembly directives. Assembly software programs with Algorithms.

Module IV: Interfacing with 8051
Interfacing with keyboards, LEDs, 7 segment LEDs, LCDs, Interfacing with ADCs.Interfacing with DACs, etc.

Course Outcome:
CO1: Understand 8086/8088 pin and timing diagram
CO2: Analyze role of microprocessor and microcontroller in a computer systems
CO3: Distinguish between maskable and non-maskable interrupt
CO4: Role of DMA in microprocessor

TEXT BOOK:
1. Krishna Kant, “Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096”. PHI 2007.
2. Douglas V Hall, “Microprocessors and Interfacing, Programming and Hardware” TMH,

2006.

REFERENCES:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay The 8051 Microcontroller and Embedded Systems, Second Edition, Pearson Education 2008.
2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007.
3. A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, TMH, 2007.
4. Ajit Pal, "Microprocessors Principles and Applications", TMH, 2005

OPERATING SYSTEMS(CS15-026)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective of the course is to analyze the concepts of Operating System and process, illustrate the Scheduling of a processor for a given problem instance, identify the dead lock situation and provide appropriate solution, analyze memory management techniques and implement page replacement Algorithm, and understand the implementation of file systems and directories.

Module – I

Introduction: What is and Operating Systems.Simple Batch Systems, Multiprogramming and Time-Sharing systems. Personal Computer Systems, Parallel Systems, Distributed systems and Real time Systems.Operating Systems structures: systems components, protection system, O.S. Services, system calls.Process Management: Process concept, process scheduling, Operation on process, Cooperating Processes, Inter process communication. Threads CPU Scheduling: Basic concepts, scheduling algorithms.

Module - II

Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.
Memory management: Background, Logical versus Physical Address space, swapping, contiguous Allocation. Paging, Segmentation.
Virtual memory: Background, Demand paging, performance of Demand paging, Page Replacement, page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

Module - III

File – system Interface : file concept, Access Methods Directory implementation, Recovery.

Module – IV

I/O systems: Overview, I/O Hardware, Application of I/O interface, Kernel I/O – subsystem Transforming I/O requests to Hardware operations. Secondary storage Structure: Disk Structure. Disk scheduling, Disk management, Swap space management, Disk Reliability, Case Studies LINUX, WINDOW NT.

Course Outcome:

CO1: Analyze the concepts of Operating System and process.
CO2: Illustrate the Scheduling of a processor for a given problem instance.
CO3: Identify the dead lock situation and provide appropriate solution.
CO4: Analyze memory management techniques and implement page replacement Algorithm.
CO5: Understand the implementation of file systems and directories.

TEXT BOOK
Operating System Concepts: Abraham Silberschatz and Peter Bear Galvin, Addison Wesley, Chapter – 1, Chapter –3 (3.1,3.2,3.3), Chapter – 4, chapter – 5 (5.1, 5.2, 5.3) , Chapter –7 (7.1,-7.7), Chapter-8, chapter – 8, Chapter – 9, Chapter-10, Chapter- 11, Chapter-12, (12.1-12.5), Chapter-13(13.1-1.35)

Reference Book :

1. Operating System, McGraw Hill, Madnik & Donovan.
2. Operating Systems and system progamming, SCITECH, P. Blkeiahn Prasad.
3. Moswen O.S. – PHI, Andrew, S. Tannenbaum

SOFTWARE ENGINEERING &OOAD (CS15-031)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of this course is to identify and build an appropriate process model for a given project, analyze the principles at various phases of software development, translate a specification into a design, and identify the components to build the architecture for a given problem, all using an appropriate software engineering methodology. It also focuses to define a Project Management Plan and tabulate appropriate Testing Plans at different levels during the development of the software, and understand the software project estimation models and estimate the work to be done, resources required and the schedule for a software project.

Module -I

Introduction – evolution & impacts, motivation for software engineering, programs vs software products, emergence of software engineering, recent trends in software development practices. Software life cycle models – reasons behind using life cycle models, study of various life cycle

models – classical waterfall, iterative waterfall, prototyping, evolutionary, spiral, etc. comparison of various life cycle models.

Module-II

Software project management – Responsibilities, Planning, Project & Empirical Estimation Techniques, COCOMO, Software Science, Staffing, Scheduling, Team Structure, Risk Management, Configuration Management. Requirement analysis & specification – Gathering Requirements & Analysis, SRS, Formal System Development Techniques, Axiomatic & Algebraic Specification.

Module-III

Software design & modelling – Cohesion & Coupling, Software Design Approaches, Object Oriented Design vs. Function Oriented Design, Function Oriented Software Design (SA/SD Methodology, Structured Analysis, DFDs, Structured & Detailed Design), Object Oriented Software Development (Design Patterns & Generalized Process), Object Modelling using UML (UML Concepts, UML Diagrams, USE Case Model; Class, Interaction, Activity & State Chart Diagrams)

User interface design – Basic concepts & its types, Component based GUI Development, User Interface Design Methodology

Module-IV

Coding & testing – Coding & Code Review, Testing – Unit, Black box & White box, Debugging, Program Analysis Tools, Integration &System Testing, General issues related to testing.
Software reliability & quality management – Software Reliability & Quality, Statistical Testing, Quality Management System, ISO 9000, SEI CMM, PSP.
Case – Environment & scope, Support in SDLC, Characteristics & Future Scope of CASE Tools, Architecture of a CASE Environment.
Software maintainance – Characteristics, Reverse Engg., Maintenance Process Models, Estimation of Maintenance Cost.
Software reuse – Basic Issues, Refuse Approach, Reuse at Organizational Level.

Course Outcome:
CO1: Identify and build an appropriate process model for a given project
CO2: Analyze the principles at various phases of software development.
CO3: Translate a specification into a design, and identify the components to build the architecture for a given problem, all using an appropriate software engineering methodology.
CO4: Define a Project Management Plan and tabulate appropriate Testing Plans at different levels during the development of the software.
CO5: Understand the software project estimation models and estimate the work to be done, resources required and the schedule for a software project.

Text Book:

1. Rajib Mall, "Fundamental of Software Engineering", PHI
2. Roger S. Pressman, "Software Engineering A Practitioners Approach". Mc-Graw Hill Publication.

Reference Book:

1. Richard Farley, "Software Engineering Concepts". Mc-Graw Hill Publication.

OPERATING SYSTEMS LAB (CS15-985)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective is to be familiar with Unix and Linux command, implement different scheduling algorithms, develop first fit, best fit and worst fit algorithm for memory, illustrate the function of a dispatcher, make packaging and sending in IPC, and implement various synchronization problem.

1. Study of Unix/Linux Commands.(2 classes)
2. Write a program to allocate blocks of memory.
3. Write a program to implement best fit algorithm in paging memory.
4. Write a program to implement the bit vector for free space management.
5. Write a program to implement first fit algorithm in paging memory.
6. Write a program to implement worst fit algorithm in paging memory.
7. Write a program to create a unique file name by the user or by the system.
8. Write a program to implement DEKKERS ALGORITHM for mutual exclusion problem.
9. Write a program to implement DINING PHILOSOPHER problem.
10. Write a program for FCFS cpu scheduling algorithm.
11. Write a program for FIFO page replacement algorithm.
12. Write a program for LRU page replacement algorithm.
13. Write a program for Optimal page replacement algorithm.
14. Write a program to implement paging scheme.
15. Write a program for ROUND ROBIN CPU scheduling algorithm.
16. Write a program for SJF cpu scheduling algorithm.
17. Write a program to implement producer-consumer problem of IPC.
18. Write a program for to create two processes and wait for them to complete.
19. Write a program to make packaging and sending as in IPC.
20. Write a program to illustrate the function of a dispatcher.

Course Outcome:

CO1: Be familiar with Unix and Linux command
CO2: Implement different scheduling algorithms

CO3: Develop first fit, best fit and worst fit algorithm for memory
CO4: Illustrate the function of a dispatcher
CO5: Make packaging and sending in IPC
CO5: Implement various synchronization problem

ADVANCE COMPUTING LAB (CS15-999)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective of this course is to learn client-server application programming using TCP/IP and UDP protocols, monitoring network traffic, client-side programming and server side programming, and VBScript Programming.

1. Client-server application programming in C using TCP/IP (like a chatting application) and UDP Protocols. (2 classes)
2. Script program to monitor network traffic like pinging and log the messages.
3. Study and analysis of network packet filter tools like tcpdump
4. Program in C++ to monitor network traffic and display the necessary messages.
5. Client side programming using HTML/Java Script and Server side Programming using Perl.
6. VBScript programming
7. C# . Net Programming

Course Outcome:

CO1: Learn client-server application programming using TCP/IP and UDP protocols.
CO2: Program to monitor network traffic like pinging and log the messages.
CO3: Learn VBScript programming and C# . Net Programming

MP&MC LAB (CS15-986)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective is to be familiar with 8085 and 8086 tool kit, generate square wave on all lines of 8255 with different frequencies, study of stepper motor and its operations, implement traffic light controller and elevator, and transfer a block of data to another memory location using indexing.

1. Addition of two 8-bit numbers, sum 8 bits
2. Subtraction of two 8-bit numbers, difference 8 bits
3. Addition of two 8-bit numbers, sum 16 bits.
4. Decimal addition of two 8-bit numbers, sum 16 bits.
5. Addition of two 16-bit numbers, sum 16 bits or more.
6. Find one's complement of an 8-bit number and 16-bit number.

7. Find two's complement of an 8-bit number and 16-bit number.
8. Find multiplication of two numbers using multiple addition.
9. Find division of two numbers using repeated subtraction.
10. Find square from lookup table.
11. Find the largest number in a data array.
12. To arrange a series of numbers in ascending or descending order.
13. Sum of a series of two 8-bit numbers, sum 8 bits
14. Sum of a series of two 8-bit numbers, sum 16 bits
15. 8-bit multiplication, product 16 bit
16. Programs on multibyte addition, subtractions etc.
17. To find the square root of a number.

Course Outcome:

CO1: Be familiar with 8085 and 8086 tool kit.
CO2: Generate square wave on all lines of 8255 with different frequencies
CO3: Study of stepper motor and its operations
CO4: Implement traffic light controller and elevator
CO5: Transfer a block of data to another memory location using indexing

SOFTWARE ENGINEERING LAB (CS15-981)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective is to implement time management software of a company, implement restaurant, supermarket, newspaper agency, medicine shop, book shop automation system, and implement library and payroll management system.

1. Time management software of a company
2. Hotel automation software
3. Judiciary information system software
4. Restaurant automation software
5. Supermarket automation software
6. Newspaper agency automation software
7. Medicine shop software
8. Bookshop automation software
9. Road tax information management system
10. Railway reservation system
11. Electricity billing system
12. Inventory control system
13. Library management system
14. Payroll management system

15. Banking system

Course Outcome:

CO1: Implement time management software of a company
CO2: Implement restaurant, supermarket, newspaper agency, medicine shop, book shop automation system
CO3: Implement library and payroll management system

COMPILER DESIGN (CS15-004)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of the course is to introduce the major concept areas of language translation and compiler design, enrich the knowledge in various phases of compiler ant its use, code optimization techniques, machine code generation, and use of symbol table, extend the knowledge of parser by parsing LL parser and LR parser, and provide practical programming skills necessary for constructing a compiler.

Module – I: Compiler Overview and Lexical Analysis 8 Hours:
Overview of language processing: preprocessors, compiler, assembler, interpreters, linkers, Bootstrap loaders and cross compiler. Structure of a compiler: phases of a compiler. Lexical Analysis: Role of Lexical Analysis, Input buffering, Regular Expressions, NFA, DFA, Minimization of DFA, Transition diagram for tokens, reserved words and identifiers. Lexical error and its recovery, LEX.

Module – II: Syntax Analysis 12 Hours:
Role of a parser, Top down parsing, derivation, ambiguity, left recursion, left factoring, backtracking parsing, recursive decent parsing, predictive parsing, LL(1) Grammars. Bottom up parsing, Shift Reduce Parsing, handle, handle pruning, Operator precedence parser, precedence function, LR Parsers, Construction of SLR, CLR, LALR Parsing tables, parser conflicts, Dangling ELSE Ambiguity, Error recovery in Parsing. YACC.

Module – III : Semantic Analysis and Intermediate code generation 10 Hours:
Semantic analysis, SDD and SDTS, evaluation of semantic rules, implementation of S-attributed and L-attributed definition. Type analysis and type checking. Intermediate code, three address code, quadraples, triples, indirect triplet, abstract syntax trees, Declarations, Assignment statements, Boolean expressions, Case statements, Back patching, Procedure calls. Symbol tables, use of symbol tables. Runtime Environment: storage organization, stack allocation, access to non-local data, heap management, parameter passing mechanisms.

Module – IV: Optimization and Code generation 10 Hours:
Machine independent code optimization: Common sub expression elimination, constant folding, copy propagation, dead code elimination, strength reduction, loop optimization, basic blocks,

data flow analysis. Code generation: Issues in the design of code generation, The target machine, A simple code generator, DAG representation of basic blocks. Machine dependent code optimization: Peephole optimization, register allocation, instruction scheduling, inter procedural optimization, garbage collection via reference counting.

Text books:

1. Compilers, Principles Techniques and Tools- Alfred V Aho, Monical S Lam, Ravi Sethi, Jeffrey D. Ullman,2nd ed, Pearson,2007.
2. Principles of compiler design, V. Raghavan, 2nd ed, TMH, 2011.

Reference books:

1. Compiler construction, Principles and Practice, Kenneth C Louden, CENGAGE
2. Compiler Design, O. G. Kakde, University Science Press.
3. Compiler Design, K. Muneeswaram, Oxford University Press.
4. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003

Course Outcome:

CO1: Identify the role of compiler and its phases
CO2: Role of the lexical analysis
CO3: Role of the top-down and bottom-up parser
CO4: Distinguish s-attributed and l-attributed definition
CO5: Issues of a code generator
CO6: Analyze different ways of code optimization

COMPUTER GRAPHICS (CS15-005)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective is to be familiar with GUI, use of points and lines algorithm, learn basic transformation such as translation, rotation and scaling, learn line and polygon clipping, and use of halftone pattern and dithering.

Module I **(10 Lectures)**

Application of Computer Graphics:

Computer Aided Design, Presentation Graphics, Computer art, Entertainment, Education and Training, Visualization, Image Processing, Graphical User Interface.

Graphics Hardware: Display Devices, Raster-Scan and Random Scan Displays, Direct View Storage Tube, Flat Panel Displays, Input Devices, Hard Copy Devices.

Output Primitives: Points and Lines, Line Drawing Algorithms, Circle Drawing Algorithms, Ellipse Drawing Algorithms, Region Filling Algorithms, Side Effects of Scan Conversion, Antialiasing.

Module II **(10 Lectures)**

Two-Dimensional Geometric Transformations: Basic Transformations (Translation, Rotation, Scaling), Matrix Representation and Homogeneous coordinates, Composite Transformation, Reflection, Shear, Transformation between coordinate system.

Two-Dimensional Viewing: Viewing Pipeline, Window-to-viewport Coordinate Transformation.

Two-Dimensional Clipping: Point Clipping, Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm)

Module III **(12 Lectures)**

Three-Dimensional Transformation and Projection: Translation Rotation, Scaling, Reflections, Shear, Projection: Types of Projections (Parallel and Prospective), Mathematical Description of Projections

Three-Dimensional Viewing and Clipping: Three-Dimensional Viewing, Clipping, Viewing Transformation

Geometric Forms and Models: Simple and Complex geometric forms, Wireframe Model

Three Dimensional Object Representations: Curve Design, Blending Functions and its types, Spline Curve, Bezier Curves and Surfaces, B-Spline Curves and surfaces.

Fractal Geometry Methods: Fractal Generation Procedure, Classification of Fractals Dimension, geometric Construction of Deterministic self-similar.

Module IV **(08 Lectures)**

Visible Surface Detection Methods: Hidden Lines and Surfaces, Depth Comparisons, Back-face Detection, Z-Buffer, A-Buffer, Area-Subdivision Algorithms

Illumination Models: Basic Models, Displaying Light Intensities, Halftone Pattern and Dithering Techniques

Surface Rending Methods: Polygon Rendering Methods, Gouraud and Phong Shading

Course Outcome:

CO1: Be familiar with GUI
CO2: Use of points and lines algorithm
CO3: Learn basic transformation such as translation, rotation and scaling
CO4: Learn line and polygon clipping
CO5: Use of halftone pattern and dithering

Text Books:

1. Computer Graphics, D.Hearn and M.P.Baker (C Version), Prentice Hall, 1999

Reference Books:

1. Computer Graphics Principle and Practice, J.D.Foley, A.Dam, S.K.Feiner, Addison, Wesley.
2. Schaum's Outlines Computer Graphics, Z. Xiang and Roy A Plastock, 2nd Edition, McGraw Hill Education, Indian Edition 2006.

DATA COMMUNICATION & COMPUTER NETWORKS

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective is to analyze the concepts of networks, types and architectures, identify error free transmission of data and analyzes data collision with various protocols, apply various routing algorithms over a network to provide optimal path, illustrate the real time applications of networks, and examine the addressing entities of a network with implementation of TCP, UDP protocols.

Module – I **(12 Lectures)**

Overview of Data Communications and Networking.
Physical Layer : Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals.
Digital Transmission: Line coding, Block coding, Sampling, Transmission mode.
Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing : FDM , WDM , TDM ,
Transmission Media: Guided Media, Unguided media (wireless)
Circuit switching and Telephone Network: Circuit switching, Telephone network.

Module –II **(12 Lectures)**

Data Link Layer

Error Detection and correction: Types of Errors, Detection, Error Correction
Data Link Control and Protocols:
Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point –to- Point Protocol, Multiple Access, Random Access, Controlled Access, Channelization.
Local area Network: Ethernet, Traditional Ethernet, Fast Ethernet, Gigabit Ethernet.
Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.

Module – III **(8 Lectures)**

Network Layer:

Host to Host Delivery: Internetworking, addressing, Routing.
Network Layer Protocols: ARP, RARP, NAT, BOOTP, DHCP, IPV4, ICMP, IPV6, ICMPV6 and Unicast routing protocols
Transport Layer: Process to Process Delivery: UDP, TCP, congestion control and Quality of service.

Module-IV **(8 Lectures)**

Application Layer :

Client Server Model, Peer to peer network, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Course Outcome:

CO 1: Analyze the concepts of networks, types and architectures
CO 2: Identify error free transmission of data and analyse data collision with various protocols.
CO 3: Apply various routing algorithms over a network to provide optimal path.
CO 4: Illustrate the real time applications of networks
CO 5: Examine the addressing entities of a network with implementation of TCP, UDP protocols.

Text Books:

1. Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4th Ed
2. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5th Ed

Reference Book : .

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4th Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9th Ed.
4. Data communication & Computer Networks: Gupta, Prentice Hall of India
5. Network for Computer Scientists & Engineers: Zheng, Oxford University Press
6. Data Communications and Networking: White, Cengage Learning

SIMULATION AND MODELING (CS15-029)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective is to understand the inventory concepts which include the technique of simulation, major application areas, concept of a system, environment, continuous and discrete systems models, Monte Carlo method etc., study of probability concepts in simulation including stochastic variables, discrete and continuous, probability functions, numerical evaluation of continuous probability functions etc., analyze discrete system simulation and GPSS which includes discrete events, representation of time, simulation of a telephone system, delayed calls, introduction to GPSS, and understand simulation languages and practical systems.

Module I **(10 hrs)**

Introduction: Definition, Advantages and Disadvantages of Simulation, Areas of application, Concept of a System, Environment, Components of a system, Continuous and discrete systems, Modeling, Types of models, Monte Carlo Method, Comparison of Simulation and Analytical Methods. Discrete and continuous models.

Module II **(10 hrs)**

Probability Concepts in Simulation: Discrete and Continuous Probability Functions, Random Number Generators – Linear Congruential Generator, Mid Square Method, rejection Method, Testing of random Numbers, Generation of Stochastic variates in Arrival Patterns and Service times.

Module III **(10 hrs)**

Discrete System Simulation: Discrete Events, Representation of Time, generation of arrival patterns, fixed time step versus next event simulation, Simulation of a Telephone System, delayed calls.

Computer model of queuing and scheduling systems, Design and Evaluation of simulation Experiments: Length of simulation runs, validation, variance reduction techniques, analysis of simulation output.

Module IV **(10 hrs)**

Simulation Languages: Introduction to GPSS: Creating and moving transactions, queues, facilities and storages, gathering statistics, conditional transfers, program control statements, priorities and parameters, standard numerical attributes, functions, gates, logic switches and tests, Variables, Select and Count, Continuous and discrete systems languages,

Course Outcome:

CO1: Understand the inventory concepts which include the technique of simulation, major application areas, concept of a system, environment, continuous and discrete systems models, Monte Carlo method etc.
CO2: Study of probability concepts in simulation including stochastic variables, discrete and continuous, probability functions, numerical evaluation of continuous probability functions etc.
CO3: Analyze discrete system simulation and GPSS which includes discrete events, representation of time, simulation of a telephone system, delayed calls, introduction to GPSS.
CO4: Understand simulation languages and practical systems.

Text Book:

1. System Simulation – Geoffrey Gordon, 2nd Edition, PHI
2. System Simulation with Digital computer – Narsingh Deo, PHI

Reference Book:

1. Discrete-Event System Simulation-Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, P. Shahabudeen

COMPILER DESIGN LAB (CS15-997)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective is to be familiar with LEX and YACC, identify token in a program, implement FIRST and FOLLOW, develop LL(1) parsing, and design recursive descent parser.

1. Introduction to LEX and YACC
2. Write a LEX program to evaluate the arithmetic expression
3. Write a LEX program for tokenizing the given program.
4. Integration LEX with YACC program
5. Write a LEX program to find out the comment lines of a given program.
6. Write a LEX program toidentify the strings ending with abb.
7. Write a YACC program to evaluate the following grammars: $\{a^nb^n|n>0\}$, $\{a^nb^nc^n|n>0\}$,$\{(ab)^n|n>0\}$

Course Outcome:

CO1: Be familiar with LEX and YACC
CO2: Identify token in a program
CO3: Implement FIRST and FOLLOW
CO4: Develop LL(1) parsing
CO5: Design recursive descent parser

COMPUTER NETWORK LAB (CS15-994)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective is to demonstrate techniques to correct and detect errors during transmission, demonstrate understanding of how computers communicate with each other and the routing algorithms employed to assure that the communication is reliable, and implementation of client server applications with protocols TCP and UDP.

1. To study about different physical equipment used for networking.

2. To Connect 2 PCs using Peer to Peer communication.
3. Development of Stop & Wait protocol for file transfer
4. Study of Network Utilities.
5. Write a program to generate CRC code for checking error.
6. To Plot Efficiency of pure Aloha and slotted ALOHA in MATLAB.
7. To plot Channel Efficiency for Ethernet in MATLAB.
8. To Study the Network Simulator (NS2).
9. To implement wired network topology and wireless network Topology in ns2.
10. To implement UDP protocol and study performance using Network simulator (ns2).
11. a) Write a program to implement bit stuffing &Destuffing.
    b) Write a program to implement character stuffing &Destuffing.
12. Write a C program for IPV4, Implementation of decimal to binary, Implementation of binary to decimal.

Course Outcome:

CO1: Demonstrate techniques to correct and detect errors during transmission.
CO2: Demonstrate understanding of how computers communicate with each other and the routing algorithms employed to assure that the communication is reliable
CO3: Implementation of client server applications with protocols TCP and UDP.

SIMULATION AND MODELLING LAB (CS15-982)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective of the course is to study comparison of simulation and analytical methods, implement Monte Carlo method, learn continuous and discrete systems, testing of random numbers, and recent trends and development.

1. Introduction to MATLAB
2. Programming in Matlab: Introduction, Branching statements, loops, functions, additional data types, plots, arrays, inputs/outputs etc.
3. Program to display a Matrix
4. Program to Addition of matrix
5. Program to transpose of a Matrix.
6. Introduction regarding usage of any Network Simulator.
7. Practical Implementation of Queuing Models using C/C++.
8. Simulation of events/models using MATLAB

Course Outcome:

CO1: Comparison of simulation and analytical methods
CO2: Implement Monte Carlo method
CO3: Learn continuous and discrete systems

CO4: Testing of random numbers
CO5: Recent trends and development

COMPUTER GRAPHICS LAB (CS15-995)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective is to implement points and lines algorithm, implement line and polygon clipping, implement translation, rotation and scaling of an object, and implementation of algorithms using open GL.

1. Write a program to construct the following figures and color them using graphics built-in library functions:
    i) Smiling Face
    ii) Indian Flag
    iii) House
2. Write a program to construct a moving car using graphics built-in library functions.
3. Write a program to construct a line by using slope-intercept method.
4. Write a program to construct a line using DDA algorithm.
5. Write a program to construct a dotted line using DDA algorithm.
6. Write a program to construct a dashed line using DDA algorithm where the length of dash is given by user.
7. Write a program to construct a dashed line using Bresenham's algorithm where the length of dash is given by user for m +ve, m<1, Direction of line left to right.
8. Write a program to construct a line using Bresenham's algorithm for the following cases:
    i) m +ve, m<1, Direction of line left to right
    ii) m +ve, m<1, Direction of line right to left
    iii) m +ve, m>1, Direction of line left to right
    iv) m +ve, m>1, Direction of line right to left
9. Write a program to construct a line using Bresenham's algorithm where the line is drawn simultaneously from both sides for m +ve, m<1, Direction of line left to right.
10. Write a menu driven program to create a circle using polynomial method:
    i. Without using the symmetric concept
    ii. Using the symmetric concept
11. Write a menu driven program to create a circle using trigonometric method:
    iii. Without using the symmetric concept
    iv. Using the symmetric concept
12. Write a program to construct a circle using the symmetric concept by applying the Mid-Point Circle Algorithm.

13. Write a program to construct a circle using the symmetric concept by applying the Bresenham's Circle Algorithm.
14. Write a program to draw two intersecting circles by applying i) Mid-Point ii) Bresenham's method and then fill the three areas differently.
15. Write a program to generate the following shapes using i) Mid-Point ii) Bresenham's circle drawing method:
16. Write a program to create a circle and a rectangle and fill those using the boundary fill algorithm using the 4-connected method.
17. Write a program to create a triangle and an ellipse and fill those using the flood fill algorithm using the 8-connected method.
18. Write a program to create a polygon with 'n' vertices and fill it using scan line fill algorithm.
19. Write a program to apply the series of transformations: Translation, Rotation and Scaling on the following graphical objects:
    i) Line
    ii) Circle
    iii) Triangle
    iv) Rectangle

    Display the original and transformed figures after applying each transformation.
20. Write a program to construct a rectangle and then rotate it by angle Θ w.r.t. pivot point Pr(Xr,Yr). Display the original and transformed figure.
21. Write a program to create a circle and then scale the circle by S(Sx,Sy) w.r.t. fixed point Pf(Xf,Yf). Display the original and transformed figure.
22. Write a program to apply the reflection transformations on the following graphical objects: (For viewing the reflected image, create the x-y axis with origin at center of the screen)
    i) Reflect a Triangle about the line y = 0
    ii) Reflect a Triangle about the line y = 5
    iii) Reflect a Rectangle about the line x = 0
    iv) Reflect a Rectangle about the line x = 5

    Display the original and transformed figure for each of the above cases.
23. Write a program to apply the shearing transformations on the following graphical objects:
    i. Shear a Triangle about the line y = 0
    ii. Shear a Triangle about the line y = 5
    iii. Shear a Rectangle about the line x = 0
    iv. Shear a Rectangle about the line x = 5
24. Display the original and transformed figure for each of the above cases.

Course Outcome:

CO1: Implement points and lines algorithm
CO2: Implement line and polygon clipping

CO3: Implement translation, rotation and scaling of an object
CO4: Implementation of algorithms using open GL

ADVANCED COMPUTER ARCHITECTURE (CS15-001)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective of this course is to gain in depth knowledge of architecture, learn parallel processing and its application to solve workloads, and understanding pipelined and non-pipelined processing.

Module-I

Flynn's classification: SISD, SIMD, MISD, MIMD, message passing, Loosely coupled and tightly coupled system,Basic ideas on parallel algorithm: SIMD algorithmfor matrix multiplication.

Parallel Processing: Definition, Theory of Parallelism. Parallel Computer Models, Parallelism in Uni-processor computers, Implicit Parallelism vs. explicit parallelism, Levels of parallelism.Soft ware Parallelism, Hardware Parallelism.

Pipelining:Linear pipe line processor, Asynchronous and Synchronous models, speed up,Efficiency,Throughput,Nonlinearpipelineprocessor,Instructionpipeline,Conditions of Parallelism pipeline hazards, Arithmetic pipeline

Module-II

Parallel Interconnection Systems: Static and Dynamic Networks, Linear Array, Ring, Star, Tree, Mesh, Systolic Array, Chordal ring, Completely connected network, Cube connected cycles, Torus, K-ary-n cube, Barrel shifter, single stage interconnection network, Multistage Interconnection Networks, Control Structure, Node degree, diameter, Bisection width, symmetric, functionality, Network Latency, Bandwidth, Scalability, Data routing functions:- Permutation, Perfect shuffle exchange, Hypercube Routing function.

Module-III

Instruction level parallelism:

Concepts and challenges – Hardware and software approaches, Dynamicscheduling, Speculation, Branch prediction. Amdhal's Law.

Module-IV

Cache performance, Reducing cache miss penalty and miss rate, Reducing hit time,
Main memory and performance, Memory Interleaving technology, Buses, RAID

Module-V

Software and hardware multithreading, SMT and CMP architectures, Design issues,
Case studies, Intel Multi-core architecture, SUN CMP architecture,heterogeneous
multi-core processors,Case study: IBM Cell Processor.

Course Outcome:

CO1: Gain in depth knowledge of architecture
CO2: Learn parallel processing and its application to solve workloads
CO3: Understanding pipelined and non-pipelined processing

Text Books:

1. Advanced Computer Architecture, byKai Hwang Mc Graw Hill.
2. Computer Architecture –A quantitative approach By J.L Hennessy and D.A.Patterson (Morgan)

EMBEDDED AND REAL TIME SYSTEM (CS15-017)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective is to get an introduction to embedded system, processor in the system, other hardware units, software embedded into a systems, exemplary embedded system-on-chip (SOC) and VLSI circuit, study devices and device drivers, I/O devices, timer and counting devices, serial communication using the IC, CAN and advance I/O buses between the networked multiple devices, host system or computer parallel communication between the networked I/O multiple devices using the ISA, PCI, PCI-X and advance buses, device drivers, parallel port devices drivers in a system, serial port device drives in a system, interrupt servicing (handling) mechanism.

Module- I

Introduction to embedded systems: Categories of embedded systems, overview of embedded system architecture; specialties of embedded systems recent trends in embedded systems, Communication interfaces: RS232/UART RS422/RS485.

Module- II

Survey of software Architectures: Round Robin, Round Robin with interrupts, Function Queue scheduling Architecture, RTOS Architecture, Architecture selection, Introduction to RTOS,Task and task states, Task and data, Semaphore and shared data, More operating system services, Message Queues, Mail boxes and pipes, Timer functions , events, Memory Management, Interrupt routine in an RTOS environment.

Module- III

Embedded Software Development Tools: Host and Target Machines, Linker/ Locator for Embedded Software , Getting Embedded Software into the target system, Debugging Techniques, Testing on your host machine, Instruction set Simulators, The Assert Macro using Laboratory tools.

Module-IV

Writing Software for Embedded Systems: The compilation process, Native versus cross compilers, Run time libraries, Writing a library, Using alternative libraries, Using a standard library, Porting Kernels, C extensions for Embedded Systems, Downloading, Emulation and Debugging Techniques, Buffering and other data structures: What is a Linear buffer, Directional

buffer, Double buffering, buffer exchanging, Linked lists, FIFO, Circular buffers, Buffer under run and overrun, Allocating buffer memory, memory leakage, Memory and performance trade offs.

Course Outcome:

CO1: Introduction to embedded system, processor in the system, other hardware units, software embedded into a systems, exemplary embedded system-on-chip (SOC) and VLSI circuit.

CO2: Study devices and device drivers, I/O devices, timer and counting devices, serial communication using the IC, CAN and advance I/O buses between the networked multiple devices, host system or computer parallel communication between the networked I/O multiple devices using the ISA, PCI, PCI-X and advance buses, device drivers, parallel port devices drivers in a system, serial port device drives in a system, interrupt servicing (handling) mechanism.

CO3: Software and programming concept: processor selection for an embedded system, memory selection for an embedded system, embedded programming in C ++, embedded programming in JAVA.

CO4: Case studies of programming with RTOS: case study of an embedded system for a smart card hardware and software co-design

TEXT BOOKS

1. "Embedded / Real time systems: Concepts, Design and Programming", Dr.K V K K Prasad, Dream Tech press, New Delhi, 2003.
2. "Embedded Software Primer", David Simon, AddisonWesley, 1999.

REFERENCES

1. "Introduction to Embedded Systems", Raj Kamal, TMS, Tata McGraw Hill Publications, 2002.
2. "Embedded System Design, A Unified Hardware/ Software Introduction", Frank Vahid,Tony D. Givargis, John Wiley and Sons, Inc 2002
3. "Embedded Microcomputer systems", Jonathan W. Valvano, Brooks / Cole, Thompson Learning.
4. "Embedded Systems Design Introduction to Processes, Tools, Techniques", Arnold S Burger, CMP books.

INTERNET & WEB PROGRAMMING (IT15-006)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective of the course is to compare and Contrast HTML, DHTML, CSS, JavaScript, XML and other Web technologies, implement JavaScript Language to perform functionalities at client

side application areas which include Banking, develop Graphical User Interface applications in Java by importing Applets and AWT, assess and evaluate the role of "WEBSERVERS" for the management and delivery of electronic information, design well formed JSP and Servlets Documents, and develop Web based applications by Servlets and JSP to have an interactive applications such as Client Server Architecture.

Module I **(10 Lectures)**

Internet architecture: Internet overview, evolution of internet. Internet components: Local Area Networks, Access Networks, Core Networks, Routers, Transmission infrastructure, ISPs. TCP/IP model, TCP/IP vs OSI model.
HTML: HTML Overview, Structure of HTML Documents, Document Types, HTML Elements and attributes. Anchor Attributes, Image Tag and its attributes, Image and Anchors, Table

Module II **(10 Lectures)**

Image Map: Attributes, Client Side Image Maps and Server Side Maps.
HTML Layout: Background,colorsand text, Tables, Frames, Layers, Page content Division <Div>, <SPAN>.
CSS: Style Sheet Basic, Properties, Positioning with Style Sheet. Forms: <FORM> Elements, Form controls. Dynamic HTML.

Module III **(10 Lectures)**
Java Script :Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security, Operators :Assignment Operators, Comparison Operators, Arithmetic Operators, % (Modulus), ++ (Increment), -- (Decrement), -(Unary Negation), Logical Operators, String Operators, Special Operators, ? (Conditional operator), ,(Comma operator), delete, new, this, void, Statements : Break, comment, continue, delete, do … while, export, for, for…in, function, if…else, import, labelled, return, switch, var, while.
JavaScript (Properties and Methods of Each) :Array, Boolean, Date, Function, Math, Number, Object, String, regExp. Document and its associated objects :document, Link, Area, Anchor, Image, Applet, Layer.

Module IV **(10 Lectures)**
Events and Event Handlers : General Information about Events, Defining Event Handlers, event, onAbort, onBlur, onChange, onClick, onDblClick, onDragDrop, onError, onFocus, onKeyDown, onKeyPress, onKeyUp, onLoad, onMouseDown, onMouseMove, onMouseOut, onMouseOver, onMouseUp, onMove, onReset, onResize, onSelect, onSubmit, onUnload.
Server Side Programming : Common Gateway Interface (CGI), Active Server Pages. Internet applications: FTP, Telnet, Email, Chat. World Wide Web: HTTP protocol. Search Engines. E-commerce and security issues including symmetric and asymmetric key, encryption and digital signature, and authentication. Emerging trends, Internet telephony, virtual reality over the web, etc. Intranet and extranet, firewall.

Course Outcome:

CO1: Compare and Contrast HTML, DHTML, CSS, JavaScript, XML and other Web technologies.
CO2: Implement JavaScript Language to perform functionalities at client side application areas which include Banking.
CO3: Develop Graphical User Interface applications in Java by importing Applets and AWT.
CO4: Assess and evaluate the role of "WEBSERVERS" for the management and delivery of electronic information.
CO5: Design well formed JSP and Servlets Documents.
CO6: Develop Web based applications by Servlets and JSP to have an interactive applications such as Client Server Architecture.

Text Books:
Computer Networking A Top-Down Approach Featuring the Internet by Kurose and Ross.
Web Design The Complete Reference by Thomas Powell, Tata McGrawHill.

Reference Books:
HTML The Complete Reference by Thomas Powell, Tata McGrawHill.
JavaScript The Complete Reference, Second Edition by Thomas Powell, Fritz Schneider . Tata McGrawHill.

INTERNET AND WEB PROGRAMMING LAB (IT15-997)

L-T-P: (0-0-3) **Cr:** 2

Course Objective:

The objective is to be familiar with HTML and PHP, embedding audio and video files in HTML, develop server side scripting, and learning CGI scripting using PERL or C.

1. Web design environment : HTML elements coding and testing
2. Cascading style sheet
3. Implementation of website navigation
4. Implementation of table elements
5. Implementation of textual linking
6. Implementation of page templates
7. Implementation of frames and frame elements
8. Implementation of web typography
9. Implementation of graphics and coloring
10. Server side and client side scripting (PHP and JavaScript)
11. Mini project on website design using active and dynamic contents

Course Outcome:
CO1: Be familiar with HTML and PHP
CO2: Embedding audio and video files in HTML
CO3: Develop server side scripting

CO4: Learn CGI scripting using PERL or C

MOBILE COMPUTING (CS15-022)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective is to be familiar with personal communication services, study global system for mobile communication, learn server-side programming, and learn case studies of the IRIDIUM and GLOBALSTAR, and quality of services in 3G.

Module – I
Overview of wireless technologies: Signal propagation, Multiplexing, Modulation and Spread Spectrum techniques;Media access control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), FDMA, TDMA, CDMA.

Module – II

Mobile Network Layer : Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP), General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes, Mobile Data Communication; WLANs (Wireless LANs) IEEE 802.II standard

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms.

Module – III

Mobile Transport Layer : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Module – IV

GSM : Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management),

Module – V
Server-side programming in Java, Pervasive web application architecture, Device Independent example application

Course Outcome:

CO1: Be familiar with personal communication services
CO2: To study global system for mobile communication
CO3: Learn server-side programming
CO4: Case studies of the IRIDIUM and GLOBALSTAR
CO5: Quality of services in 3G

Text Book:

1. Mobile Communication, J.Schiller, Pearson
2. Mobile computing, Talukdar& Yavgal.

Reference Book:

1. Mobile and Personal Communication Systems and Services", Raj Pandya, Prentice Hall of India, 2001.

PARALLEL AND DISTRIBUTED SYSTEMS (CS15-027)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective is to gain knowledge in issues for constructing the distributed systems, examine how the message oriented communication can be done in a Distributed system to achieve the synchronous and asynchronous communication, implement the suitable clock Synchronization algorithms to manage the resources in a distributed operating system environment, compare the client and data centric consistency models to improve performance and scalability in terms of memory, and analyze issues dealing with recovery failure and able to implement Distributed file system in Network file system.

Module – I

Need for Parallel Computers, Models of Computation, Analyzing Parallel Algorithms, Expressing Parallel Algorithms, Matrix Vector Multiplication, Matrix Matrix Multiplication, Database Query Processing, 15 Puzzle Problem, Parallel Discrete Event Simulation, Image Dithering, Dense LU Factorization.

Module – II

Hyper Quick Sort, Merge Sort, Bitonic Merge Sort, Odd Even Transposition, Enumeration Sort, Sorting on the CRCW Model, CREW Model and EREW Model, MPI and PVM.

Module – III

Introduction to Distributed Systems, Routing Algorithms, Destination-Based Routing, The All-Pairs Shortest-Path Problem, The Netchange Algorithm, Routing with Compact Routing Tables, Hierarchical Routing.

Module – IV
Fault Tolerance in Distributed Systems, Fault Tolerance in Asynchronous and Synchronous Systems, Failure Detection, Stabilization.

Course Outcome:
CO1: Gain knowledge in issues for constructing the distributed systems
CO2: Examine how the message oriented communication can be done in a Distributed system to achieve the synchronous and asynchronous communication
CO3: Implement the suitable clock Synchronization algorithms to manage the resources in a distributed operating system environment.
CO4: Compare the client and data centric consistency models to improve performance and scalability in terms of memory.
CO5: Analyze issues dealing with recovery failure and able to implement Distributed file system in Network file system

Text Books

1. G. Tel, Introduction to Distributed Algorithms, 2nd Edition, Cambridge University Press, 2000.
2. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Second Edition, Addison Wesley, 2003.

Reference Books:

1. F. T. Leighton, Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes, M K Publishers, San Mateo California, 1992.
2. B. Wilkinson, M. Allen, Parallel Programming Techniques and Applications using Networked Workstations and Parallel Computers, Prentice Hall, 2005.
3. Michael J. Quinn, Parallel Computer Theory and Practice, McGraw Hill, Second Edition, 1994.
4. S. G. Akl, The Design and Analysis of Parallel Algorithms, PHI, 1989.

ARTIFICIAL INTELLIGENCE AND ROBOTICS (CS15-002)

Course Objective:
The objective of the course is to learn different forms of logic, deal with inconsistencies and uncertainties of logic, familiar with informed and uniformed searching techniques, study different matching techniques, and learn pattern recognition and expert systems.
Module 1:
Introduction to AI, production system, production rules, State-space problem, Problem Solving by Intelligent search: BFS, DFS, Iterative Deepening Search, Hill Climbing, Simulated Annealing, heuristic Search: A*,AO* , Adversary Search: MIN-MAX Algorithm, Alpha-Beta Cut-off algorithm.

Module 2:

Propositional Logic, Theorem Proving by Propositional Logic, Resolution principle, Predicate Logic, wff conversion to clausal form, Dealing with Imprecision and Uncertainty: Probabilistic Reasoning, Dempster-Shafer Theory for Uncertainty Management.

Module 3:
Machine Learning: Supervised learning, unsupervised learning, Reinforcement learning, Artificial Neural Net, perceptron model, feed-forward neural network, Back propagation.

Module 4:
Fundamentals: Components, degrees of freedom, joints, reference frames, characteristics Mathematical modelling of a robot: Mapping between frames, Description of objects in space, Transformation of vectors. Direct Kinematic model: Mechanical Structure and notations, Description of links and joints, Kinematic modelling of the manipulator, Denavit-Hartenberg, Kinematic relationship between adjacent links, Manipulator Transformation matrix, Inverse Kinematics: Manipulator workspace, Solvable of inverse kinematic model, Manipulator Jacobian, Jacobian inverse, Application of robotics : path planning of mobile robot.

Course Outcome:
CO1: To learn different forms of logic
CO2: Deal with inconsistencies and uncertainties of logic
CO3: Be familiar with informed and uniformed searching techniques
CO4: To study different matching techniques
CO5: To learn pattern recognition and expert systems

Text book:
Fu, Gonzales and Lee, Robotics, McGraw Hill
Robotics and Control Mittal and Nagrath Tata McGraw-Hill Education
Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of the Human Brain, Amit Konar, CRC Press
Artificial Intelligence, Dan W Patterson, Prentice Hall of India
S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education

Reference Books:
Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India
Artificial Intelligence, Nils J.Nilsson, ELSEVIER.
E.Rich and K.Knight, Artificial Intelligence, - TMH

COMPUTER GRAPHICS AND VISUALIZATION (CS15-006)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective is to be familiar with GUI, use of points and lines algorithm, learn basic transformation such as translation, rotation and scaling, learn line and polygon clipping, and use of halftone pattern and dithering.

MODULE I **(10 LECTURES)**

Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable pipelines; Performance characteristics. Graphics Programming: The Sierpinski gasket; Programming two-dimensional applications.

The OpenGL: The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting implicit functions.

MODULE II **(12 LECTURES)**

Input and Interaction: Interaction; Input devices; Clients and servers; Display lists; Display lists and modeling; Programming event-driven input; Menus; Picking; A simple CAD program; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations.

Geometric Objects and Transformations: Scalars, points, and vectors; Three-dimensional primitives; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling. Transformations in homogeneous coordinates; Concatenation of transformations; OpenGL transformation matrices; Interfaces to three-dimensional applications; Quaternions.

MODULE III **(10 LECTURES)**

Viewing: Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive mesh displays; Parallel-projection matrices; Perspective-projection matrices; Projections and shadows.

Lighting and Shading: Light and matter; Light sources; The Phong lighting model; Computation of vectors; Polygonal shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global illumination.

MODULE IV **(08 LECTURES)**

Curves and surfaces: Representation of curves and surfaces; Design criteria; Parametric cubic polynomial curves; Interpolation; Hermite curves and surfaces; Bezier curves and surfaces; Cubic B-Splines; General B-Splines; Rendering curves and surfaces; Curves and surfaces in OpenGL.

Course Outcome:

CO1: Be familiar with GUI
CO2: Use of points and lines algorithm
CO3: Learn basic transformation such as translation, rotation and scaling
CO4: Learn line and polygon clipping
CO5: Use of halftone pattern and dithering

TEXT BOOK:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson, 2009.

REFERENCE BOOKS:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 2nd Edition, Pearson, 2004.
2. F.S. Hill,Jr.: "Computer Graphics Using OpenGL",2nd Edition, Pearson, 2001.
3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Addison-wesley 1997.

DIGITAL IMAGE PROCESSING (CS15-014)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective is to study of digital images, bits and bytes, raster scan format, quantization, understanding of scaling, translation, rotation, sums and differences, study of contrast and grey levels, histograms, Gaussian and other non-linear stretches, understanding of topography and shaded relief displays, contours, parallax and stereo, perspective viewing and anaglyphs, and study on image morphing, false color images, principle components analysis.

Module-I: Introduction

What Is Digital Image Processing? The Origins of Digital Image Processing. Examples of Fields that Use Digital Image Processing. Fundamental Steps in Digital Image Processing. Components of an Image Processing System. Image Sampling and Quantization.Some Basic Relationships between Pixels.Linear and Nonlinear Operations.

Module-II: Image Enhancement in the Spatial Domain

Some Basic Gray Level Transformations.Histogram Processing.Enhancement Using Arithmetic/Logic Operations.Basics of Spatial Filtering.Smoothing Spatial Filters. Sharpening Spatial Filters.Combining Spatial Enhancement Methods.

Module-III: Image Enhancement in the Frequency Domain

Introduction to the Fourier Transform and the Frequency Domain. Smoothing Frequency-Domain Filters. Sharpening Frequency Domain Filters. Homo-morphic Filtering.

Module-IV: Morphological Image Processing and Image Segmentation

Dilation and erosion, opening and closing, Hit-or-Miss transformations, basic morphological algorithms, Detection of discontinues, edge linking and boundary detection, thresh holding, region –based segmentation.

Module-V: Use of Image Processing in Pattern Recognition

Introduction to the tools of Matlab and Open CV. Case study on Object Identification, Biometrics and Content Based Image retrieval.

Course Outcome:

CO1: Study of digital images, bits and bytes, raster scan format, quantization
CO2: Understanding of scaling, translation, rotation, sums and differences
CO3: Study of contrast and grey levels, histograms, Gaussian and other non-linear stretches

CO4: Understanding of topography and shaded relief displays, contours, parallax and stereo, perspective viewing and anaglyphs
CO5: Study on image morphing, false color images, principle components analysis

Text Books:
Rafael C Gonzalez and Richard E Woods, Digital Image Processing, Pearson Education, 2002.
Anil K Jain, Fundamental of Digital Image Processing, Prentice Hall of India, 2004.

Reference Books:
William K Pratt, Digital Image Processing PIKS Scientific Inside, 4th Edition, Wiley
Vipul Singh, Digital Image Processing With Matlab&LabView, Reed Elsevier India Pvt Ltd, 2013,

DISTRIBUTED COMPUTING SYSTEMS (CS15-015)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective is to gain knowledge in issues for constructing the distributed systems, examine how the message oriented communication can be done in a Distributed system to achieve the synchronous and asynchronous communication, implement the suitable clock Synchronization algorithms to manage the resources in a distributed operating system environment, compare the client and data centric consistency models to improve performance and scalability in terms of memory, and analyze issues dealing with recovery failure and able to implement Distributed file system in Network file system.

Module – I
Introduction to Distributed Computing, Architectures, Models: Workstation, Workstation-Server and Processor-Pool, Issues in Designing Distributed Systems, Inter Process Communication (IPC), Message Passing, IPC Message Format, IPC Synchronization, Message Buffering Strategies, Process Addressing Techniques, Failure Handling Mechanism: 4-Message, 3-Message and 2-Message IPC Protocol, Introduction to Remote Communication, Remote Procedural Call (RPC), RPC Implementation, RPC Communication and Issues, Introduction to Remote Method Invocation (RMI), RMI Implementation, Design Issues, RMI Execution, RMI Parameter Passing.

Module – II
Introduction to Synchronization, Clock Synchronization, Synchronization Algorithms: Centralized and Distributed, Logical Clocks: Event Ordering, Implementation, Lamport's Timestamps and Vector Timestamps, Global State, Mutual Exclusion: Centralized, Distributed and Token Ring Algorithm, Election Algorithms: Bully and Ring.

Module - III
Introduction to Distributed System Management, Resource Management, Task Assignment: Graph Theoretic Deterministic, Centralized Heuristic and Hierarchical Algorithm, Load-Balancing, Load Sharing, Global Scheduling Algorithms, Process Management, Process Migration, Threads, Thread Control Block, Models, Design Issues, Fault Tolerance, Component

Faults, System Failures, Use of Redundancy, Distributed Shared Memory Architecture, Types, Design Issues in DSM Systems, Implementing DSM Systems, Data Location and DSM Management: Centralized-Manager, Broadcast, Fixed and Dynamic Distributed-Manager Algorithm, Replication vs Migration.

Module - IV
Introduction to Distributed File System (DFS), File Models: Structured and Unstructured Files, Mutable and Immutable Files, Design: File Service Interface, Directory Service Interface and Naming Transparency, File Caching in DFS: Location and Consistency, Cache Consistency, Replication, Introduction to Grid Computing, Grid Middleware, Architecture: Fabric, Connectivity, Resource, Collective and Application Layer, Types of Grids, Applications, Simulators, Globus Toolkit, BOINC, SETI, Service Oriented Architecture.

Course Outcome:
CO1: Gain knowledge in issues for constructing the distributed systems
CO2: Examine how the message oriented communication can be done in a Distributed system to achieve the synchronous and asynchronous communication
CO3: Implement the suitable clock Synchronization algorithms to manage the resources in a distributed operating system environment.
CO4: Compare the client and data centric consistency models to improve performance and scalability in terms of memory.
CO5: Analyze issues dealing with recovery failure and able to implement Distributed file system in Network file system

Text Books
S. Mahajan and S. Shah, Distributed Computing, 2nd Edition, Oxford University Press, 2013.
A. S. Tanenbaum, Distributed Systems: Principles and Paradigms, Maarten Van Steen, 2nd Edition, Pearson Prentice Hall, 2007.
G. F. Coulouris, J. Dollimore and T. Kindberg, Distributed Systems: Concepts and Design, Addison Wesley, 2005.

Reference Books
(Edited By) I. Foster and C. Kesselman, The Grid: Blueprint for a New Computing Infrastructure, Morgan Kaufmann, Elsevier, 2004.
S. Ghosh, Distributed Systems: An Algorithmic Approach, Chapman and Hall / CRC, 2006.

OBJECT ORIENTED ANALYSIS AND DESIGN (CS15-024)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of the course is to give students a detailed understanding of processes and techniques for building large object-oriented software systems. To develop skills

to evolve object-oriented systems from analysis, to design, to implement and to understand most of the major object-oriented technologies including basic OO concepts, processes, languages, databases, user interfaces, frameworks, and design patterns.

Module - I
Review of Object modeling, new paradigm, object oriented thinking-rethinking, Objects and Classes. Links and association, Generalization and specialization, Inheritance, Grouping concepts, aggregation, composition , abstracts classes, Polymorphism, Metadata, Constraints, Reuse.
Object Oriented Lifecycle Model, Introduction to Object Oriented Methodology, Overview of various object oriented methodologies- OOD, HOOD, OMT, CRC, OOA, OOSA, OOSE, OOSD, OORASS.

Module - II
Architecture: Introduction, System development is model building, model architecture, requirements model, analysis model, the design model, the implementation model, test model.
Analysis: Introduction, the requirements model, the analysis model.

Module - III
Construction: Introduction, the design model, block design, working with construction.
Testing: introduction, on testing, unit testing, integration testing, system testing, the testing process.

Module - IV
Modeling with UML: Origin of UML, 4+1 view architecture of UML, Basic Building Blocks of UML, A Conceptual Model of UML, Basic Structural Modeling, UML Diagrams. Case Studies.

Course Outcome:
CO1: Identify and build an appropriate process model for a given project
CO2: Analyze the principles at various phases of software development.
CO3: Translate a specification into a design, and identify the components to build the architecture for a given problem, all using an appropriate software engineering methodology
CO4: Define a Project Management Plan and tabulate appropriate Testing Plans at different levels during the development of the software
CO5: Understand the software project estimation models and estimate the work to be done, resources required and the schedule for a software project

Text books:
Ivar Jacobson, "Object Oriented Software Engineering", Seventh Impression , Pearson, 2009.
Grady Booch, James Rumbaugh, Ivar Jacobson, "The UML User Guide", 2nd Edition, Pearson, 2008.

PATTERN RECOGNITION (CS15-028)

L-T-P: 3-1-0 Cr.-4

Course Objective:
The objective of this course is to learn machine perception, pattern recognition systems, Applications of pattern recognition, probability of events, random variables, Joint distributions and densities, moments of random variables, Baye's Theorem, multiple features, conditionally independent features, decision boundaries, histograms, Kernel and window estimators, nearest neighbor classification techniques, and unsupervised learning and clustering.

Module-I
INTRODUCTION: Machine perception, pattern recognition systems, design cycle, learning and adaptation, training and learning in pattern recognition approach, Applications of pattern recognition, Patterns and features, different types of pattern recognition
Module-II
PROBABILITY: Introduction, probability of events, random variables, Joint distributions and densities, moments of random variables, estimation of parameters from samples, minimum risk estimators.
Module-III
STATISTICAL DECISION MAKING: Introduction, Baye's Theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, the leavingone- out technique. Characteristic curves, estimating the composition of populations.
Module-IV
NONPARAMETRIC DECISION MAKING: Introduction, histograms, Kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate Functions, minimum squared error discriminate functions, choosing a decision making technique.
Module-V
UNSUPERVISED LEARNING AND CLUSTERINGS: Unsupervised Bayesian learning, data decryption and clustering, criterion functions and clustering, Hierarchical clustering, Online clustering, component analysis.
Module-VI
ARTIFICIAL NEURAL NETWORKS: Introduction, nets without hidden layers. nets with hidden layers, the back Propagation algorithms, Hopfield nets, an application.

Course Outcome:
CO1: Understand pattern recognition systems and applications of pattern recognition systems.
CO2: Learn Joint distributions and densities and estimation of parameters from samples, minimum risk estimators.
CO3: Identify Baye's Theorem, unequal costs of error and characteristic curves
CO4: Learn unsupervised learning and clustering
CO5: Understand artificial neural networks

TEXT BOOKS:
1**.** Pattern Classification Duda R. O., and Hart P E., and Stork D G., Wiley Publishers
2. Pattern Recognition and Image Analysis, Earl Gose, Richard J and Steve J, PHI
3. Pattern recognition (Statistical, structural and Neural Approaches), Robert Schalkoff

SOFT COMPUTING (C15-030)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective is to be familiar with neural network and artificial neural network, learning effect of tuning parameters of back propagation neural network, gain knowledge in associative memory and adaptive resonance, theory, analyze convergence in genetic algorithm, and examine how the hybrid system can solve the real life problems.

Module 1: Neural Network
Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks, perception model, feed forward neural network, Back propagation, Adaline, Widrow-Hoff's Adaline model, Madaline, Unsupervised learning neural network: Hopfield neural network, Competitive learning, self-organizing feature map, Reinforcement learning: Q-learning, Temporal difference learning.

Module 2 : Fuzzy Logic
Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, membership functions, Fuzzy set theory and operations, Extension principle of fuzzy set, fuzzy inference, Fuzzy implications, fuzzy relation, fuzzy reasoning , fuzzy c-means clustering , fuzzy inference Engine on VLSI architecture, Defuzzification techniques

Module 3: Evolutionary Computing
Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction Genetic Modeling : Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA. Convergence of Genetic algorithm. GA as an alternative to back propagation, Applications of GA in navigational planning of robots , Real life Problems.

Module 4: Hybrid Systems
Hybrid Systems: Neuro-fuzzy synergism, weakly coupled Neuro-fuzzy system, Tightly coupled Neuro-Fuzzy System, fuzzy-GA synergism, Neuro-GA, Adaptation of neural learning algorithm using GA

Course Outcome:
CO1: Be familiar with neural network and artificial neural network
CO2: Learning effect of tunning parameters of back propagation neuralnetwork
CO3: Gain knowledge in associative memory and adaptive resonance theory
CO4: Analyze convergence in genetic algorithm
CO5: Examine how the hybrid system can solve the real life problems

Text Books:
Computational Intelligence Principles, Techniques and Applications, Amit Konar, Springer publication.

1. Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application) S.Rajasekaran, G.A. Vijayalakshmi Pai, PHI

2. **Principles of Soft Computing** S.N.Sivanandam & S.N.Deepa,Wiley-India Edition

Reference Books:

1. Neuro Fuzzy and Soft Computing, J. S. R. JANG,C.T. Sun, E. Mitzutani, PHI Soft-computing, D.K.Pratihar,Alpha Scie

WIRELESS SENSOR NETWORKS (CS15-034)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of this course is to learn fundamentals of Wireless Sensor Networks, understand single-node architecture, network architecture, gateway concepts, networking sensors, geographic sensors, routing protocols, Sensor Node Hardware – Berkeley Motes, Node-level software platforms, and State-centric programming.

Module - I
OVERVIEW OF WIRELESS SENSOR NETWORKS: Challenges for Wireless Sensor Networks, Enabling Technologies For WirelessSensor Networks.

Module - II
ARCHITECTURES: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, GatewayConcepts.

Module - III
NETWORKING SENSORS: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and NameManagement, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing. INFRASTRUCTURE ESTABLISHMENT: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

Module - IV
SENSOR NETWORK PLATFORMS AND TOOLS: Sensor Node Hardware – Berkeley Motes, ProgrammingChallenges, Node-level software platforms, Node-level Simulators, State-centric programming.

Course Outcome:
CO1: Be familiar with basics and challenges of wireless sensor network
CO2: Learning single-node and network architectures
CO3: Gain knowledge in routing protocols and time synchronisation
CO4: Analyze sensor node hardware and node level simulators

Text books:

Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
Feng Zhao & Leonidas J. Guibas, "Wireless SensorNetworks- An Information Processing Approach", Elsevier, 2007.

Reference Books:

Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor NetworksTechnology, Protocols, And Applications", John Wiley, 2007.
Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

INFORMATION SECURITY (IT15-002)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:

The objective is to learn Security Goals, Attacks, Security services and Mechanism, understand different cryptographic algorithms, know about viruses and malicious code, security in operating systems, database security, network security, legal and ethical issues.

Module I: (8 LECTURES)

Introduction to Information Security: Security Goals, Attacks, Security services and Mechanism. Cryptography: Plain Text and Cipher Text, Encryption and Decryption, Substitution cipher, Transposition Cipher, Stream and Block Cipher, Modern block ciphers, Modern stream Ciphers

Module II: (14 LECTURES)

Data Encryption Standard (DES), Security of DES, Advanced Encryption Standard (AES), Analysis of AES, Use of Modern Block Ciphers, Use of Stream ciphers. Public Key Encryption, Hash Functions, Key exchange, Digital Signatures

Module III: (8 LECTURES)

Viruses and Malicious Code:

Secure Programs, Non-malicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats

Operating Systems Security:

Access Control, File Protection, User Authentication, Security Policies, Models of Security

Module IV: (10 LECTURES)

Data base Security:

Security requirements, Reliability and integrity, Sensitive data, Inference, multilevel database, proposals for multilevel security.

Security in Network:

Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-Mail.

Legal and Ethical Issues:

Protection of data and Information Laws, Employees rights, Software failure, Computer Crime, Privacy, Ethics

Course Outcome:
CO1: Be familiar with security goals, attacks, and different types of ciphers
CO2: Learning DES, AES, modern block cipher and digital signatures
CO3: Gain knowledge in malicious codes and viruses
CO4: Analyze security in operating system, network and database.
CO5: Learn different legal and ethical issues

Text Books:
B. A. Forouzan & D Mukhopadhyay ,Cryptography and Network Security., McGraw Hill, 2nd ed.2010

Reference Book:
Stallings ,Cryptography and Network Security., PHI, 4th ed.2010
A. Kahate, Cryptography and Network Security, TMH.

SOFTWARE TESTING (IT15-009)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of this course is to learn basic of software testing, software testing life-cycle, testing methodology, black box testing, white box testing, mutation testing, test management, testing metrics, testing tools, object-oriented testing and web-based testing.

MODULE I:
Introduction- Basics of Software Testing, Goals of Software Testing, Model for Software Testing. Software Testing Terminology & Methodology - Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology. Verification&Validation- Verification of High Level Design, Low Level Design, Verification of a Code.

MODULE II:
Black Box Testing- Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing,State Table Based Testing. White Box Testing- Need, Logic Coverage Criteria, Basic Path Testing, Graph Matrices, Loop Testing, Data Flow Testing, Mutation Testing. Static Testing – Inspections, Structured Walkthrough, Technical Reviews. Validation Activities- Unit Validation Testing, Integration Testing, Function Testing, System Testing, Acceptance Testing. Regression Testing.

MODULE III:
Test Management- Test Organization, Test Planning, Test Design & Test Specification. Software Metrics, Testing Metrics for Monitoring and Controlling the Testing Process, Efficient Test Suite Management- Test Suite Minimization & Test Suite Prioritization, Software Quality Management.

MODULE IV:

Automation & Testing Tools- Need for Automation, Categorization of Testing Tools, Selection of Testing Tools, Overview of Testing Tools. Testing Object Oriented Software- OOT Basics, Object Oriented Testing. Testing Web Based System- Web Based System, Challenges in Testing for Web Based System, Web Engineering, Testing for Web Based System. Debugging

Course Outcome:
CO1: Be familiar with software testing goals and software testing life cycle.
CO2: Learning black box testing, white box testing, mutation testing and regression testing.
CO3: Gain knowledge in test management and testing metrics.
CO4: Analyze & develop automated testing tools
CO5: Learn object-oriented testing and web-based testing.

Text books
Foundations of Software Testing – Aditya P Mathur. Pearson Education
Software Testing Principles and Practices- Naresh Chauhan, Oxford University Press.
Software Testing Tools - Dr.K.V.K.K.Prasad, Dreamtech press.
Software Testing: Principles and Practices- Srinivasan Desikan, Gopalaswamy Ramesh, Pearson Education.

Reference books
Software Testing - B.Bezier- 2nd Edn, Techniques, Dreamtech, New Delhi
Software Testing, Second Edition By: Ron Patton, Pearson Education
Software Testing Principles and Tools By M.G. Limaye TMG Hill Publication

COMBINATORIAL OPTIMIZATION (CS15-003)

L-T-P: 3-1-0 **Cr.-4**

Course Objective:
The objective of this course is to learn linear optimization problems, sorting, different types of graph, knowledge about linear programming algorithms, integer programming, shortest paths and network flows.

MODULE I (10 periods)
Introduction : Enumeration, Running Time of Algorithms, Linear Optimization Problems, Sorting.
Graphs : Trees, Circuits, and Cuts , Connectivity, Eulerian and Bipartite Graphs, Planarity, Planar Duality.

MODULE II (10 periods)
Linear Programming : Polyhedra, The Simplex Algorithm, Duality, Convex Hulls and Polytopes.
Linear Programming Algorithms : Size of Vertices and Faces, Continued Fractions, Gaussian Elimination, The Ellipsoid Method, Khachiyan's Theorem, Separation and Optimization.

MODULE III (10 periods)

Integer Programming : The Integer Hull of a Polyhedron, Unimodular Transformations, Total Dual Integrality , Totally Unimodular Matrices, Cutting Planes.
Shortest Paths : Shortest Paths From One Source, Shortest Paths Between All Pairs of Vertices, Minimum Mean Cycles.

MODULE IV **(10 periods)**
Network Flows : Max-Flow-Min-Cut Theorem, Menger's Theorem, The Edmonds-Karp Algorithm, Blocking Flows, The Goldberg-Tarjan Algorithm, The Minimum Cut in an Undirected Graph.
Minimum Cost Flows : Problem Formulation, An Optimality Criterion, Minimum Mean Cycle-Cancelling Algorithm, Successive Shortest Path Algorithm

Course Outcome:
CO1: Be familiar with linear optimization problem.
CO2: Analyze linear programming algorithms, separation and optimization.
CO3: Gain knowledge in integer programming and shortest paths
CO4: learning network flows and minimum cost flows.

Text Book –
Combinatorial Optimization Theory and Algorithms : B. Korte, Springer, 2nd Edition.

COMPUTER VISION (CS15-009)

L-T-P: 3-1-0 Cr.-4

Course Objective:
The objective of this course is to gain knowledge in Digital Image Formation and low-level processing, Depth estimation and Multi-camera views, Feature Extraction: Edges, Scale-Space Analysis, Image Segmentation, Object Recognition, clustering and classification, motion analysis and its applications.

Module I **(10 Lectures)**
Digital Image Formation and low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing. Depth estimation and Multi-camera views: Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

Module II **(10 Lectures)**
Feature Extraction: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.
Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

Module III **(08 Lectures)**

Object Recognition: Structural, model-based, appearance and shape-based methods; probabilistic paradigms; discriminative part-based models; BOW, ISM, Learning methods.
Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Module IV **(12 Lectures)**

Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.
Shape from X: Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.
Miscellaneous: Applications: CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing; Modern trends - super-resolution; GPU, Augmented Reality; cognitive models, fusion and SR&CS.

Course Outcome:

CO1:Gain knowledge in Digital Image Formation and low-level processing
CO2: Learn techniques of Depth estimation and Multi-camera views
CO3: Analyze Feature Extraction and Scale-Space Analysis,
CO4: Learning Image Segmentation, Object Recognition, clustering and classification, motion analysis and its applications.

Textbooks:

Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

Reference Books:

Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

GAME THEORY (CS15-018)

L-T-P: 3-1-0 Cr.-4

Course Objective:

The objective of this course is to get introduction about game theory, Strategic Games and Nash Equilibrium Strategic games, Auctions Accident Laws, Mixed Strategy Nash Equilibrium, and Extensive Games and Nash Equilibrium.

Module-I
Introduction to Game Theory : Game theory, Theory of rational choice, Interacting decision makers.
Strategic Games and Nash Equilibrium Strategic games: examples Nash equilibrium: concept and examples Best response functions Dominated Actions Symmetric games and symmetric equilibria.

Module-II
Illustrations of Nash Equilibrium Cournot's model of duopoly market, Bertrand's model of duopoly market Electoral Competition War of Attrition, Auctions Accident Laws.

Module-III
Mixed Strategy Nash Equilibrium Introduction Strategic games with randomisation Mixed strategy Nash equilibrium: concept and examples Dominated Actions Formation of Players' beliefs.

Module-IV
Extensive Games and Nash Equilibrium Introduction to extensive games Strategies and outcomes Nash equilibrium Subgame perfect Nash equilibrium Backward induction. Illustrations of Extensive Games and Nash Equilibrium Stackelberg model of duopoly markets Ultimatum game

Course Outcome:
CO1:Gain knowledge about game theory, Strategic Games and Nash Equilibrium
CO2: Learning Strategic games, Auctions Accident Laws.
CO3: Analyze Mixed Strategy Nash Equilibrium, and Extensive Games and Nash Equilibrium

Textbooks :
Osborne, M.J.An Introduction to Game Theory, Oxford University Press, 2004
Mas-Colell,A., M.D. Whinston and J.R. Green Microeconomic Theory, Oxford University Press, 1995
Gibbons, R.A Primer in Game Theory,Pearson Education, 1992

HUMAN-COMPUTER INTERFACE (CS15-020)

L-T-P: 3-1-0 Cr.-4

Course Objective:
The objective is to learn basics of human computer interaction, Basic Components of Emotion, Emotion dynamics and stability analysis, System Modeling and Stability, Stability Analysis of T-

S Fuzzy Systems, EEG Prediction by Adaptive Filtering, Machine Interactive Systems, and Emotion Recognition from Voice Samples.

Module I :
Introduction to human computer interaction , Input-output channels, human memory, Thinking, Emotion, cause of emotion, characteristics of emotion Basic Components of Emotion, regulation and control of Emotion, biological basis of Emotion, emotion learning, mathematical modelling of emotional dynamics, controlling emotion by artificial means, effect of emotion modelling on Human machine interaction, Emotion dynamics and stability analysis, text entry devices, device for virtual reality and 3D interaction, models of interaction, frameworks and HCL

Module II:
System Modeling and Stability, Stability Analysis of Dynamics by Lyapunov Energy Functions, Stability Analysis of Fuzzy Systems, Mamdani Type Fuzzy Systems, Takagi-Sugeno Type Fuzzy Systems, Stability Analysis of T-S Fuzzy Systems, Emotional Dynamics and Stability Analysis, Emotion Processing by the Human Brain, Role of Medial Frontal Cortex in Self-regulation of Emotion, Anterior Cingulate Cortex as a Self-regulatory Agent, Neural Circuitry Underlying Emotional Self-regulation, EEG Conditioning and Affective Disorders

Module III:
EEG Prediction by Adaptive Filtering: LMS Filter, EEG Prediction by NLMS Algorithm, RLS Filter for EEG Prediction, Emotion Clustering by Neural Networks, Application in Human-Machine Interactive Systems: Input Interfaces, Output Interfaces, Embodiment of Artificial Characters, Application in Multi-agent Co-operation of Mobile Robotics, Detection of Anti-social Motives from Emotional Expressions, Emotion Recognition from Voice Samples.

Course Outcome:
CO1: Learn basics of human computer interaction, and Basic Components of Emotion.
CO2: Be familiar with Emotion dynamics and stability analysis.
CO3: Analyze System Modeling and Stability, Stability Analysis of T-S Fuzzy Systems.
CO4: Learning EEG Prediction by Adaptive Filtering, Machine Interactive Systems.
CO5: Learning Emotion Recognition from Voice Samples.

Text Books
Emotional Intelligence: A Cybernetic Approach, Aruna Chakraborty and Amit Konar, springer
Dix A. et al., Human-Computer Interaction. Harlow, England: Prentice Hall

Reference Books
B. Shneiderman, C. Plaisant, M. Cohen, and S. Jacobs, Designing the User Interface: Strategies for Effective Human-Computer Interaction, Addison-Wesley,
Y. Rogers, H. Sharp, and J. Preece, Interaction Design: Beyond Human-Computer Interaction, John Wiley & Sons

VLSI ALGORITHMS (CS15-033)

L-T-P: 3-1-0 Cr.-4

Course Objective:
The objective is to learn VLSI Physical Design Automation, various Partitioning Algorithms, Performance Driven Partitioning, Classification of Placement Algorithms, Classification of Floor

planning Algorithms, Classification of Pin Assignment Algorithms, Global Routing, and detailed routing.

Module I INTRODUCTION AND BASIC CONCEPTS (8 Lectures)
VLSI Physical Design Automation : VLSI Design Cycle, Physical Design Cycle, Design Styles, System Packaging Styles.
Design and Fabrication of VLSI Devices : Fabrication Materials, Transistor Fundamentals, Fabrication of VLSI Circuits, Layout of Basic Devices, Additional Fabrication Factors.

Module II PARTITIONING (8 Lectures)
Partitioning : Problem Formulation, Classification of Partitioning Algorithms, Group Migration Algorithms, Kernighan-Lin Algorithm, Fiduccia-Mattheyses Algorithm, Goldberg and Burstein Algorithm, Component Replication, Ratio Cut, Simulated Annealing and Evolution, Simulated Annealing and Evolution, Other Partitioning Algorithms, Performance Driven Partitioning.

Module III PLACEMENT, FLOOR PLANNING AND PIN ASSIGNMENT (12 Lectures)
Placement : Problem Formulation, Classification of Placement Algorithms, Simulation Based Placement Algorithms, Partitioning Based Placement Algorithms, Other Placement Algorithms, Performance Driven Placement.
Floor-planning : Problem Formulation, Classification of Floor planning Algorithms, Constraint Based Floorplanning, Integer Programming Based Floorplanning, Rectangular Dualization.
Pin Assignment : Problem Formulation, Classification of Pin Assignment Algorithms, General Pin Assignment, Channel Pin Assignment.

Module IV ROUTING, COMPACTION AND FPGA (12 Lectures)

Global Routing : Maze Routing, Line-Probe, Shortest-Path, Steiner Tree, Integer Programming based Algorithms.
Detailed Routing : Problem Formulation, Single-Layer Routing, Two-Layer Channel Routing, Three-Layer Channel Routing, Multi-Layer Channel Routing, Switchbox Routing Algorithms.
Concepts of Compaction, Physical Design Automation of FPGAs.

Course Outcome:
CO1: Learn VLSI Physical Design Automation, and various Partitioning Algorithms.
CO2: Analyze Performance Driven Partitioning
CO3:Be familiar with Classification of Placement Algorithms, Classification of Floor planning Algorithms, Classification of Pin Assignment Algorithms,
CO4: Gain knowledge about Global Routing, and detailed routing.

Text Book :

Algorithms for VLSI Physical Design Automation – N. A. Sherwani, Kluwer Academic Publishers.

CLOUD COMPUTING (IT15-001)

L-T-P: 3-1-0 Cr.-4

Course Objective:
The objective is to learn emerging techniques in cloud computing and its applications, fault tolerance and security in cloud, learn different Resource Allocation, Leases, Task scheduling algorithms, introduction to Energy Efficient Task Consolidation, High-Throughput Computing, and knowledge about CloudSim, Cloudlet, Virtual Machine and its Provisioning.

Module – I
Introduction to Cloud Computing, Gartner's Hype Cycle for Emerging Technologies, Comparisons: Cluster, Grid and Cloud, Cloud Computing at a Glance, Vision, A Close Look, The NIST Model, Cloud Cube Model, Types: Deployment and Service Models, Public, Private, Hybrid and Community Cloud, IaaS, PaaS, SaaS, Characteristics, Applications, Benefits, Disadvantages, Web 2.0, The Laws of Cloudonomics, Obstacles, Cloud Adoption, Measuring the Costs, Service-Level Agreement, Cloud Architecture, Virtual Appliances, Connecting to the Cloud, IaaS Workloads, Open SaaS and SOA, OnDemand vs. OnPremises IT, Bird's-Eye View of Cloud Computing Vendors, Virtualization, Characteristics of Virtualized Environments, Taxonomy of Virtualized Techniques, Full Virtualization, Paravirtualization, Partial Virtualization, Pros and Cons of Virtualization, Hypervisor, Open Challenges: Interoperability, Scalability, Fault Tolerance, Security, Trust and Privacy.

Module – II
Resource Allocation, Leases: Advance Reservation, Best Effort, Immediate, Deadline Sensitive and Negotiated, Haizea, Swapping and Backfilling, Resource Allocation Measures, Task Scheduling, Task: Dependent and Independent, Job, Application, Workflow: Montage, Epigenomics, SIPHT, LIGO, CyberShake, Machine: Homogeneous and Heterogeneous, Mode: Immediate, Intermediate and Batch, Expected Time to Compute Matrix, Manager Server, Data Center, Virtual Machine, Server, Makespan, Resource Utilization, Average Execution Time, Uncertainty, Heterogeneity: Consistent, Inconsistent and Partially-Consistent, Mapping Heuristics, Immediate: MCT, MET, RR, CLS, Switching Algorithm, KPB OLB and MCC, Batch: Min-Min, Max-Min, Sufferage, Duplex, GA, PSO, SA, GSA, Tabu, A*, CMMS, MEMAX and CMMN, CNXM, QoS Guided Min-Min and Selective Algorithm, Synthetic and Benchmark Datasets, Fairness-Based Task Scheduling, Allocation-Aware Task Scheduling.

Module - III
Introduction to Energy Efficient Task Consolidation, Energy-Conscious Task Consolidation, MaxUtil, Energy-Aware Task Consolidation, Virtual Cluster, CPU Utilization Threshold, Sleep or Power Saving Mode, High-Throughput Computing: Task Computing and Task-based Application Models, Aneka Task-Based Programming, Market-Based Management of Clouds, Green Cloud Computing Architecture, Federated Clouds, Pricing Mechanism, SLA Violation.

Module - IV
Introduction to Cloud Security, Case Studies: Manjrasoft Aneka, Amazon Web Services, Google AppEngine, Microsoft Azure, Force.com and Salesforce.com, MetaCDN, SpotCloud, Introduction to CloudSim, Cloudlet, Virtual Machine and its Provisioning, Time and Space-shared Provisioning.

