

Department of CSE and IT
Jaypee University of Information Technology, Waknaghat

OUTLINE SYLLABUS

This document contains the outline syllabus for following courses offered in the Department of CSE and IT:

Departmental Courses.

- B.Tech. Courses(Theory- Core Course)
- B.Tech. Courses(Theory- Elective Courses)
- B.Tech. Courses(Labs- Core Courses)
- M.Tech. Courses(Theory- Core Courses)
- M.Tech. Courses(Theory- Elective Courses)
- M.Tech. Courses(Labs- Core/Elective Courses)

Other Department Courses(HSS/ECE/PHY/MATH/ENV).

- Department of HSS Theory Courses
- Department of Mathematics Theory Courses
- Department of Physics and Material Science Engg Theory Courses
- Department of Electronics & Communication Engg Theory Courses
- Department of Civil Engg Theory Courses
- All Other Department Lab Courses.

Departmental Courses

B.Tech. Courses(Theory- Core Course)

1. Introduction to Computer and Programming (10B11CI111)

I Sem (All Branches) Credits-4(3-1)

Basic Computer Architecture. Programming Language hierarchy. Program translation and execution. Algorithms, Pseudo codes and flowcharts. Program design and Basic SDLC. Program as State machine. Basic Testing and Debugging. Number system. Character & Instruction Representation. Structured Programming. Selection. Control Flow. Looping control structure. Arrays and Strings. Pointers. Functions. Structures and Unions. Enumerations. Preprocessor. Iteration. Recursion. Dynamic Memory Allocation. Linked-lists. File I/O. Basic Graphics. C Libraries. User defined header files.

2. Introduction to Computers and Basic Programming(13B21CI121)

I Sem (BT) Credits-4(3-1)

Introduction to Computers, the Internet and the World Wide Web, Bits, Data Types and Operations, The von Neumann Model, Introduction to C programming, C Program Control, C Functions, C Arrays, C Pointers, C Characters and Strings, C Formatted Input/Output, C Structures, Unions, Bit Manipulations and Enumerations, C File Processing

3. Data Structure (10B11CI211)

II Sem (CSE/IT/ICT/ECE/BI) Credits-4(3-1)

Interactive Software. Problem analysis and Data design. Introduction to Complexity

Analysis. Searching and Sorting Algorithms. Algorithm Visualization. Data Representation and Data Types. Abstract Data Types. Array based, Linked, Indexed, and Simulated pointer based storage. Orthogonal Lists. Sparse matrices. List of list. Doubly linked lists.

Stack. Recursion removal. Queue. Dequeue. Buffer. Discrete event simulation. Tree. Binary Tree. K-ary Tree. BST. Tree traversal. Quad Tree, Octree. Graphs and graph traversal.

4. Basic Data Structure(14B21CI211)

II Sem (BT) Credits-4(3-1)

Introduction to Data Structures, Abstract Data Type (ADT), Arrays and Strings, Structures, Recursion, Pointers, Dynamic memory allocation, Algorithm Design, Scalability, Introduction to Complexity Analysis , Big O Notation, Relationship between time complexity and hardware performance, Linked Lists:- ADT type, Linear List , Linear Linked list, doubly linked list, circular linked list, header, Linked list, various implementations and applications of Linked Lists, Stack: ADT type, specifications, array based and linked list based, recursion and its removal with stack . Queues:- ADT type, array based and linked list based,, queue as buffer, searching, Circular queues, Deque, Managing multiple queues, , various implementations and applications of Queues, Binary Trees:- Introduction to non-linear data structures, ADT type, array based and linked list based, binary tree, binary search tree, AVL tree, tree traversal, Sorting Algorithms: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Searching:- Linear and Binary Search Hashing:- Hash table, Graphs: - ADT type, array based and linked list based, graph traversal algorithms i.e. Breadth First & Depth First, various implementations and applications of graphs.

5. Object Oriented Programming (10B11CI311)

III Sem (CSE/IT), II Sem (ICT) Credits-4(3-1)

Interactive Software. O-O paradigm. Objects, Classes, Methods, Constructors and Destructors. Complex classes. Object-oriented Analysis. File Handling. Friend Functions and Static member functions. Inheritance. Multiple Inheritance. Polymorphism and Virtual Functions. RTTI and Casting types in C++. Function and Operator overloading in C++. Namespace and Templates in C++. STL and Container classes. AWT, Swing and Applet. Concept of Packages and Class path. Interfaces in JAVA. Exception Handling in C++ and JAVA. Basic object oriented testing.

6. Database Systems (10B11CI312)

III Sem (CSE/IT/ICT) Credits-4(3-1)

Database driven Interactive software. Database Environment. Relational Model. Relational Algebra, SQL. PL/SQL. ER & EER Modeling. Normalization. Database Connectivity. Transactions. Concurrency. Recovery & Security. Query Processing & Optimization.

7. Database Management Systems (13B22CI321)

III Sem (ICT) Credits-4(3-1)

Overview of Database management systems, Introduction to database design, The Relational Model, Relational Algebra and Calculus, SQL: Queries, Constraints, Triggers, Normalization, Database Application Development, Internet Database Environment, Object oriented Data management, Database Administration, Database design and tuning, Storage and Indexing, Transaction Management

8. Microprocessor and Controllers (10B11CI401)

IV Sem(CSE/ICT), V Sem (ECE) Credits-4(3-1)

Introduction to 8086 based Microprocessor and Microcontrollers. Architecture. Addressing modes. Structure of machine instruction, Instruction set, Hardware specification. Programming the microprocessors and microcontroller. Memory interface. I/O interfacing. 8255 PPI, 8254 counter timer, 8259 Interrupt controller. 8237 Direct memory access and DMA controlled I/O. 16550 USART Serial data communications. Introduction to Embedded systems. 8051 microcontroller interfacing.

9. Computer Organisation (10B22CI421)

IV Sem (IT) Credits-4(3-1)

Introduction to Structured computer organization. Review of digital components. Register transfer and microoperations. Instruction codes, computer instructions, timing & control, instruction cycle, Classification of instruction set. Instruction format. Addressing modes. Assembly Language Programming. