PROGRAM EDUCATIONAL OBJECTIVES:
Bachelor of Technology in Information Technology curriculum is designed to prepare the graduates having attitude and knowledge to:

1. Have successful professional and technical career in Information Technology
2. Have core competence in basic engineering and mathematics to formulate, analyze, and solve hardware / software engineering problems.
3. Train student community with good knowledge in core areas of Information Technology and related engineering so as to analyze, design, and synthesize data and technical concepts to produce novel solutions for the real life problems.
4. To inculcate in students to maintain high professionalism and ethical standards, effective oral and communication skills, to work as part of teams on multidisciplinary projects and diverse professional environment.
5. Practice and inspire high ethical values and technical standards

PROGRAM OUTCOMES:
a) An ability to apply knowledge of mathematics, including discrete mathematics, probability, statistics, science, computer science and engineering, electronic engineering and electrical engineering as it applies to computer hardware and software.
b) An ability to design and conduct experiments, as well as to organize, analyze and interpret data to produce meaningful conclusions and recommendations.
c) Ability to understand and apply programming principles in real time applications and also in the field of communication systems to provide better Information Technology based solution.
d) An ability to work individually or as a member with responsibility to function on multidisciplinary teams.
e) Ability to understand and apply computational platforms and software tools for Information Technology applications
f) Ability to understand ethical and professional responsibilities
g) Ability to review, comprehend and report technological development in Information Technology
h) An ability to recognize the importance of professional development by pursuing postgraduate studies or face competitive examinations that offer challenging and rewarding careers in computing.
A broad relation between the programme objective and the outcomes is given in the following table.

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This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

OBJECTIVES:
- To develop the four language skills – Listening, Speaking, Reading and Writing.
- To improve the students’ communicative competence in English.
- To teach students the various aspects of English language usage.

CONTENTS:

UNIT I  GREETING AND INTRODUCING ONESELF  12
Listening – Types of listening – Listening to short talks, conversations; Speaking – Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family/ friend; Reading – Skimming a passage– Scanning for specific information; Writing – Guided writing - Free writing on any given topic (My favourite place/ Hobbies/ School life, writing about one’s leisure time activities, hometown, etc.); Grammar – Tenses (present and present continuous) -Question types - Regular and irregular verbs; Vocabulary – Synonyms and Antonyms.

UNIT II  GIVING INSTRUCTIONS AND DIRECTIONS  12
Listening – Listening and responding to instructions; Speaking – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; Reading – Reading and finding key information in a given text - Critical reading - Writing –Process description( non-technical)- Grammar – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; - Vocabulary – Compound words – Word formation – Word expansion ( root words).

UNIT III  READING AND UNDERSTANDING VISUAL MATERIAL  12
Listening- Listening to lectures/ talks and completing a task; Speaking –Role play/ Simulation – Group interaction; Reading – Reading and interpreting visual material; Writing- Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative); Grammar – Tenses (perfect), Conditional clauses –Modal verbs; Vocabulary –Cause and effect words; Phrasal verbs in context.

UNIT IV  CRITICAL READING AND WRITING  12
Listening- Watching videos/ documentaries and responding to questions based on them; Speaking–Informal and formal conversation; Reading –Critical reading (prediction & inference); Writing–Essay writing ( compare & contrast/ analytical) – Interpretation of visual materials; Grammar – Tenses (future time reference); Vocabulary – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V  LETTER WRITING AND SENDING E-MAILS  12
Listening- Listening to programmes/broadcast/ telecast/ podcast; Speaking – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation; Reading –Extensive reading; Writing- Poster making – Letter writing (Formal and E-mail) ; Grammar – Direct and Indirect speech – Combining sentences using connectives; Vocabulary –Collocation;

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.
EVALUATION PATTERN:
Internals – 50%
End Semester – 50%
TOTAL: 60 PERIODS

LEARNING OUTCOMES:
- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

TEXTBOOK:

REFERENCES:
3. Redston, Chris & Gillies Cunningham Face 2 Face (Pre-intermediate Student’s Book& Workbook) Cambridge University Press, New Delhi: 2005

MA7151 MATHEMATICS – I
(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

OBJECTIVES:
- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS
Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES
UNIT III INTEGRAL CALCULUS 12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

UNIT V DIFFERENTIAL EQUATIONS 12
Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

TOTAL: 60 PERIODS

OUTCOMES:
- Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple standard examples.

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications.
- To inculcate an idea of thermal properties of materials, heat flow through materials and quantum physics.
- To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors.
- To establish a sound grasp of knowledge on the basics, significance and growth of single crystals.

UNIT I  PROPERTIES OF MATTER

UNIT II  ACOUSTICS AND ULTRASONICS

UNIT III  THERMAL AND MODERN PHYSICS

UNIT IV  APPLIED OPTICS

UNIT V  CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS
OUTCOME:
- The students will understand different moduli of elasticity, their determination and applications.
- The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics.
- The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further they will gain an idea of quantum physics.
- The students will gain knowledge on interferometers, lasers and fiber optics.
- The students will secure knowledge on the basics of crystal structures and their significance. Further they gain basic ideas of growing single crystals.

TEXTBOOKS:

REFERENCES:

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OBJECTIVE
To develop an understanding about fundamentals of polymer chemistry.
Brief elucidation on surface chemistry and catalysis.
To develop sound knowledge photochemistry and spectroscopy.
To impart basic knowledge on chemical thermodynamics.
To understand the basic concepts of nano chemistry.

UNIT I  POLYMER CHEMISTRY
Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II  SURFACE CHEMISTRY AND CATALYSIS

UNIT III  PHOTOCHEMISTRY AND SPECTROSCOPY
UNIT IV CHEMICAL THERMODYNAMICS 9
Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V NANO CHEMISTRY 9

TOTAL: 45 PERIODS

OUTCOMES:
- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXTBOOKS:

REFERENCES:

GE7151 COMPUTING TECHNIQUES L T P C 3 0 0 3
(Common to all branches of Engineering and Technology)

OBJECTIVES:
- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION 9
Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS 9
UNIT III

ARRAYS AND STRINGS


UNIT IV

POINTERS

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V

FUNCTIONS AND USER DEFINED DATA TYPES


OUTCOMES:
On Completion of the course, the students should be able to:
- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort.
- Use programming language to solve problems.

TEXTBOOKS:

REFERENCES:

BS7161

BASIC SCIENCES LABORATORY

L T P C
(Common to all branches of B.E. / B.Tech Programmes) 0 0 4 2

OBJECTIVE:
- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves, band gap determination and viscosity of liquids.

PHYSICS LABORATORY: (Any Seven Experiments)
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young’s modulus
3. Uniform bending – Determination of young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
13. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille"s flow

**TOTAL: 30 PERIODS**

**OUTCOME:**
Upon completion of the course, the students will be able
- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

**CHEMISTRY LABORATORY** (Minimum of 8 experiments to be conducted)

1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.

**TOTAL: 30 PERIODS**

**TEXTBOOKS:**
OBJECTIVES:

- To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions to real world problems.
- To learn to use user defined data structures.

LIST OF EXPERIMENTS

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function
10. Program using structures and unions.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
- Demonstrate the use of conditional statement.

OBJECTIVES:

- To enable students acquire proficiency in technical communication.
- To enhance their reading and writing skills in a technical context.
- To teach various language learning strategies needed in a professional environment.

CONTENTS

UNIT I  ANALYTICAL READING  12
Listening- Listening to informal and formal conversations; Speaking – Conversation Skills(opening, turn taking, closing )-explaining how something works-describing technical functions and applications; Reading –Analytical reading, Deductive and inductive reasoning; Writing- vision statement--structuring paragraphs.

UNIT II  SUMMARISING  12
Listening- Listening to lectures/ talks on Science & Technology; Speaking –Summarizing/ Oral Reporting, Reading – Reading Scientific and Technical articles; Writing- Extended definition –Lab Reports – Summary writing.

UNIT III  DESCRIBING VISUAL MATERIAL  12
Listening- Listening to a panel discussion; Speaking – Speaking at formal situations; Reading – Reading journal articles - Speed reading; Writing-data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts- writing critiques
UNIT IV  WRITING/ E-MAILING THE JOB APPLICATION 12
Listening- Listening to/ Viewing model interviews; Speaking –Speaking at different types of interviews – Role play practice (mock interview); Reading – Reading job advertisements and profile of the company concerned; Writing- job application – cover letter – Résumé preparation.

UNIT V REPORT WRITING 12
Listening- Viewing a model group discussion; Speaking –Participating in a discussion - Presentation; Reading – Case study - analyse -evaluate – arrive at a solution; Writing– Recommendations- Types of reports (feasibility report)- designing and reporting surveys- – Report format.- writing discursive essays.

TEACHING METHODS:
Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication.
Interactive sessions.

EVALUATION PATTERN:
Internals – 50%
End Semester – 50%

TOTAL: 60 PERIODS

LEARNING OUTCOMES
• Students will learn the structure and organization of various forms of technical communication.
• Students will be able to listen and respond to technical content.
• Students will be able to use different forms of communication in their respective fields.

TEXTBOOK:

REFERENCES:
OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of the electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I  MATRICES


UNIT II  VECTOR CALCULUS

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

UNIT III  ANALYTIC FUNCTION

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c$, $az$, $\frac{1}{z}$, $z^2$ - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION


UNIT V  LAPLACE TRANSFORMS


TOTAL: 60 PERIODS

OUTCOMES:

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

- Evaluate real and complex integrals using the Cauchy integral formula and the residue Theorem.
- Appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate line, surface and volume integrals in simple coordinate systems.
- Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities.
- Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
TEXTBOOKS:

REFERENCES:

PH7255 PHYSICS FOR ELECTRONICS AND INFORMATION SCIENCE
(Common to ECE & IT Branches)

OBJECTIVE:
- To understand the electrical properties of materials including free electron theory and applications of quantum mechanics
- To instill knowledge on physics of semiconductors, determination of charge carriers and device applications
- To promote the knowledge of magnetization of matter, classification of magnetic materials and their applications
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS
9

UNIT II SEMICONDUCTORS AND TRANSPORT PHYSICS
9

UNIT III MAGNETIC PROPERTIES OF MATERIALS
9
UNIT IV  OPTICAL PROPERTIES OF MATERIALS  9
Classification of optical materials – Absorption emission and scattering of light in metals, insulators & Semiconductors – LED’s – Organic LED’s – Plasma light emitting devices – LCD’s – Laser diodes – Optical data storage techniques (including DVD, Blue -ray disc, Holographic data storage).

UNIT V  NANO DEVICES  9

TOTAL: 45 PERIODS

OUTCOME:
At the end of the course, the students will
• come to have firm knowledge on the electrical properties of materials and applications
• acquire adequate understanding of semiconductor physics and functioning of semiconductor devices
• gain knowledge on magnetization of matter, classification of magnetic materials and their theoretical understanding, and device applications
• understand the optical properties of materials and working principles of various optical devices
• appreciate the importance of nanotechnology, physics of nanodevices, low-dimensional structures and their applications

TEXT BOOKS:

REFERENCES:

IT 7202  DATA STRUCTURES  L T P C
OBJECTIVES:
• To introduce the basics of C programming language
• To introduce the concepts of ADTs and linear data structures
• To introduce the concepts of Sorting and Searching techniques
• To familiarize the concepts of Hashing and Sets
UNIT I  C PROGRAMMING  9
Arrays - Functions - Pointers - Structures - Union - Enumerated Data Types - File Handling - Preprocessor Directives

UNIT II  LINEAR DATA STRUCTURES – LIST, STACK AND QUEUE  9
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – cursor-based linked lists – doubly-linked lists – circular linked list- applications of lists – Polynomial Manipulation – Stack ADT – Implementation of Stack- Applications- Queue ADT – Queue Implementation - Double ended Queues

UNIT III  NON-LINEAR DATA STRUCTURES - TREES  9

UNIT IV  SORTING AND SEARCHING TECHNIQUES  9
Sorting algorithms: Insertion sort - Shell sort - Quick sort - Heap sort - Merge sort - External Sort– Searching: Linear search - Binary search

UNIT V  HASHING AND DISJOINT SETS  9
Hashing: Hash Functions – Separate Chaining – Open Addressing: Linear Probing- Quadratic Probing- Double Hashing- Rehashing – Extendible Hashing - Disjoint Sets – Basic data structure- Smart Union Algorithms - Path Compression

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Implement data structures using C language.
- Solve the problem using linear and non linear data structures.
- Analyze and implement hashing techniques that solves in linear time.

TEXT BOOK:

REFERENCES:

GE7152  ENGINEERING GRAPHICS  L  T  P  C
3  2  0  4

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

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)  1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.
UNIT I  PLANE CURVES AND FREE HANDSKETCHING  14

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  14
Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS  14
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  14
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  15
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)  3
Introduction to drafting packages and demonstration of their use.

L = 45 + T = 30, TOTAL:75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
• Perform free hand sketching of basic geometrical shapes and multiple views of objects.
• Draw orthographic projections of lines, planes and solids
• Obtain development of surfaces.
• Prepare isometric and perspective views of simple solids.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

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

IT7201 INFORMATION TECHNOLOGY ESSENTIALS

OBJECTIVES:
• To introduce the concept of Internet, Networks and its working principles.
• To know scripting languages.
• To understand various applications related to Information Technology.

UNIT I WEB ESSENTIALS
Creating a Website - Working principle of a Website - Browser fundamentals - Authoring tools - Types of servers: Application Server - Web Server - Database Server

UNIT II SCRIPTING ESSENTIALS
Need for Scripting languages - Types of scripting languages - Client side scripting - Server side scripting - PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - PHP and MySQL - PHP and HTML - Cookies - Simple PHP scripts

UNIT III NETWORKING ESSENTIALS
Fundamental computer network concepts - Types of computer networks - Network layers - TCP/IP model - Wireless Local Area Network - Ethernet - WiFi - Network Routing - Switching - Network components

UNIT IV MOBILE COMMUNICATION ESSENTIALS

UNIT V APPLICATION ESSENTIALS
Creation of simple interactive applications - Simple database applications - Multimedia applications - Design and development of information systems – Personal Information System – Information retrieval system – Social networking applications

TOTAL: 45 PERIODS
OUTCOMES:
On Completion of the course, the students should be able to:
- Design and deploy web-sites
- Design and deploy simple web-applications
- Create simple database applications
- Develop information system
- Describe the basics of networking and mobile communications

TEXT BOOKS:

REFERENCES:
3. it-ebooks.org

IT7211 INFORMATION TECHNOLOGY ESSENTIALS AND DATA STRUCTURES L T P C LABORATORY 0 0 4 2

OBJECTIVES:
- To write simple scripts for the creation of web sites
- To create various information technology enabled applications
- Creation of interactive web sites - Design using HTML and authoring tools
- Creation of simple PHP scripts - Dynamism in web sites
- Handling multimedia content in web sites
- Database applications using PHP and MySQL
- Study of computer networking components
- Creation information retrieval system using web, PHP and MySQL

OUTCOMES:
On Completion of the course, the students should be able to:
- Design interactive websites using basic HTML tags, different styles, links and with all basic control elements.
- Create client side and server side programs using scripts using PHP.
- Design dynamic web sites and handle multimedia components
  - Create applications with PHP connected to database.
  - Create Personal Information System
  - Implement the technologies behind computer networks and mobile communication.

Part B - DATA STRUCTURES LABORATORY

OBJECTIVES:
- To introduce the concepts of structured Programming language and writing ADT’s.
- To introduce the concepts of primitive Data Structures.
- To introduce the concepts of Hashing and Sorting.
LIST OF EXCERCISE:
1. Practice of C Programming
2. Implementation of Linked List
3. Implementation of Stack using Arrays and Linked List.
4. Implementation of Queue using Arrays and Linked List.
5. Implementation of Stack and Queue applications.
8. Implementation of Sorting and Searching techniques.

OUTCOMES:
On Completion of the course, the students should be able to:
- Implement any data structures using ADT's.
- Solve the given problem using appropriate data structures

TOTAL: 60 PERIODS

GE7162  ENGINEERING PRACTICES LABORATORY  L  T  P  C
(Common to all Branches of B.E. / B.Tech. Programmes)  0  0  4  2

OBJECTIVES:
- To provide exposure to the students with hands-on experience on various Basic Engineering Practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICES

PLUMBING
Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
- Laying pipe connection to the suction side of a pump.
- Laying pipe connection to the delivery side of a pump.
- Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK
- Sawing, planning and making joints like T-Joint, Mortise and Tenon joint and Dovetail joint.

STUDY
- Study of joints in door panels and wooden furniture
- Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICES

- Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
- Stair case light wiring
- Tube – light wiring
- Preparation of wiring diagrams for a given situation.
- Study of Iron-Box, Fan Regulator and Emergency Lamp
GROUP – B (MECHANICAL AND ELECTRONICS)  

3. MECHANICAL ENGINEERING PRACTICES
WELDING
• Arc welding of Butt Joints, Lap Joints, and Tee Joints
• Gas welding Practice.
• Basic Machining - Simple turning, drilling and tapping operations.
• Study and assembling of the following:
  a. Centrifugal pump
  b. Mixie
  c. Air Conditioner.

DEMONSTRATION ON FOUNDRY OPERATIONS.
4. ELECTRONIC ENGINEERING PRACTICES
• Soldering simple electronic circuits and checking continuity.
• Assembling electronic components on a small PCB and Testing.
• Study of Telephone, FM radio and Low Voltage Power supplies.

TOTAL: 60 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
• Ability to fabricate carpentry components and to lay pipe connections including plumbing works.
• Ability to use welding equipments to join the structures
• Ability to do wiring for electrical connections and to fabricate electronics circuits.

GE7251 ENVIRONMENTAL SCIENCE AND ENGINEERING

OBJECTIVES:
• To the study of nature and the facts about environment.
• To find and implement scientific, technological, economic and political solutions to environmental problems.
• To study the interrelationship between living organism and environment.
• To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
• To study the dynamic processes and understand the features of the earth’s interior and surface.
• To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds.
Field study of simple ecosystems – pond, river, hill slopes, etc.
UNIT II ENVIRONMENTAL POLLUTION
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

TEXT BOOKS:
REFERENCES:

IT7301 DATABASE SYSTEMS L T P C 3 0 0 3

OBJECTIVES:
- To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram.
- To make a study of SQL and relational database design.
- To learn about the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
- To have an introductory knowledge about the Storage and Query processing Techniques

UNIT I RELATIONAL DATABASES 9

UNIT II DATABASE DESIGN 9

UNIT III TRANSACTION MANAGEMENT 9

UNIT IV IMPLEMENTATION TECHNIQUES 9

UNIT V ADVANCED TOPICS 9
Introduction to Distributed databases - Cloud Databases - Data warehouse and Mining - Mobile Databases - XML Databases - Multimedia Databases.

TOTAL : 45 PERIODS
OUTCOMES:
On Completion of the course, the students should be able to:
- To design database using E-R modeling and apply normalization techniques over it.
- To manage the transactions that happens in a database.
- To analyze the recent advancements in databases.
- To design and implement database for real world applications.

TEXT BOOKS:

REFERENCES:

IT7302 DIGITAL COMMUNICATION L T P C 3 0 0 3

OBJECTIVES:
- To provide knowledge on various amplitude, frequency and pulse modulation and demodulation systems.
- To provide some analysis of noise performance of various receivers.
- To study some basic information theory.

UNIT I INTRODUCTION TO DATA COMMUNICATION & STOCHASTIC PROCESSES 9

UNIT II REPRESENTATION OF SIGNALS AND SYSTEMS 8
Signals and Systems - Fourier Series representation of signals - Sampling process - Discrete Fourier transform - Z-transform - Convolution and Correlation.

UNIT III MODULATION 10

UNIT IV TRANSMISSION AND RECEPTION 9
Baseband Transmission: Line coding - NRZ, RZ, Manchester Coding - Baseband M-ary PAM transmission - Pass band Transmission: Frequency Shift Keying - Phase Shift Keying- Reception: Correlation Filters - Matched filter - Error rate due to noise - Inter Symbol Interference
UNIT V  INFORMATION THEORY AND ERROR CONTROL CODING

Uncertainty, Information and Entropy - Source Coding theorem - Mutual information - Channel capacity - Channel coding theorem - Information capacity theorem - Rate-distortion theory and Data compression - Linear block codes - Cyclic codes - Convolutional Codes.

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Know the various modulation and demodulation techniques.
- Know the representation of signals, will be able to analyze the transmission & reception processes and information coding techniques.

TEXT BOOK:

REFERENCES:

IT7303 OBJECT ORIENTED PROGRAMMING AND ADVANCED DATA STRUCTURES  L  T  P  C

3  0 0 3

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

UNIT I  OBJECT ORIENTED PROGRAMMING FUNDAMENTALS

Data Abstraction - Encapsulation - Class - Object - Constructors - Static members – Constant members – Member functions – Pointers – References - Role of this pointer - String Handling – Copy Constructor - Polymorphism – Function overloading – Operators overloading – Dynamic memory allocation - Inheritance.

UNIT II  OBJECT ORIENTED PROGRAMMING - ADVANCED FEATURES

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

UNIT III  ADVANCED NON-LINEAR DATA STRUCTURES


UNIT IV  ELEMENTARY GRAPH ALGORITHMS


UNIT V  GRAPH ALGORITHMS


TOTAL: 45 PERIODS
OUTCOMES:
On Completion of the course, the students should be able to:
- Solve the given problem using object oriented programming concepts.
- Implement advanced data structures through ADT’s using OOP.
- Apply graph data structures for a real world problem.

TEXT BOOKS:

REFERENCES

IT7351 DIGITAL PRINCIPLES AND DESIGN L T P C
3 0 0 3

OBJECTIVES:
- Learn how to design digital circuits, by simplifying the Boolean functions.
- Learn to design combinational and sequential circuits.
- To study about asynchronous sequential logic.
- Give an idea about designs using PLDs.
- To write code in hardware definition languages for designing larger digital systems.

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES

UNIT II COMBINATIONAL LOGIC

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC

UNIT V MEMORY AND PROGRAMMABLE LOGIC

TOTAL: 45 PERIODS
OUTCOMES:
On Completion of the course, the students should be able to:
- Design and analyze digital circuits.
- Simplify complex Boolean functions.
- Implement design using MSI chips and PLDs.
- Build digital systems involving combinational and sequential logic.

TEXT BOOK:

REFERENCES:

MA7355 PROBABILITY AND QUEUEING THEORY

OBJECTIVES:
- To provide the required fundamental concepts in probability and queueing models and apply these techniques in networks, image processing etc.
- Acquire skills in analyzing queueing models.

UNIT I RANDOM VARIABLES
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III RANDOM PROCESSES

UNIT IV QUEUEING THEORY
Markovian queues – Birth and Death processes – Single and multiple server queueing models – Little’s formula - Queues with finite waiting rooms – Finite source models.

UNIT V NON-MARKOVIAN QUEUES AND QUEUEING NETWORKS
M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/E_k/1 as special cases – Series queues – Open and closed Jackson networks.

TOTAL: 60 PERIODS
OUTCOMES:
- Students will be able characterize probability models using probability mass (density) functions & cumulative distribution functions.
- Students will be able to understand the terminology & nomenclature appropriate queueing theory.
- Students will demonstrate the knowledge and understand the various queueing models.
- Students will be able to formulate concrete problems using queueing theoretical approaches.

TEXT BOOKS:

REFERENCES:

IT7311 DIGITAL AND DATABASE SYSTEMS LABORATORY L T P C 0 0 4 2

OBJECTIVES:
- To learn how to develop combinational and sequential circuits.
- To use Hardware description language for simulation of digital circuits.
- To write code in HDL - VHDL or Verilog.

LIST OF EXPERIMENTS FOR DIGITAL LAB:
1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
3. Design and implementation of combinational circuits using MSI devices
   - 4 – bit binary adder / subtractor
   - Parity generator / checker
   - Application using multiplexers and decoders
4. Design and implementation of sequential circuits:
   - Shift –registers
   - Synchronous and asynchronous counters
5. Coding combinational / sequential circuits using HDL and a simple digital system (Mini Project).

OUTCOMES:
On Completion of the course, the students should be able to:
- Build digital circuits using basic gates and MSI devices
- Simulate and analyze digital circuits.
- Debug implementation issues for Boolean functions.
OBJECTIVES:
- To learn and implement DDL, DML, DCL and TCL commands in query language
- To practice SQL Queries, PL/SQL programming concepts and Triggers
- To design and develop a database application

LIST OF EXPERIMENTS FOR DATABASE LAB:
1. Data Definition, Manipulation of Tables and Views
2. Database Querying – Simple queries, Nested queries, Join Queries, Views
3. Triggers
4. High level language extensions - PL/SQL Basics
5. Procedures and Functions
6. Front End Tools/Programming Languages
7. Database Connectivity with Front End Tools
8. Database Design and Implementation (Case Study)

TOTAL: 60 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- To design databases using E-R modeling and apply normalization techniques.
- To implement DDL, DML and DCL commands in SQL.
- To implement database in open source software environment.
- To design and implement database for real world applications.

IT7312 OBJECT ORIENTED PROGRAMMING AND ADVANCED
DATA STRUCTURES LABORATORY

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

LIST OF EXPERIMENTS:
1. Practicing C++ programs with Classes, Objects, Constructors and Destructors.
2. Function overloading and Operator overloading.
3. Inheritance.
4. Polymorphism – Virtual functions.
5. Templates and STL
6. Exception handling.
8. Implementation of Splay Tree.
9. Implementation of a Heap tree
10. Implementation of Graphs - Topological Sort
11. Graph Traversals Algorithms - Breadth-First Search – Depth-First Search

TOTAL: 60 PERIODS
OUTCOMES:
On Completion of the course, the students should be able to:
- Implement the given problem using object oriented programming concepts.
- Implement advanced data structures through ADT’s using OOP.
- Analyze and apply the graph data structures for a real world problem.

UNIT I   SOFTWARE PROCESS MODELS

UNIT II   REQUIREMENT ENGINEERING

UNIT III   ANALYSIS MODELLING

UNIT IV   DESIGN AND TESTING

UNIT V   QUALITY AND MAINTENANCE

TOTAL: 45PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to:
- To differentiate the perspective of various software process models
- To elicit the requirements for real-time problems
- To compile a SRS pertaining to industry standards
- To create a behavioral model from the set of requirements
- To develop a user-interface design for the given system
- To outline various software metrics and their context in measuring software programs
- To estimate the software cost

TEXTBOOKS:

REFERENCES:

CS7451 COMPUTER ARCHITECTURE

OBJECTIVES:
- To identify the functional units in a digital computer system
- To distinguish between the various ISA styles
- To trace the execution sequence of an instruction through the processor
- To compare different approaches used for implementing a functional unit
- To understand the fundamentals of memory and I/O systems and their interaction with the processor
- To evaluate different computer systems based on performance metrics

UNIT I FUNDAMENTALS OF A COMPUTER SYSTEM

UNIT II ARITHMETIC FOR COMPUTERS

UNIT III BASIC PROCESSING UNIT

UNIT IV MEMORY AND I/O
UNIT V ILP AND PARALLEL PROCESSING

TOTAL : 60 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Identify the functional units of a computer system and their operation
- Point out the various metrics of performance
- Critically analyze the different types of ISA styles
- Explain the data path and control path implementation of a processor
- Discuss the implementations of various functional units
- Point out the characteristics of the memory and I/O systems and discuss their design

TEXTBOOK:

REFERENCES:

CS7452 OPERATING SYSTEMS
OBJECTIVES:
- To learn the concepts of operating systems.
- To learn about the various issues in operating systems.
- To familiarize with the important mechanisms in operating systems.
- To appreciate the emerging trends in operating systems.

UNIT I OPERATING SYSTEMS OVERVIEW
UNIT II   PROCESS MANAGEMENT 9
Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple-
processor scheduling – Operating system examples – Algorithm Evaluation – The critical-section
problem – Peterson’s solution – Synchronization hardware – Semaphores – Classic problems of
synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System
model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention –
Deadlock Avoidance – Deadlock detection – Recovery from deadlock.

UNIT III   STORAGE MANAGEMENT 9
Memory Management – Swapping – Contiguous memory allocation – Paging – Segmentation –
Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write –
Page replacement – Allocation of frames – Thrashing.

UNIT IV   I/O SYSTEMS 9
Directory implementation – Allocation methods – Free-space management – Disk scheduling –
Disk management – Swap-space management – Protection.

UNIT V   CASE STUDY 9
Scheduling – Memory management – File systems – Input and Output – Inter-process

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
• Articulate the main concepts, key ideas, strengths and limitations of operating systems
• Explain the core issues of operating systems
• Know the usage and strengths of various algorithms of operating systems

TEXT BOOK:

REFERENCES:
   Education”, 1996.
   Prentice Hall, 2011.

IT7401   ALGORITHMICS  L T P C
3 0 0 3

OBJECTIVES:
• To learn about the process of problem solving and writing algorithms
• To analyze the algorithms for time/space complexity
• To use algorithm design paradigms for various algorithmic design
• To learn the applications of algorithmic design.
UNIT I FUNDAMENTALS 9

UNIT II DESIGN TECHNIQUES 9

UNIT III ANALYSIS AND SEARCH TECHNIQUES 9
Probabilistic Analysis and Randomized Algorithms -The Hiring Problem - Randomized Algorithms - Amortized Analysis - Branch and Bound - Integer Linear Programming - Job Scheduling - Backtracking - All Simple Paths in a Graph

UNIT IV APPLICATIONS 9

UNIT V NP-COMPLETENESS 9

OUTCOMES:
On Completion of the course, the students should be able to:
- Design and implement any problem using design techniques
- Critically analyze the complexity of the given algorithm.
- Solve the problem in polynomial time or prove that to be a NP-Complete problem.

TEXT BOOK:

REFERENCES:

IT7402 WEB TECHNOLOGY L T P C 3 0 0 3
OBJECTIVES:
- To know the object oriented programming basics using Java
- To train the students to acquire knowledge in Object Oriented application development
- To acquire knowledge in concurrent programming in Java
- To gain skill to develop simple web applications using Java based technologies
- To know the basics of python programming
UNIT I        JAVA BASICS  9
Introduction to Java - Test-driving a java application - Input / Output and operators - Classes, Objects, Methods and strings - control statements - Methods: A deeper look - Arrays and Array Lists - classed and objects: A deeper look - Inheritance - polymorphism and Interfaces

UNIT II        JAVA GUI, FILE STREAM AND CONCURRENCY  9
Exception handling - swing GUI components - Graphics and Java 2d - Strings, characters and Regular Expressions - File streams and object serialization - Generic collections - Lambdas and Streams - Generic classes and methods - advanced Swing GUI components - concurrency - thread states and life cycles - thread synchronization

UNIT III    HTML AND JAVA SCRIPT  9

UNIT IV     JAVA SERVER SIDE PROGRAMMING  9

UNIT V     PYTHON PROGRAMMING BASED WEB DEVELOPEMENTNT  9
Strings - Operators - Decisions- Functions - Classes and Objects - Files and Directories - Modules - Text processing - Accessing Databases - Simple web application using python

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Have knowledge on the concepts of Java based implementation of Object Oriented system
- Write thread based parallel programs using Java
- Develop simple web applications using Java based technologies
- Write simple programs using Python language

TEXT BOOKS:
3. James Payne, Beginning Python - Using Python 2.6 and 3.1, Wiley India Pvt. Ltd., 2010

REFERENCES:
4. http://www.w3schools.com/
5. http://nptel.ac.in/courses/106105084/
OBJECTIVES:
- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input output functions in computer science.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as semi groups, monoids and groups.

UNIT I LOGIC AND PROOFS 12

UNIT II COMBINATORICS 12

UNIT III GRAPHS 12
Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV ALGEBRAIC STRUCTURES 12

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the module the student should be able to:
- Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
- Understand the basics of discrete probability and number theory, and be able to apply the methods from these subjects in problem solving.
- Use effectively algebraic techniques to analyse basic discrete structures and algorithms.
- Understand asymptotic notation, its significance, and be able to use it to analyse asymptotic performance for some basic algorithmic examples.
- Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples.

TEXTBOOKS:
REFERENCES:

IT7411 OPERATING SYSTEMS LABORATORY

OBJECTIVES:
• To learn about the basic commands of operating systems.
• To learn various process management schemes in operating systems.
• To practice with the important memory management mechanisms in operating systems.
• To implement the file handling techniques in operating systems

LIST OF EXERCISES:
1. Basic unix commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc.,
2. Shell script
3. Process control System calls - demonstration of fork, execute and wait
4. Thread management
5. Thread synchronization
6. Deadlock avoidance using semaphores
7. Interprocess communication using pipes
8. Interprocess communication using FIFOs
9. Interprocess communication using signals
10. Implementation of CPU scheduling policy in Linux
11. Implement a memory management policy in Linux
12. Implement a file system in Linux
13. Linux kernel configuration

TOTAL : 60 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
• Learn the concepts to identify, create and maintain the basic command in operating systems
• Express strengths and limitations of various managements schemes in operating systems
• Explain the core issues of operating systems
• Implement algorithms of operating systems

IT7412 WEB TECHNOLOGY LABORATORY

OBJECTIVES:
• To learn about web technologies related concepts
• To develop Java and HTML based web applications
• To implement parsers and XML related concepts
EXERCISES:
1. Creating simple applications using JAVA by exploring all the object oriented programming concepts such as inheritance, polymorphism, interfaces and packages.
2. Creating GUI based application using JAVA Swings
3. Developing concurrent and generic programming using Threads
4. Creation of simple websites using HTML 5 Tags
5. Creation of web forms and validating it through javascripts
6. Creation of XML file and validating with DTD and XML schema
7. Working with DOM and SAX parsers
8. Creation of AJAX based application
9. Developing JSON application
10. Creation of dynamic HTML based web applications
11. Creation of servlet based web application with JDBC
12. Developing JSP application
13. Creating simple applications using python
14. Simple database and web application using python

TOTAL: 60 PERIODS

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

- Create simple web applications
- Implement server side and client side programming develop web applications with various web technology concepts.

IT7501 COMPILER ENGINEERING

OBJECTIVES:
- To learn the concepts in the design of compilers
- To learn about the runtime store organization.
- To know the data structures used to implement symbol tables.
- To be familiar with garbage collection.

UNIT I LEXICAL ANALYSIS

UNIT II SYNTAX ANALYSIS
Introduction-Context Free Grammar-Top Down Parsing-Recursive Descend Parsing-Predictive Parsing-Non-Recursive Predictive Parsing-Error Recovery- Bottom Up Parsing- LR Parsers- Construction of SLR(1) Parsing Table, Canonical LR(1) Parsing Table and LALR(1) Parsing Table - Parser Generators.

UNIT III INTERMEDIATE CODE GENERATION

UNIT IV RUNTIME ENVIRONMENT
Storage Organization - Stack Allocation - Access To Non-Local Data - Heap Management - Symbol Tables - Introduction to Garbage Collection - Trace-Based Collection.
UNIT V  
CODE GENERATION  
9

TOTAL : 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Use compiler construction tools.
- Design and implement a prototype compiler

TEXT BOOK:

REFERENCES:

IT7502  
COMPUTER NETWORKS  
L T P C  
3 0 0 3

OBJECTIVES:
- Identify the component required to build different types of networks
- To learn about the division of network functionalities into layers.
- Identify solution for each functionality at each layer
- Choose the required functionality at each layer for given application

UNIT I  
FUNDAMENTALS  
9

UNIT II  
TRANSPORT LAYER  
9

UNIT III  
NETWORK LAYER AND UNICAST ROUTING  
9

UNIT IV  
NETWORK RELATED PROTOCOLS  
9
UNIT V  DATA LINK LAYER AND LAN  9
Link layer services - Framing – Error Detection and Correction - Flow control - Media access control - Ethernet - CSMA/CD - Token Ring - FDDI - Link Virtualization - Data Center Networking Wireless LANs - CSMA/CA –BLUETOOTH

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Differentiate between the various fundamental computer network concepts
- Analyze issues in design and deployment of a computer network
- Solve computational problems in networks
- Design and implement a networking application incorporating the different layering protocols

TEXT BOOKS:

REFERENCES:

IT7503  EMBEDDED SYSTEMS  L  T  P  C
3  0  0  3

OBJECTIVES:
- To learn the internal architecture of an embedded processor including timers and interrupts
- To quantize the core specifications of an embedded processor
- To introduce interfacing I/O devices to the processor
- To learn programming an embedded processor
- To run and debug programs in an IDE

UNIT I  8-BIT EMBEDDED PROCESSOR  11

UNIT II  EMBEDDED C PROGRAMMING  7
Programming embedded systems in C – Implementing Timers, Interrupts and Serial communication in embedded C- Multi-state systems

UNIT III  LOW-POWER EMBEDDED PROCESSORS  9
ARM7 TDMI processing core - instruction sets and programming – Intel ATOM/Quark Processor – Architecture – Programming- Advanced Low Power Processors - Introduction to IoT

UNIT IV  RTOS  9
Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Performance issues - Need for RTOS - Introduction to µC/OS II
UNIT V        EMBEDDED SYSTEM DEVELOPMENT

Embedded software development tools – Emulators and debuggers. Challenges of Embedded Systems – Embedded system design process - Design issues – Design methodologies – Case studies – Complete design of example embedded systems.

TOTAL: 45 PERIODS

OUTCOMES :
On Completion of the course, the students should be able to:
• Design a simple embedded application
• Compare various embedded processors
• Design and deploy timers and interrupts
• Design an embedded processor based system for a real-time application

TEXT BOOKS:

REFERENCES:

IT7551        UNIX INTERNALS

OBJECTIVES:
• To learn about the design of the UNIX operating system.
• To become familiar with the various data structures used.
• To learn the various low-level algorithms used in UNIX.

UNIT I        OVERVIEW

UNIT II        FILE SUBSYSTEM
Internal Representation of Files: Inodes – Structure of a Regular File – Directories –Conversion of a Path Name to an Inode – Super Block – Inode Assignment to a New File – Allocation of Disk Blocks.

UNIT III        SYSTEM CALLS FOR THE FILE SYSTEM
UNIT IV PROCESSES

UNIT V MEMORY MANAGEMENT AND I/O

OUTCOMES:
On Completion of the course, the students should be able to:
- To design and implement the subsystems of an operating system.
- To explain the data structures of an open source operating system.
- To modify and implement the data structures and algorithms of an open source operating system.

TEXT BOOK:

REFERENCES:

IT7511 COMPUTER NETWORKS LABORATORY

OBJECTIVES:
To learn about the low-level network programming concepts using APIs and Simulation tools.

LIST OF EXERCISES:
1. Write a network application program
2. Use tools to visualize packet flow
3. Configure Router/Switch to set up network (network administration)
4. Simple Chat Program using TCP Sockets
5. Simulation of HTTP Protocol using TCP Sockets
6. Simulation of Sliding Window Protocol using TCP Sockets
7. Simulation of DNS using UDP Sockets
8. Simulation of Ping using Raw Sockets
9. Learn to use commands like TCP Dump, Netstat, Trace Route
10. Study of TCP/UDP performance using simulation tool
11. Performance comparison of MAC protocols using simulation tool
12. Performance comparison of Routing protocols using simulation tool

TOTAL: 60 PERIODS
OUTCOMES:
On Completion of the course, the students should be able to:
- To implement a network layer software and analyze functionalities of computer networks

IT7512  EMBEDDED SYSTEMS LABORATORY  L T P C
0 0 4 2

OBJECTIVES:
- To learn tools relevant to Embedded Systems
- To explore Embedded C Programs for different embedded processor
- To write and interpret simple assembly programs that use various features of the processor.

LIST OF EXERCISES:
1. 8051 Assembly Language Experiments(Kit and Simulator) based on:
   - Data transfer programs
   - Arithmetic and logical programs
   - Conversions and sorting
   - Timers and Interrupts
   - Serial Communication
   - I/O interfacing: Traffic Generator ,DAC, ADC, Stepper Motor
2. Basic and Interfacing Programs Using Embedded C
3. Real time system programs (Embedded C)
4. KEIL software example programs
2. ARM/Atom based Application Development:
   i. Programs to practice data processing instructions.
   ii. Interfacing programs
   iii. Program that uses combination of C and ARM/Atom assembly code.
3. Embedded Application Development on Platforms like Bluemix:

TOTAL : 60 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Develop Applications based on Embedded Systems
- Write an Embedded C Program, Debug and interpret the Results
- Write and implement simple assembly programs that use various features of the processor.
- Able to do an experiment that senses an analog signal, process and control [e.g., Keypad, Display.

IT7513  SOCIALLY RELEVANT PROJECT  L T P C
0 0 2 1

Students are expected to take up problems that would directly benefit the society and design and implement an IT based solution for the problem, based on the courses undertaken up to that semester. The evaluation of the project would be based on the formulation of the problem, and the technical merit of the solution.

OUTCOMES:
On Completion of the course, the students should be able to:
- Be a benefit to the society by solving a socially pertinent problem, design and implement it with an IT based solution for the problem.

TOTAL: 30 PERIODS
OBJECTIVES:
- To introduce the concepts and models of security in computing
- To design and implement symmetric and asymmetric cryptosystems
- To explain the security standards followed at the network level and at the application level
- To estimate the level of security risk faced by an organization and the counter measures to handle the risk
- To learn secured software development

UNIT I SECURITY - AN OVERVIEW 9

UNIT II ADVANCED CRYPTOGRAPHY 9

UNIT III SECURITY STANDARDS 9

UNIT IV SECURITY PRACTICES 9

UNIT V SECURE DEVELOPMENT 9

OUTCOMES:
On Completion of the course, the students should be able to:
- Apply the basic security algorithms and policies required by computing system.
- Predict the vulnerabilities across any computing system and hence be able to design a security solution for any computing system.

TEXT BOOKS:
REFERENCES:

IT7602 INTEGRATED PROGRAMMING

OBJECTIVES:
- To know the importance of Java based Enterprise level application development
- To train the students to acquire knowledge in various frameworks
- To gain skill to develop enterprise applications using Java based technologies

UNIT I SERVER SIDE PROGRAMMING

UNIT II ENTERPRISE JAVA BEANS

UNIT III HIBERNATE FRAMEWORK

UNIT IV JAVA WEB SERVICES
Overview of SOA - Overview of Java Web Services (JWS) - Role of WSDL, SOAP, and Java/XML Mapping in SOA - JAX-WS 2.2 and JAXB 2.2 Specification - WSEE, WS-Metadata, SAAJ, JAXR specifications

UNIT V STRUT AND SPRING FRAMEWORKS
Struts - Struts 2 Architecture - Actions in Struts 2 - Spring Framework Architecture - Spring’s web MVC framework - Spring with Hibernate - Struts 2 with Spring - Securing Java EE Applications - JAAS - AJAX

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Develop complex real world web applications
- Differentiate the importance of various application development frameworks
TEXT BOOKS:
2. https://docs.oracle.com/javaee/7/JEE7T.pdf

REFERENCES:

IT7603 MOBILE COMPUTING

OBJECTIVES:
- To know about the intricacies of wireless communication
- To study about the popular cellular networking technologies
- To learn about widely used wireless LAN technologies
- To explore the various protocols that support mobility at network layer and transport layer
- To learn the principles of mobile application development

UNIT I WIRELESS COMMUNICATION
9

UNIT II TELECOMMUNICATION NETWORKS
9

UNIT III WIRELESS LAN
9

UNIT IV MOBILE NETWORK AND TRANSPORT LAYER
9

UNIT V MOBILE APPLICATION DEVELOPMENT
9
Three Tier Architecture - Presentation Tier - Application Tier and Data Tier – Google Android Platform – Eclipse Simulator – Android Application Architecture – Apple iPhone Platform – UI Tool Kit Interfaces – Event Handling – Event based Programming – Storing and Retrieval of data

TOTAL: 45 PERIODS
OUTCOMES:
On Completion of the course, the students should be able to:

- To articulate the concept of wireless communication
- To have knowledge on the architecture of GSM and LTE protocol
- To choose the appropriate WLAN technology for a given scenario
- To deploy various protocols that support mobility at network layer and transport layer
- To design and implement mobile applications

TEXT BOOKS:

REFERENCES:

IT7604 PARALLEL AND DISTRIBUTED SYSTEMS L T P C
3 0 0 3

OBJECTIVES:
- To provide knowledge on principles underlying the design of distributed and parallel systems
- To lay the foundations of Distributed and Parallel Systems.
- To introduce the idea of Distributed and Parallel Architecture.
- To introduce the idea of Distributed operating system and related issues.

UNIT I INTRODUCTION TO DISTRIBUTED AND PARALLEL SYSTEMS

UNIT II COMMUNICATION IN DISTRIBUTED AND PARALLEL ENVIRONMENT

UNIT III DISTRIBUTED OPERATING SYSTEMS

UNIT IV DISTRIBUTED RESOURCE MANAGEMENT
UNIT V  FAULT TOLERANCE AND CONSENSUS

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Articulate the principles and standard practices underlying the design of distributed and parallel systems.
- Explain the core issues of distributed and parallel systems.
- Appreciate the difficulties in implementing basic communication in parallel and distributed systems.
- Have knowledge on the substantial difficulty in designing parallel and distributed algorithms in comparison to centralized algorithms.
- Appreciate the issues in distributed operating system, resource management and fault tolerance

TEXT BOOKS:

REFERENCES:

IT7611  CREATIVE AND INNOVATIVE PROJECT  L T P C
0 0 4 2

OBJECTIVES:
The goal of this course is to encourage the students to identify innovative projects that help in exploring variables that promote creativity and innovation. Each student is expected to choose a real life or socially relevant problem At the end of the project, students should be familiar with the state of art in their respective fields. They would be able to apply the concepts learnt to relevant research problems or practical applications.

OUTCOMES:
On Completion of the course, the students should be able to:
Know concepts, models, frameworks, and tools that engineering graduates’ need in a world where creativity and innovation is fast becoming a pre-condition for competitive advantage.

TOTAL: 60 PERIODS
OBJECTIVES:
- The Information Security Laboratories to present several hands-on exercises to help reinforce the students knowledge and understanding of the various Information security aspects.
- The lab exercises are based on implementation of cryptographic algorithms and with usage of various security attacks/defenses related tools and utilities.

LIST OF EXERCISES:
The following exercises are based on the cryptographic algorithms. They can be implemented using C, C++, Java, etc.
1. Write a program to perform encryption and decryption using the following algorithms
   a. Caesar cipher
   b. Substitution cipher
   c. Hill Cipher
2. Write a program that contains functions, which accept a key and input text to be encrypted/decrypted. This program should use the key to encrypt/decrypt the input by using the triple DES algorithm. Make use of Cryptography package.
3. Write a program to implement the Rijndael algorithm logic.
4. Write the RC4 logic in any language
5. Using cryptography, encrypt the text "Helloworld" using Blowfish. Create your own key using key tool.
6. Write a program to implement RSA algorithm.
7. Implement the Diffie-Hellman Key Exchange mechanism using HTML and Script. Consider the end user as one of the parties (Alice) and the Script application as the other party (Bob)
8. Calculate the message digest of a text using the SHA-1/MD5 algorithm in any language
9. Create a digital certificate of your own by using the key tool.
10. Write a program to encrypt user’s passwords before they are stored in a database table, and to retrieve the whenever they are to be brought back for verification.
11. Key generation (public and private key pair) can be performed using Java. Write a program which can do this.
12. Write a program which performs a digital signature on a given text.

TOTAL: 60 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Have knowledge on the fundamentals of secret and public cryptography.
- Familiar with network security designs using available secure solutions (such as PGP, SSL, IPSec, etc)

IT7613 INTEGRATED PROGRAMMING LABORATORY

OBJECTIVES:
- To learn about the concepts of developing simple web applications
- To practice the concepts of enterprise level java frameworks
- To familiarize the students with the development of advanced java applications

EXERCISES
1. Creating servlet based application with session and cookies
2. Developing JSP applications with JDBC and session management
3. Experimenting with basic EJB applications.
4. Developing EJB application with session and entity beans
5. Creation of web services using JAVA
6. Creation of RESTful web services and SOAP based web services
7. Developing SOA based solutions using web service composition
8. Hibernate based application development
9. Application development using spring
10. Application development using strut framework
11. Creation of Database applications using Hibernate
12. Creation of java based secure application

TOTAL : 60 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
• Develop enterprise level java applications
• Implement enterprise java concepts such as JSP, Servlet, EJB
• Create the applications using the concepts of hibernate, spring, struts

IT7701 COMPUTER GRAPHICS AND MULTIMEDIA

OBJECTIVES:
• To know the mathematical basis of computer graphics
• To train the students to acquire knowledge in Graphic generation and Animation creation
• To acquire knowledge about multimedia compression techniques
• To gain skill to develop multimedia systems

UNIT I INTRODUCTION TO COMPUTER GRAPHICS
Graphics display devices- Graphics input primitives and devices - OpenGL basic graphic primitives-Line drawing algorithms DDA and Bresenham - World windows and viewports- Clipping algorithms for lines, Regular polygons, circles and arcs- The parametric form for a curve- Review of vectors- Representations of key geometric objects- Lines and Planes

UNIT II MODELING AND TRANSFORMATIONS OF OBJECTS
Introduction to transformations-Two dimensional transformations-3D affine transformations- Drawing 3D scenes interactively- Introduction to solid modeling with polygonal meshes-Mesh approximations to smooth objects-Particle systems and physically based systems-Three-dimensional viewing -Perspective projections of 3D objects - Introduction to shading models-Flat shading and smooth shading- Adding texture to faces.

UNIT III VISUAL REALISM
Manipulating pixmaps-Manipulating symbolically defined regions-Aliasing and anti aliasing techniques-Describing curves using polynomials-Bezier curves-The B-Spline basis functions-Modeling curved surfaces- Color theory- Overview of the ray tracing process-Intersecting rays with other primitives-Adding shadows for greater realism-Reflections and transparency- Boolean operations on objects-Ray casting.

UNIT IV INTRODUCTION TO MULTIMEDIA
UNIT V COMPRESSION TECHNIQUES


TOTAL: 45 PERIODS

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

- Articulate the concepts and techniques used in three-dimensional graphics
- Design and model graphical structures
- Design and implement algorithms and techniques applied to multimedia objects

TEXTBOOKS:

REFERENCES:

IT7702 DATA ANALYTICS L T P C 3 0 0 3

OBJECTIVES:
- To introduce big data and its importance towards analytics
- To familiarize the students with fundamentals of data analysis
- To expose the students to different of big data frameworks
- To learn about the stream mining concepts

UNIT I INTRODUCTION TO DATA ANALYTICS 9

UNIT II DATA ANALYSIS - FUNDAMENTALS 9

UNIT III ANALYTICAL FRAMEWORKS - I 9
UNIT IV ANALYTICAL FRAMEWORKS – II
Overview of Application development in Languages for Hadoop – PigLatin, Hive, jaql, Sqoop, Apache drill, Cloudera Impala – Introduction to NoSQL databases - HBase, MongoDB – CouchDB – Introduction to R Language for statistical computing and visualization – R Installation and integration with Hadoop.

UNIT V MINING DATA STREAMS

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Identify the differences between reporting and analytics
- Demonstrate fundamental mathematics behind analytics
- Install Hadoop and write Map Reduce Programs
- Critically analyze different big data frameworks for programming, storage and statistical analysis
- Apply mining techniques for stream data

TEXT BOOKS:

REFERENCES:

IT7703 KNOWLEDGE ENGINEERING AND INTELLIGENT SYSTEMS

OBJECTIVES:
- The background of intelligent agents and search mechanisms
- The various knowledge representation techniques
- The reasoning methods of proposition, predicate and higher order logics
- The learning techniques in artificial agents

UNIT I KNOWLEDGE REPRESENTATION IN INTELLIGENT AGENTS
UNIT II  SEARCH STRATEGIES

UNIT III  REASONING WITH PROPOSITION AND PREDICATE LOGIC
Proposition Logic - Syntax - Semantics - Horn Clauses - Resolution - First Order Logic - Syntax - Conversion from English Statements to First order logic formula - Semantics - Reasoning methods - Forward chaining - Backward chaining - Resolution - Application: AI Planning

UNIT IV  REASONING WITH HIGHER ORDER LOGICS
Modal Logic - Syntax - Semantics - Kripke structures - Temporal Logic - Syntax and Semantics - Reasoning mechanisms using Temporal Logic - Epistemic Logic - Syntax and Semantics - Multiagent reasoning using Epistemic Logic- Case based reasoning

UNIT V  LEARNING
Statistical methods - Bayesian techniques- Supervised learning- Unsupervised learning- Regression methods - Learning under uncertainty - Probability methods - Text processing

OUTCOMES:
On Completion of the course, the students should be able to:
• Use the knowledge representation and reasoning techniques for the design of intelligent systems
• Apply the reasoning methods of various logics to computer science domains.
• Create intelligent systems using learning mechanisms.

TEXT BOOKS:

REFERENCES:

IT7704  PRINCIPLES OF HUMAN COMPUTER INTERACTION
OBJECTIVES:
• To study about the design, implementation and evaluation of effective and usable graphical computer interfaces.
• To describe and apply core theories, models and methodologies from the field of HCI.
• To learn various case studies in HCI
UNIT I  FOUNDATIONS FOR INTERACTION DESIGN  9
The psychopathology of Everyday things – Psychology of everyday actions - Human memory –
Thinking – Emotion - Psychology and design of interactive system - Text entry devices - display
devices - devices for virtual reality and 3D interaction - Models of interaction - Frame work and
HCI-Ergonomics - Interaction styles - Elements of WIMP interface – Interactivity - paradigms for
interaction - Affective aspects of HCI.

UNIT II  MODELS AND THEORIES  9

UNIT III  DESIGN PROCESS  9
Interaction design basics: The process of design - user focus - navigation design - Screen design
and layout - iteration and prototyping, HCI in software Process: Usability Engineering - iterative
design and prototyping, Design rules: Principles to support usability - Standards - Guidelines -
Golden rules and heuristics - HCI patterns, Designing for collaboration and communication.

UNIT IV  IMPLEMENTATION AND EVALUATION TECHNIQUES  9
Interaction styles – Direct manipulation and virtual environments – menu selection – form fill in –
dialog boxes – command and natural languages – interaction devices – layouts – fragments –
wizards – views – adapters – evaluation strategies

UNIT V  CASE STUDIES  9
Goals of HCI case studies: Exploration - Explanation - Description - Demonstration, Types of case
study: Intrinsic or instrumental - Single case multiple cases - Embedded or holistic, Groupware:
Groupware systems - Computer mediated communication - Meeting and decision support system -
Shared applications and artifacts - Frameworks for groupware - Implementing synchronous
groupware, Ubiquitous computing and augmented realities: Ubiquitous computing applications
research - Virtual and augmented reality - Information and data visualization - HCI for smart
environment – Virtual reality – HCI for scientific applications, medical applications – HCI for
assistive technology

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Interpret the contributions of human factors and technical constraints on human-computer
interaction.
- Evaluate the role of current HCI theories in the design of software.
- Apply HCI techniques and methods to the design of software.
- Categorize and carefully differentiate various aspects of multimedia interfaces
- Design and develop issues related to HCI for real application.

TEXT BOOKS:
1. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, Human – Computer Interaction,
2. Ben Shneiderman, Catherin Plaisant, Maxine Cohen and Steven M. Jacobs, Designing the

REFERENCES:
OBJECTIVES:

- To introduce the necessary background, the basic algorithms, and the applications of computer graphics.
- To examine the various graphics applications of modeling, design and visualization.
- To develop an innovative multimedia projects.

Implement the exercises from 1 to 4 using C/ OpenGL / Java

1. Implementation of Algorithms for drawing 2D Primitives with attributes
   a. Line (DDA, Bresenham) - all slopes
   b. Circle (Midpoint), Ellipse.
2. 2D Geometric Transformations -
   a. Translation
   b. Rotation
   c. Scaling
   d. Reflection
   e. Shear
3. Window- Viewport transformation
4. Composite 2D Transformations
5. Line Clipping - Liang Barsky, Cohen Sutherland

Implement the exercises from 6 to 8 using OpenGL

6. 3D Transformations - Translation, Rotation, Scaling
7. 3D Projections - Parallel, Perspective
8. Creating 3D Scenes

Implement the exercise 9 and 10 using any programming language

9. To implement text compression algorithms
10. To implement image compression algorithms

Implement the exercises from 11 to 12 using respective open source tools

11. Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image optimization
12. 3D Animation - To create Interactive animation using any open source 3D Modelling tool

TOTAL : 60 PERIODS

OUTCOMES:

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

- Be able to construct interactive computer graphics programs using OpenGL.
- Have a thorough understanding of working of 2D and 3D computer graphics.
- Able to create animation in both 2D and 3D.
- Have the ability to build a multimedia application.
Three member team is identified to carry out mini project, the goal of mini project is to choose the final year project, Perform Literature Survey, refer IEEE papers, IEEE/ACM papers, study the implementation issues, familiarize with the tools needed for implementation, study necessary simulation software (if any) and implement the initial phase of the project. Three reviews needs to be conducted project report has to be submitted by the team. Final review will be conducted by external member.

TOTAL : 60 PERIODS

OBJECTIVES:
- To comprehend graphs as modeling and analysis tool
- To introduce various data structures with graph theory
- To learn fundamentals behind principle of counting and combinatorial.

UNIT I INTRODUCTION

UNIT II TREES, CONNECTIVITY & PLANARITY

UNIT III MATRICES, COLOURING AND DIRECTED GRAPH

UNIT IV PERMUTATIONS & COMBINATIONS

UNIT V GENERATING FUNCTIONS

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Write programs involving basic graph algorithms
- Write programs for graph coloring
- Differentiate the potential use of directed and undirected graphs
- Outline the concepts of permutations and combinations
TEXTBOOKS:

REFERENCES:

CS7074 SOFT COMPUTING

OBJECTIVES:
- To give students knowledge of soft computing theories fundamentals,
- To learn the fundamentals of non-traditional technologies and approaches to solving hard real-world problems.
- To learn and apply artificial neural networks, fuzzy sets and fuzzy logic, and genetic algorithms in problem solving and use of heuristics based on human experience
- To introduce the ideas of fuzzy sets, fuzzy logic To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations

UNIT I NEURAL NETWORKS - I

UNIT II NEURAL NETWORKS - II

UNIT III FUZZY LOGIC - I

UNIT IV FUZZY LOGIC – II
(Fuzzy Membership, Rules) Membership Functions, Interference in Fuzzy Logic, Fuzzy If-Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzifications and Defuzzificataions, Fuzzy Controller, Industrial Applications

UNIT V GENETIC ALGORITHM

TOTAL :45 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to:

- Awake the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.
- Acquire knowledge of soft computing theories fundamentals and so they will be able to design program systems using approaches of these theories for solving various real-world problems.
- Try and integrate the knowledge of neural networks, fuzzy logic, genetic algorithms, probabilistic reasoning, rough sets, chaos, hybrid approaches (combinations of neural networks, fuzzy logic and genetic algorithms).

TEXTBOOKS:

REFERENCES:
1. Siman Haykin, “Neural Networks”, Prentice Hall of India, 1999

CS7551 DIGITAL SIGNAL PROCESSING

OBJECTIVES:
- To get an idea on designing analog and digital filters
- To acquire knowledge related to Fourier transform and its applications.
- To learn the design of infinite and finite impulse response filters for filtering undesired signals.
- To understand signal processing concepts in systems having more than one sampling frequency.

UNIT I SIGNALS AND SYSTEMS

UNIT II FREQUENCY TRANSFORMATIONS
UNIT III IIR FILTER DESIGN

UNIT IV FIR FILTER DESIGN

UNIT V APPLICATIONS

TOTAL: 45 PERIODS

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

- Perform frequency transforms for signals
- Design IIR and FIR filters
- Write programs using analog and digital filters and to compare the respective output
- Identify finite word length errors in digital filters

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT I  INTRODUCTION TO DISASTERS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II  APPROACHES TO DISASTER RISK REDUCTION (DRR)

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III  INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV  DISASTER RISK MANAGEMENT IN INDIA

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V  DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

OUTCOMES:

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

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

TOTAL: 45 PERIODS
TEXTBOOKS:

REFERENCES:
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

GE7072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT

UNIT II REQUIREMENTS AND SYSTEM DESIGN

UNIT III DESIGN AND TESTING
UNIT IV   SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT   9

UNIT V   BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY   9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES:

GE7074   HUMAN RIGHTS   L T P C
3 0 0 3

OBJECTIVE:
To sensitize the Engineering students to various aspects of Human Rights.

UNIT I
UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

TOTAL : 45 PERIODS

OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

GE7652 TOTAL QUALITY MANAGEMENT

AIM
To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES
- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

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

UNIT II TQM PRINCIPLES
UNIT III  TQM TOOLS & TECHNIQUES I


UNIT IV  TQM TOOLS & TECHNIQUES II


UNIT V  QUALITY MANAGEMENT SYSTEM


TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:


REFERENCES:


IT7001  ADVANCED DATABASE TECHNOLOGY

OBJECTIVES:

- To learn the advanced concepts of databases.
- To familiarize the concepts of spatial and xml databases for better representation.
- To learn various enhanced data models.
- To learn and understand the concepts of No SQL databases for large scale data management.

UNIT I  PARALLEL AND DISTRIBUTED DATABASES

Database System Architectures: Centralized and Client-Server Architectures - Parallel databases: I/O Parallelism - Inter and Intra query parallelism - Inter and Intra operation parallelism - Distributed database concepts - Distributed data storage - Distributed transactions - Commit protocols - Concurrency control - Distributed Query Processing - Heterogeneous Distributed databases - Cloud based Databases.
UNIT II        SPATIAL DATABASES & XML DATABASES

UNIT III        INFORMATION RETRIEVAL AND WEB SEARCH
Information Retrieval concepts - Retrieval Models - Types of Queries in IR systems - Text Preprocessing - Inverted Indexing - Evaluation measures of search relevance - Web search and analysis - Web databases

UNIT IV        ENHANCED DATA MODELS
Active database concepts and Triggers - Temporal Database concepts - Object Oriented Databases - Multimedia Database concepts - Introduction to Deductive databases - Mobile Databases - Data Warehousing - Data Mining

UNIT V        NoSQL DATABASES
Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – column family stores - relationships – graph databases – schema-less databases – materialized views - Cassandra - MongoDB

OUTCOMES:
On Completion of the course, the students should be able to:
• To create data models and representations for a database application.
• To evaluate the usage and effectiveness of various databases.
• To develop IR systems and Web search engines.
• To demonstrate the NoSQL databases using recent big data tools.

TEXT BOOKS:

REFERENCES:

IT7002        ADVANCED NETWORKS
OBJECTIVES:
• To explain QoS requirements and compare different approaches to QoS.
• To appreciate need for high speed networks
• To identify reliability issues and provide solutions

UNIT I        INTERNETWORKING
UNIT II  QUALITY OF SERVICE  9
QoS taxonomy - Resource allocation - Scheduling - Queuing disciplines - Delay Analysis - Integrated services - Differentiated services - RSVP.

UNIT III  MPLS AND VPN  9

UNIT IV  OPTICAL NETWORKS  9
Photonic Packet switching - WDM network design - Introduction to optical networks - optical layer - SONET/SDH - Optical packet switching - Client layers - Signaling protocols and network operation.

UNIT V  SOFTWARE DEFINED NETWORKING  9
Introduction to SDN - Network Function Virtualization - Data Plane- Control Plane - SDN software stack - Data center Traffic Management

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Gain an understanding of advanced networks concept.
- Describe the principles behind the enhancement in networking.
- Know the recent development in networks.

TEXT BOOKS:

REFERENCES:

IT7003  AGENT BASED INTELLIGENT SYSTEMS  L T P C
3 0 0 3

OBJECTIVES:
- The structure of agents
- The learning mechanisms of agents
- The communication and cooperation within agents
- The design of agents

UNIT I  INTRODUCTION  9
Agents as a paradigm for software engineering - Agents as a tool for understanding human societies - Intelligent Agent: Agents and Objects - Agents and Expert Systems - Agents as Intentional Systems - Abstract Architectures for Intelligent Agents - How to Tell an Agent What to Do
UNIT II LEARNING IN AGENTS

UNIT III COMMUNICATION AND COOPERATION IN AGENTS
Software tools for ontology - OWL - XML - KIF - Speech acts - Cooperative Distributed Problem Solving - Task Sharing and Result Sharing - Result Sharing - Combining Task and Result Sharing - Handling Inconsistency - Coordination - Multi agent Planning and Synchronization

UNIT IV DEVELOPING INTELLIGENT AGENT SYSTEMS
Situated Agents: Actions and Percepts - Proactive and Reactive Agents: Goals and Events - Challenging Agent Environments: Plans and Beliefs - Social Agents - Agent Execution Cycle - Deciding on the Agent Types - Grouping functionalities - Review Agent Coupling - Acquaintance Diagrams - Develop Agent Descriptors

UNIT V APPLICATIONS

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Implement a computational agent with various searching techniques.
- Apply the reasoning mechanisms of proposition and predicate logic to agents.
- Use the learning mechanisms for an artificial agent.
- Execute different communication and co-operation methodologies in a multi-agent setup.

TEXT BOOKS:

REFERENCES:

IT7004 C# AND .NET PROGRAMMING

OBJECTIVES:
- To cover all segments of programming in C# starting from the language basis, followed by the object oriented programming concepts
- To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET
- To introduce advanced topics namely data connectivity, WPF, WCF and WPF with C# and .NET 4.5
- To implement mobile applications using .Net Compact Framework
UNIT I  C# LANGUAGE BASICS
.Net Architecture - Core C# - Variables - Data Types - Flow control - Objects and Types- Classes and Structs - Inheritance- Generics – Arrays and Tuples - Operators and Casts - Indexers

UNIT II  C# ADVANCED FEATURES
Delegates - Lambdas - Lambda Expressions - Events - Event Publisher - Event Listener - Strings and Regular Expressions - Generics - Collections - Memory Management and Pointers - Errors and Exceptions - Reflection

UNIT III  BASE CLASS LIBRARIES AND DATA MANIPULATION

UNIT IV  WINDOW BASED APPLICATIONS, WCF AND WWF
Window based applications - Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services - .Net Remoting - Windows Service - Windows Workflow Foundation (WWF) - Activities - Workflows

UNIT V  .NET FRAMEWORK AND COMPACT FRAMEWORK

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
• Write various applications using C# Language in the .NET Framework
• Develop distributed application using .NET Framework
• Create Mobile Application using .NET compact Framework

TEXT BOOK:

REFERENCES:

IT7005  CLOUD COMPUTING

OBJECTIVES:
• To learn about the concept of cloud and utility computing.
• To have knowledge on the various issues in cloud computing.
• To be familiar with the lead players in cloud.
• To appreciate the emergence of cloud as the next generation computing paradigm.
UNIT I  INTRODUCTION  

UNIT II  VIRTUALIZATION  

UNIT III  CLOUD ENABLING TECHNOLOGIES AND INFRASTRUCTURE  

UNIT IV  RESOURCE MANAGEMENT AND SECURITY IN CLOUD  

UNIT V  PROGRAMMING MODELS  

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
• Articulate the main concepts, key technologies, strengths and limitations of cloud computing. Identify the architecture, infrastructure and delivery models of cloud computing.
• Explain the core issues of cloud computing such as security, privacy and interoperability.
• Choose the appropriate technologies, algorithms and approaches for the related issues.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- Learn about the statistical modeling and classification for NLP
- Learn the basic techniques of information retrieval
- Know about the basics of text mining
- Learn the generic issues in speech processing and applications relevant to natural language generation

UNIT I  NATURAL LANGUAGE PROCESSING  9

UNIT II  INFORMATION RETRIEVAL  9
Information Retrieval architecture - Indexing - Storage - Compression techniques - Retrieval approaches - Evaluation - Search Engines - Commercial search Engine features - comparison - Performance measures - Document processing - NLP based Information Retrieval - Information Extraction - Vector Space Model

UNIT III  TEXT MINING  9
Categorization : Extraction based Categorization - Clustering - Hierarchical clustering - Flat Clustering - Document classification and routing - Finding and organizing answers from text search - Categories and clusters for organizing retrieval results - Text Categorization - Efficient summarization using lexical chains - Pattern extraction

UNIT IV  GENERIC ISSUES  9

UNIT V  APPLICATIONS  9
Machine translation - Transfer metaphor - Interlingua and statistical approaches - Discourse processing - Dialog and conversational agents - Natural language generation - Surface Realization and discourse planning.

OUTCOMES:
On Completion of the course, the students should be able to:
- Develop applications related to speech processing
- Develop applications related to text mining

TEXT BOOKS:
REFERENCES:

IT7007 COMPUTER FORENSICS L T P C
3 0 0 3

OBJECTIVES:
- To introduce the concept of Computer Forensic and Investigations
- To know about the principles of evidence collection and management
- To learn about the types of attacks and remedial actions in the context of systems, networks, images and video.

UNIT I INCIDENT AND INCIDENT RESPONSE

UNIT II FILE STORAGE AND DATA RECOVERY

UNIT III NETWORK AND EMAIL FORENSICS

UNIT IV SYSTEM FORENSICS

UNIT V IMAGE AND VIDEO FORENSICS
Image encryption and decryption –Steganography – Fraud using image and video – Detection of Fraud in images and video.

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Able to recognize attacks on systems
- Design an counter attack incident response
- To plan and implement counter-attacks
- To use Forensic tools and collect evidences of a computer crime.
TEXT BOOKS:

REFERENCES:

IT7008 E-LEARNING TECHNIQUES

OBJECTIVES:
- To gain knowledge about modern technology for learning.
- To be acquainted with e-Learning Tools.
- To learn technologies involved in e-learning application development.
- To become aware of the current business potential of e-learning based business.