Course Outcome:

CO1: Learn emerging techniques in cloud computing and its applications.
CO2: Gain knowledge in fault tolerance and security in cloud
CO3: Learn different Resource Allocation, Leases, Task scheduling algorithms
CO4: Introduction to Energy Efficient Task Consolidation, High-Throughput Computing
CO5: Acquire knowledge about CloudSim, Cloudlet, Virtual Machine and its Provisioning.

Text Books

R. Buyya, C. Vecchiola and S. T. Selvi, Mastering Cloud Computing Foundations and Applications Programming, Morgan Kaufmann, Elsevier, 2013.
B. Sosinsky, Cloud Computing Bible, Wiley, 2011.
D. N. Chorafas, Cloud Computing Strategies, CRC Press, Taylor and Francis Group, 2011.
(Edited By) I. Foster and C. Kesselman, The Grid: Blueprint for a New Computing Infrastructure, Morgan Kaufmann, Elsevier, 2004.

Reference Books

R. Buyya, High Performance Cluster Computing: Architectures and Systems, Volume 1, Pearson Education, 2008.
A. Chakrabarti, Grid Computing Security, Springer, 2007.
B. Wilkinson, Grid Computing: Techniques and Applications, CRC Press, 2009.
C. S. R. Prabhu, Grid and Cluster Computing, PHI, 2008.
D. Janakiram, Grid Computing, Tata McGraw-Hill, 2005.
6.P. K. Pattnaik, M. R. Kabat and S. Pal, Fundamentals of Cloud Computing, Vikas Publishing House Pvt. Ltd., 2015.

DATA MINING (IT15-003)

L-T-P: 3-1-0 Cr.-4

Course Objective:

The objective is to learn Data Mining overview, Data Warehouse and OLAP Technology, Data Mining Primitives, System Architectures, Mining Association Rules in Large Databases, Classification and Prediction, Classification by Back propagation, Categorization of Major Clustering Methods, and Applications and Trends in Data Mining.

Module - I

Data Mining overview, Data Warehouse and OLAP Technology Data Warehouse Architecture, Steps for the Design and Construction of Data Warehouses, A Three-Tier Data Warehouse Architecture, OLAP , OLAP Queries, Metadata Repository, Data Preprocessing – Data Integration and Transformation, Data Reduction,
Data Mining Primitives, System Architectures – Data Mining Primitives: What Defines a Data Mining Task? Task-Relevant Data, The Kind of Knowledge to be Mined, KDD

Module - II

Mining Association Rules in Large Databases, Association Rule Mining, Market Basket Analysis: Association Rule Mining, Basic Concepts, Association Rule Mining A Road Map, Mining Association Rules from Frequent Itemsets, Mining Multilevel Association Rules from Transaction Databases, Multilevel Association Rules, Approaches to Mining Multilevel

Association Rules, Mining Distance-Based Association Rules, From Association Mining to Correlation Analysis,

Module - III

Classification and Prediction – What is Classification? What Is Prediction? Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Bayes Theorem, Classification by Back propagation, A Multilayer Feed-Forward Neural Network, MLP, RBFN, Defining a Network Topology, Classification Based of Concepts from Association Rule Mining, Other Classification Methods, k-Nearest Neighbor Classifiers, Genetic Algorithms, Fuzzy Set Approaches, Prediction, Linear and Multiple Regression, Nonlinear Regression, Other Regression Models, Classifier Accuracy,

Module – IV

Cluster Analysis – What Is Cluster Analysis, Types of Data in Cluster Analysis, , A Categorization of Major Clustering Methods, Classical Partitioning Methods: k-Means and k-Medoids, Partitioning Methods in Large Databases: k-Medoids, Hierarchical Methods, Agglomerative and Divisive Hierarchical Clustering, Clustering Using Wavelet Transformation, Clustering High-Dimensional Space, Model-Based Clustering Methods, Statistical Approach, Neural Network Approach, LVQ, SOM,Mining Time-Series and Sequence Data, Mining Text Databases, Mining the World Wide Web. Applications and Trends in Data Mining – Data Mining Applications, Data Mining System Products.

Course Outcome:

CO1: Learn Data Mining overview, Data Warehouse and OLAP Technology
CO2: Gain knowledge in Data Mining Primitives, System Architectures, Mining Association Rules in Large Databases
CO3: Learn Classification and Prediction, Classification by Back propagation, Categorization of Major Clustering Methods
CO4: Be familiar with Applications and Trends in Data Mining.

Textbooks:

Data Mining:Concepts and Techniques by Jiawei Han and Micheline Kamber, Morgan Kaufmann Publisher (Elseviers)
Data Mining Concepts, Models, Methods and Algorithms By Mehmed Kantardzic Wiley Interscience, IEEE Press.

INFORMATION RETRIEVAL (IT15-005)

L-T-P: 3-1-0 Cr.-4

Course Objective:

The objective of this course is to learn Digital libraries and Data Warehouses, Information Retrieval System Capabilities, Cataloging and Indexing, Inverted file structures, Automatic Indexing algorithms, User Search Techniques, Information Visualization technologies, and Information System Evaluation.

Module-I
Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses. Information Retrieval System Capabilities: Search, Browse, Miscellaneous

Module-II
Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure.

Module-III
Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

Module-IV
User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Weighted searches of Boolean systems, Searching the Internet and hypertext. Information Visualization: Introduction, Cognition and perception, Information visualization technologies.

Module-V
Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems. Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results.

Course Outcome:
CO1: Learn Digital libraries and Data Warehouses.
CO2: Gain knowledge about Information Retrieval System Capabilities, Cataloging and Indexing.
CO3: Analyze Inverted file structures, Automatic Indexing algorithms, User Search Techniques.
CO4: Know Information Visualization technologies, and Information System Evaluation.

Textbook:
Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.

Reference Books :
Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
Modern Information Retrival By Yates Pearson Education.
Information Storage & Retieval By Robert Korfhage – John Wiley & Sons.

SOFTWARE ARCHITECTURE (IT15-007)

L-T-P: 3-1-0 Cr.-4

Course Objective:
The objective of this course is to learn different patterns categories and relationship between them, know about software architectural patterns, architecture in life-cycle, Reconstructing Software Architectures, Software Product Lines, Off-the-Shelf Components, Component-based design, different design patterns and their implementation.

Module-I
Review of Basic Concepts: What is a pattern? What makes a pattern? Pattern Categories; Relationships between patterns; Pattern description; Patterns and software architecture; What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views.

Module-II
Designing the Architecture: Architecture in the life cycle; Designing the architecture; Forming the team structure; Creating a skeletal system. Reconstructing Software Architectures: Introduction; Informal extraction; Database construction; View fusion; Reconstruction; Examples.

Module-III
Software Product Lines: Introduction; What makes software product lines work? Scoping; Architectures for product lines; What makes software product lines difficult? Building Systems from Off-the-Shelf Components: Impact of components on architecture; Architectural mismatch; Component-based design as search; ASEILM example.

Module-IV
Some Design Patterns: Introduction; Management: Command processor, View handler; Communication: Forwarder-Receiver, Client-Dispatcher-Receiver, Publisher-Subscriber. Pattern Systems: What is a Pattern System? Pattern classification; Pattern selection; Pattern systems as implementation guidelines; The evolution of pattern systems.

Course Outcome:
CO1: Learn different patterns categories and relationship between them
CO2: Know about software architectural patterns, architecture in life-cycle,
CO3: Analyze Reconstructing Software Architectures, Software Product Lines, Off-the-Shelf Components, Component-based design.
CO4: Aware of different design patterns and their implementation.

Text books:
Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 2nd Edition, Pearson Education, 2003.
Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
Mary Shaw and David Garlan: Software Architecture-Perspectives on an Emerging Discipline, PHI Learning, 2007.

Reference books:
E. Gamma, R. Helm, R. Johnson, J. Vlissides: Design Patterns-Elements of Reusable Object-Oriented Software, Pearson Education, 1995.

SOFTWARE PROJECT MANAGEMENT (IT15-008)

L-T-P: 3-1-0 Cr.-4

Course Objective:
The objective of this course is to gain knowledge about software project management, project planning, project evaluation, Selection of an appropriate project approach, Software Effort Estimation Techniques, Cost Monitoring, Organizational Behaviour, Importance Of Software Quality, Defining Software Quality, ISO 9126, Practical Software Quality Measures, and Product Versus Process Quality Management.

Module I:
Introduction To Software Project Management And Step Wise Project Planning: Introduction, What is a Project? Software Projects Versus Other Types of Project, Contact Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods, and Methodologies, Some ways of Categorizing Software Projects, What is Management?, Problems with Software Projects, Setting Objectives, Stakeholders, The Business Case, Requirement Specification, Management Control, Overview of Project Planning (Step wise).Project Evaluation: Introduction, Strategic Assessment, Technical Assessment, Cost-Benefit Analysis, Cash Flow Forecasting, Cost- Benefit Evaluation Techniques, Risk Evaluation. Selection Of An Appropriate Project Approach: Introduction, Choosing Technologies, Technical Plan Contents List, Choice of Process Models, Structure Versus Speed of Delivery, The Waterfall Model, The V- Process Model, The Spiral Model, Software Prototyping, Other ways of Categorizing Prototyping, Controlling Changes during Prototyping, Incremental Delivery, Dynamic Systems Development Method, Extreme Programming, Managing Iterative Processes.

Module II:
Software Effort Estimation: Introduction, Where are Estimates done? , Problems with Over-and Under- Estimates, The Basis for Software Estimating, Software Effort Estimation Techniques, Expert Judgement, Estimating by Analogy, Albrecht Function Point Analysis, Function Point Mark II, Object Points, A Procedural Code- Oriented Approach, COCOMO: A Parametric Model.Activity Planning: Introduction, The Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, The Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity- On – Arrow Networks.Risk Management: Introduction, The Nature of Risk, Types of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning and Control, Evaluating Risks to the Schedule. Resource Allocation: Introduction, The Nature of Resources, Identifying Resources Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resources Schedule, Cost Schedules, The Scheduling Sequence.
.

Module III:
Monitoring And Control: Introduction, Creating the Framework, Collecting the Data, Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting the Project Back to Target, Change Control. Managing Contracts: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.Managing People And Organizing Teams: Introduction, Understanding Behaviour, Organizational Behaviour: A Background, Selecting The Right Person For The Job, Instruction In The Best Methods, Motivation, The Oldham- Hackman Job Characteristics Model, Working In Groups, Becoming A Team, Decision Making, Leadership, Organizational Structures.

Module IV:
Software Quality: Introduction, The Place Of Software Quality In Project Planning, The Importance Of Software Quality, Defining Software Quality, ISO 9126, Practical Software Quality Measures, Product Versus Process Quality Management, External Standards, Techniques To Help Enhance Software Quality, Quality Plans.

Course Outcome:
CO1: Gain knowledge about software project management, project planning, and project evaluation.
CO2: Learn selection of an appropriate project approach, and Software Effort Estimation Techniques
CO3: Analyze Cost Monitoring, Organizational Behavior.
CO4: Learn importance Of Software Quality, Defining Software Quality, ISO 9126, Practical Software Quality Measures, and Product Versus Process Quality Management.

Text Books:
B.Huges and M.Cotterell- Software Project Management 3rd Edn, TMH, New Delhi.
Ashfaque Ahmed- SoftwareProjectManagement- CRC Press.

Reference Book:
P.Jolote- Software Project Management in Practice, Pearson Education, New Delhi.