UNIT I INTRODUCTION

UNIT II DESIGN
Identifying and organizing course content-Needs analysis- Analyzing the target audience-Identifying course content-Defining learning objectives-Defining the course sequence-Defining instructional, media, evaluation and delivery strategies-Defining instructional methods, Defining the delivery strategy, Defining the evaluation strategy. Instructional design – Design issues – Types of learning engagements – Blended learning – Team – Infra structure – Vendor relationships

UNIT III CREATING INTERACTIVE CONTENT

UNIT IV WEB BASED TRAINING

UNIT V LEARNING METHODOLOGY

TOTAL: 45 PERIODS
OUTCOMES:
On Completion of the course, the students should be able to:

- Work with technologies involved in e-Learning Applications.
- Design and Develop e-Learning Application and working with e-Learning tools.

TEXTBOOKS:

REFERENCES:

IT7009 GAME PROGRAMMING

OBJECTIVES:
- To know the mechanics and logic of Game design
- To train the students to acquire knowledge in game modeling techniques
- To acquire knowledge about the issues in game design
- To gain skill in game engine development

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING
Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation

UNIT II GAME DESIGN PRINCIPLES
Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding

UNIT III GAMING ENGINE DESIGN
Renderers, Software Rendering, Hardware Rendering, and Controller based animation, Spatial Sorting, Level of detail, collision detection, standard objects, and physics

UNIT IV GAMING PLATFORMS AND FRAMEWORKS
Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DX Studio, Unity

UNIT V GAME DEVELOPMENT
Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

TOTAL: 45 PERIODS

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

- Have knowledge on the concepts and techniques used in Game design
- Design and model interactive game.
- Design and implement algorithms and techniques applied to Game design
REFERENCES:

IT7010
HETEROGENEOUS COMPUTING

OBJECTIVES:
- To learn about the development of massively parallel systems
- To learn about the challenges in heterogeneous processing systems
- Learn to program heterogeneous systems
- Learn to provide effective parallel solutions for GPGPU architectures

UNIT I
PARALLEL COMPUTING BASICS

UNIT II
SHARED MEMORY PROGRAMMING WITH OpenMP
OpenMP program structure - OpenMP Clauses and directives – Scheduling primitives – Synchronization primitives – Performance issues with caches - Case study – Tree Search

UNIT III
PROGRAMMING GPUS
GPU architectures - Data parallelism - CUDA Basics – CUDA program structure - Threads, Blocks, Grids - Memory handling

UNIT IV
PROGRAMMING WITH CUDA
Parallel patterns – Convolution – Prefix sum – Sparse matrix-vector multiplication – Imaging case study

UNIT V
OTHER GPU PROGRAMMING PLATFORMS
Introduction to Open CL – Open ACC – C++AMP – Thrust – Programming Heterogeneous clusters – CUDA and MPI

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Identify parallelism in an application
- Choose the right parallel processing paradigm for a given problem
- Devise solutions for an application on a heterogeneous multi-core platform
- Program using CUDA and Open MP
TEXT BOOKS:

REFERENCES:

IT7011 INTELLECTUAL PROPERTY RIGHTS L T P C 3 0 0 3

OBJECTIVES:
- To learn about the patents processing system
- To be familiar with copyrights and IPR related issues

UNIT I INTRODUCTION TO IPR 9

UNIT II CLASSIFICATIONS OF IPR 9

UNIT III INTERNATIONAL TREATIES ON IPR 9

UNIT IV INDIAN IPR LEGISLATIONS 9

UNIT V IPR IN ELECTRONICS AND INFORMATION TECHNOLOGY 9
IPR in Electronics & Information Technology -Case Studies on – Patents pertaining to Electronics & Information Technology – Software patents International scenario – Patent & Copyright Protection for software& Electronic inventions - IPR in Electronics and Information Technology.

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- File patents for their innovations.
- Distinguish between legal procedures for patents and copyrights.
TEXT BOOKS:

REFERENCES:

IT7012 INTERNET OF THINGS

OBJECTIVES:
- To learn about the fundamentals of Internet of Things
- To build a small low cost embedded system using Arduino/ Raspberry Pi or equivalent boards
- To apply the concept of Internet of Things in real world scenario

UNIT I FUNDAMENTALS OF IOT
Introduction-Characteristics - Physical design - Protocols-Logical design - Enabling technologies - IoT levels-Domain specific IoTs - IoT vs M2M

UNIT II IOT DESIGN METHODOLOGY
IoT systems management - IoT design methodology-Specifications - Integration and Application Development

UNIT III IOT COMPONENTS
Sensors and activators - Communication modules - Zigbee-RFID-Wi-Fi-Power sources.

UNIT IV BUILDING IOT WITH HARDWARE PLATFORMS
Platform - Arduino/Intel Galileo/Raspberry Pi- Physical device - Interfaces - Programming - APIs/Packages - Web services.

UNIT V CASE STUDIES AND ADVANCED TOPICS
Various Real time applications of IoT-Connecting IoT to cloud-Cloud storage for IoT-Data Analytics for IoT- Software & Management Tools for IoT.

TOTAL:45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Design a portable IoT using Arduino/Equivalent boards and relevant protocols
- Develop web services to access/control IoT devices
- Deploy an IoT application and connect to the cloud
- Analyze applications of IoT in real time scenario
TEXT BOOK:

REFERENCES:

IT7013 MOBILE APPLICATION DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES:
- To learn the characteristics of mobile applications.
- To learn about the intricacies of UI required by mobile applications.
- To study about the design aspects of mobile application.
- To learn development of mobile applications.

UNIT I INTRODUCTION 9

UNIT II USER INTERFACE 9

UNIT III APPLICATION DESIGN 9

UNIT IV APPLICATION DEVELOPMENT 9

UNIT V TOOLS 9

TOTAL:45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- To design and implement the user interfaces for mobile applications.
- To design the mobile applications that is aware of the resource constraints of mobile devices.
- To develop advanced mobile applications that accesses the databases and the web.
- To develop useful mobile applications in the current scenario using Google Android and Eclipse simulator.
TEXT BOOKS:

REFERENCES:
1. Professional mobile Application Development paperback, 2012 Jeff Mcherter (Author), Scott Gowell (Author), Wiley India Private Limited
6. Pro iOS TableVs: for iPhone, iPad and IPod Touch Paperback, 2012, Tim Duckett, Apress
10. Android App Development for Young Adults & The Rest of US Paperback, 2015, Paula Beer, Carl Simmons.

IT7014 NETWORK PROGRAMMING AND MANAGEMENT LTPC 3 0 0 3

OBJECTIVES:
- To learn the basics of socket programming using TCP Sockets.
- To learn about Socket Options
- To learn to develop Macros for including Objects In MIB Structure
- To have knowledge on SNMPv1 and SDN concepts.

UNIT I SOCKETS AND APPLICATION DEVELOPMENT 9
Introduction to Socket Programming - System Calls - Address conversion functions - POSIX Signal Handling - Server with multiple clients - Boundary conditions - Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown - I/O Multiplexing - I/O Models - TCP echo client/server with I/O Multiplexing.

UNIT II SOCKET OPTIONS 9
Socket options - getsockopt and setsockopt functions - Generic socket options - IP socket options - ICMP socket options - TCP socket options - Multiplexing TCP and UDP sockets - SCTP Sockets - SCTP Client/server - Streaming Example - Domain name system - gethostbyname, gethostbyaddr, getservbyname and getservbyport functions - Protocol Independent functions in TCP Client/Server Scenario.

UNIT III ADVANCED SOCKETS 9
IPv4 and IPv6 interoperability - Threaded servers - Thread creation and termination - TCP echo server using threads - Mutex - Condition variables - Raw sockets - Raw socket creation - Raw socket output - Raw socket input - ping program - trace route program.
UNIT IV SIMPLE NETWORK MANAGEMENT

UNIT V SOFTWARE DEFINED NETWORK

OUTCOMES:
On Completion of the course, the students should be able to:
- Implement Client/Server communications using TCP and UDP Sockets
- Describe the usage of Socket Options for handling various Sockets in programming
- Learn about handling Raw sockets
- Learn the functionalities of SNMP and MIB structure
- Articulate network engineering principles and implementation of SDN.

TEXT BOOKS:

REFERENCES:

IT7015 PATTERN RECOGNITION L T P C
3 0 0 3

OBJECTIVES:
- To know about supervised and unsupervised Learning.
- To study about feature extraction and structural pattern recognition.
- To explore different classification models.
- To learn about fuzzy pattern classifiers and perception.

UNIT I PATTERN CLASSIFIER

UNIT II CLUSTERING
Clustering for unsupervised learning and classification – Clustering concept – C Means algorithm – Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION
UNIT IV  HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE  9

UNIT V  RECENT ADVANCES  9
Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception.

TOTAL: 45 PERIODS

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

- Classify the data and identify the patterns.
- Extract feature set and select the features from given data set.

TEXT BOOKS:

REFERENCES:

IT7016  PROGRAMMING WITH OPEN SOURCE SOFTWARE  L T P C
3 0 0 3

OBJECTIVES:
- To learn about the various Linux distributions.
- To learn the programming practices in FOSS
- To explore Linux embedded device
- To acquire the knowledge of open source programming using embedded Linux device.

UNIT I  INTRODUCTION TO LINUX BASED DISTRIBUTIONS  9
Philosophy - licences - Distributions - Desktop environments - Bash commands - Files and file systems - Partitions- Installing software - Configuration

UNIT II  PROGRAMMING TECHNIQUES AND PRACTICES  9
Programming using python - GUI development - Menu and toolbar - Layout management - event-dialog - widget - Programming practices - Documentation - use of version control system in FOSS

UNIT III  OVERVIEW OF AN EMBEDDED LINUX DEVICE  9
Peripherals - Choice of distribution and installation - commands - files and file systems - configuration - game programming

UNIT IV  WEB PROGRAMMING USING EMBEDDED LINUX DEVICE  9
Web server - Linux - Apache - Mysql - Php - Content management systems - adding content - text - images - components, modules and plugin- development of a sample content management site.
UNIT V  INTERFACE WITH OTHER HARDWARE
Basic Inputs and outputs - Scheduling commands with Cron - installing and testing GPIO with python- Expansion boards - Prototyping boards

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Work in the linux environment and contribute to free and open source software
- Implement content management systems
- Install and configure linux os distribution in embedded devices that support linux
- Build simple hardware projects using embedded linux devices

TEXT BOOK:

REFERENCES:
1. Philosophy of GNU URL: http://www.gnu.org/philosophy/
3. Introduction to Linux – A Hands on Guide. URL: http://tldp.org/guides.html
UNIT IV  ONTOLOGY MANAGEMENT AND TOOLS  

UNIT V  APPLICATIONS  

TOTAL :45 PERIODS

OUTCOMES:  
On Completion of the course, the students should be able to:
- Create Ontology for a given domain.
- Develop an application using ontology languages and tools.
- Design and develop web service applications using semantic portals.

TEXT BOOKS:

REFERENCES:

IT7018  SERVICE ORIENTED ARCHITECTURE  
OBJECTIVES:
- To learn the concepts of distributed application development
- To differentiate XML based web services from other standard models
- To study the importance of service composition
UNIT I  SOA FUNDAMENTALS  

UNIT II  SERVICE-ORIENTED ANALYSIS AND DESIGN  

UNIT III  SERVICE COMPOSITION  
Service Composition with REST - Fundamental Service Composition with REST - Advanced Service Composition with REST - Service Composition with REST Case Study - Design Patterns for SOA with REST - Service Versioning with REST - Uniform Contract Profiles

UNIT IV  RESTFUL SERVICES AND THE RESOURCE-ORIENTED ARCHITECTURE  

UNIT V  SOA TRANSACTION AND SECURITY  
SOA and performance - SOA and security – Service Management - Model driven service deployment – Establishing SOA and SOA governance

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Analyze and design SOA based solutions
- Create RESTful and SOAP based services
- Define workflow automation and develop BPM based applications

TEXT BOOKS:
1. Nicolai M.Josuttis, SOA in design - The art of distributed system design, O'REILLY publication, 2007.
3. Leonard Richardson and Sam Ruby, RESTful Web Services, O'REILLY publication, 2007.

REFERENCE:
OBJECTIVES:
- To gain knowledge about social networks, its structure and social network data sources
- To learn the analysis and mining techniques for Social networks
- To study about the semantic technologies for social network analysis
- To gain knowledge on Visualization of Social networks and its applications

UNIT I  INTRODUCTION

UNIT II  SOCIAL NETWORK ANALYSIS
Introduction to Social networks profiles – types of commercial social network profiles (CSNP) - Quantitative and Qualitative Analysis of CSNPs – Analysis of social networks extracted from log files - Data Mining Methods Related to SNA and Log Mining - Clustering Techniques – Case study.

UNIT III  SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS

UNIT IV  SOCIAL NETWORK MINING
Detecting and discovering Communities in Social Networks - Definition of Community - Evaluating Communities - Methods for Community Detection – divisive, spectral and modularity optimization algorithms - Applications of Community Mining Algorithms - Overview of tools for Detecting Communities - Understanding and Predicting Human Behavior for Social Communities.

UNIT V  VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- To apply knowledge for current web development in the era of Social Web
- To model and represent knowledge for Semantic Web
- To design extraction and mining tools for Social networks
- To develop personalized visualization for Social networks

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To develop an awareness of the need for project planning and management
- To learn about the stages in the software development lifecycle and associated activities.
- To know about the procedures needed to schedule, monitor and control the project.
- Discuss and where appropriate apply the principles of project risk management.
- Understand the key concepts relating to managing projects.
- Create and schedule tasks and add project constraints and deadlines.
- Assign costs and learn about different effort estimation techniques.
- View the critical path, monitor progress and reschedule work.

UNIT I   FUNDAMENTALS
Conventional software management - Evolution of software economics - Improving software economics - Conventional Vs Modern software project management.

UNIT II  SOFTWARE MANAGEMENT PROCESS FRAMEWORK
Lifecycle phases - Artifacts of the process - Model based software architectures - Workflows of the process - Checkpoints of the process.

UNIT III SOFTWARE PROCESS MATURITY MODELS

UNIT IV  SOFTWARE EFFORT ESTIMATION

UNIT V   SOFTWARE RISK AND PEOPLE MANAGEMENT

OUTCOMES:
On Completion of the course, the students should be able to:
- Know about software Economics.
- Discuss about software process models: their advantages and disadvantages.
- Discuss about software estimation techniques.
- Know activity planning techniques.
- Have project planning skills.
- Have Project scheduling and risk evaluation skills.
- Have Professional skills.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To introduce the basics and necessity of Software testing
- To provide various testing techniques along with concepts of Software bugs and its impact
- To develop and validate a test plan
- To design and choose test cases
- To prepare testing policies and standards and make use of automation tools

UNIT I  OVERVIEW OF SOFTWARE TESTING
Software quality and reliability - Testing and Debugging - Verification and Validation - Test metrics
- Test plan – Test-generation strategies - Static testing - Model based testing and Model checking
- Saturation effect - Defect management - Origins of defects - Cost of defects - Defect classes - Defect repository and Test design.

UNIT II  TEST CASE DESIGN AND SELECTION
Design strategies - Black box approach - Random testing - Boundary value analysis - State based testing - Cause-effect graphing - User documentation testing - Domain testing - White box approach - Test adequacy criteria - Code functional testing - Coverage and control flow graphs - Covering code logic – Scaffolding - Generic Vs specific scaffolding - Test Oracles - Self-checks as Oracles - Capture and replay.

UNIT III  EXECUTION OF ADEQUACY TEST
Process: Test and analysis activities - Quality process - Planning and Monitoring - Testing - Improving the process - Organizational factors - Integration testing strategies - Testing components and assemblies - System testing - Acceptance testing - Usability - Regression testing - Regression test selection techniques - Test case prioritization.

UNIT IV  TEST MANAGEMENT
Organization structures for testing teams - Test plan components and attachments - Locating test items - Test management tools: HP ALM/Quality center, qTest, PractiTest, TestRail and TestLink - Reporting test results - Role of three groups in test planning and policy development - Test specialist - Skills - Building a testing group.

UNIT V  TEST AUTOMATION
Software test automation - Skills - Scope - Design and architecture for automation - Requirements for a test tool - Challenges in automation – Automated desktop application testing tools: Sikuli Script -web testing tools: Wind Mill and SOAPUI- GUI testing tools: Test Complete, Test Studio and eggplant – Android application testing tools: Robotium, Ranorex and Appium.

TOTAL : 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- An insight to Software Testing will be obtained
- Have knowledge about the role of software tester and aware of automated testing tools
- Emphasis on maintaining documentation for testing will be understood

TEXT BOOKS
REFERENCES:

IT7022 VISUALIZATION TECHNIQUES

OBJECTIVES:
- To learn about the importance of data visualization.
- To know the different types of visualization techniques.
- To create various visualizations.

UNIT I INTRODUCTION

UNIT II FOUNDATIONS FOR DATA VISUALIZATION
Visualization stages – Experimental Semiotics based on Perception Gibson’s Affordance theory – A Model of Perceptual Processing – power of visual perception-Types of Data-visualization and data objects.

UNIT III COMPUTER VISUALIZATION
Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces – Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data – Interacting with visualization.

UNIT IV MULTIDIMENSIONAL VISUALIZATION

UNIT V CASE STUDIES
Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis

OUTCOMES:
On Completion of the course, the students should be able to:
- Compare various visualization techniques.
- Design creative visualizations.
- Apply visualization over different types of data.

TEXT BOOKS:
REFERENCE:

OBJECTIVES:
- To learn about the issues in the design of wireless sensor and mesh networks
- To learn about the working of protocols in different layers of sensor and mesh networks
- To expose the students to different aspects in sensor and mesh networks

UNIT I FUNDAMENTALS OF WSN AND WMN
Introduction and overview of WSN-Basic wireless sensor technology-Operating systems for WSN-Applications of WSN-Comparison between Ad hoc and mesh networks-Challenges and design issues in wireless mesh networks-Applications of WMNs.

UNIT II TRANSMISSION LAYER AND MAC LAYER FOR WSN

UNIT III ROUTING AND TRANSPORT LAYER IN WSN
Data dissemination and gathering- Routing challenges and routing strategies in WSNs-Routing strategies in WSN-Transport layer and QoS in wireless sensor networks-Coverage and deployment-Reliable data transport-Single packet delivery-Block delivery-Congestion control and rate control.

UNIT IV TRANSMISSION LAYER AND MAC LAYER FOR WMN
Adaptive coding/modulation and link adaptation-Cooperative diversity and cooperative communications-Multichannel systems-Advanced radio technologies-Design objective and challenges-Advanced MAC protocols for WMNs.

UNIT V ROUTING AND TRANSPORT LAYER IN WMN

TOTAL:45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
- Identify different issues in wireless sensor and mesh networks
- To analyze the protocols developed for sensor and mesh networks

TEXT BOOKS:
# REFERENCES:

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<thead>
<tr>
<th>IT7071</th>
<th>DIGITAL IMAGE PROCESSING</th>
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**OBJECTIVES:**
- To learn about the basic concepts of digital image processing and various image transforms.
- To familiarize the student with the image enhancement techniques
- To expose the student to a broad range of image processing techniques and their applications.
- To appreciate the use of current technologies those are specific to image processing systems.
- To expose the students to real-world applications of image processing.

**UNIT I   FUNDAMENTALS OF IMAGE PROCESSING**
Introduction – Applications of Image Processing - Steps in image processing Applications - Digital imaging system - Sampling and Quantization - Pixel connectivity – Distance measures - Color fundamentals and models - File Formats, Image operations.

**UNIT II   IMAGE ENHANCEMENT AND IMAGE RESTORATION**

**UNIT III   MULTI RESOLUTION ANALYSIS AND COMPRESSION**

**UNIT IV   IMAGE SEGMENTATION AND FEATURE EXTRACTION**

**UNIT V   IMAGE CLASSIFICATION AND APPLICATIONS OF IMAGE PROCESSING**

**TOTAL: 45 PERIODS**

**OUTCOMES:**
On Completion of the course, the students should be able to:
- Implement basic image processing algorithms
- Design an application that uses different concepts of Image Processing
- Apply and develop new techniques in the areas of image enhancement- restoration-segmentation- compression-wavelet processing and image morphology.
- Critically analyze different approaches to different modules of Image Processing.
TEXT BOOKS:

REFERENCES:

IT7072 TCP/IP DESIGN AND IMPLEMENTATION

OBJECTIVES:
• To learn about the design of TCP/IP Protocol structure
• To learn about the implementation of TCP and IP functionalities in the form of data structures
• To learn about how TCP handles input and output with synchronization
• To learn about the importance of timers and how it is managed in a TCP communication.
• To learn about the functionality of ICMP error processing routines.

UNIT I FUNDAMENTALS
Internetworking concepts - IP and datagram forwarding - TCP services - Interactive data flow - Timeout and retransmission - Bulk data flow - Persist timer – Keep-alive timer

UNIT II ARP AND IP
Structure of TCP/IP in OS - Data structures for ARP - Cache design and management - IP software design and organization - Sending a datagram to IP

UNIT III IP ROUTING IMPLEMENTATION
Routing table - Routing algorithms - Fragmentation and reassembly - Error processing (ICMP) - Multicast Processing (IGMP)

UNIT IV TCP I/O PROCESSING AND FSM
Data structure and input processing - Transmission control blocks - Segment format - Comparison - Finite state machine implementation - Output processing - Mutual exclusion - Computing TCP data length

UNIT V TCP TIMER AND FLOW CONTROL
Timers - Events and messages - Timer process - Deleting and inserting timer event - Flow control and adaptive retransmission - Congestion avoidance and control - Urgent data processing and push function

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
• Learn the fundamentals of internetworking
• Have knowledge on the data structures of ARP, IP and TCP software design
• Analyze the routing of packets by routers using its table contents
TEXT BOOKS:

REFERENCE:

MA7359 ALGEBRA AND NUMBER THEORY

OBJECTIVES :
• To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
• To examine the key questions in the Theory of Numbers.
• To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

UNIT I GROUPS AND RINGS
Groups: Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange’s theorem. Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism.

UNIT II FINITE FIELDS AND POLYNOMIALS
Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

UNIT III DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS
Division algorithm- Base-b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

UNIT IV DIOPHANTINE EQUATIONS AND CONGRUENCES
Linear Diophantine equations – Congruence’s – Linear Congruence’s - Applications: Divisibility tests - Modular exponentiation - Chinese remainder theorem – 2x2 linear systems.

UNIT V CLASSICAL THEOREMS AND MULTIPlicative FUNCTIONS
Wilson’s theorem – Fermat’s Little theorem – Euler’s theorem – Euler’s Phi functions – Tau and Sigma functions.

TOTAL: 60 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
• Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
• Demonstrate accurate and efficient use of advanced algebraic techniques.
• The students should be able to demonstrate their mastery by solving non-trivial problems related to the concepts, and by proving simple theorems about the, statements proven by the text.

TEXT BOOKS:
REFERENCES:

MA 7354NUMERICAL METHODS

OBJECTIVES:
- To provide the mathematical foundations of numerical techniques for solving linear system, eigenvalue problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

UNIT II INTERPOLATION AND APPROXIMATION
Interpolation with unequal intervals - Lagrange interpolation – Newton’s divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton’s forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL: 60 PERIODS
TEXT BOOKS:

REFERENCES: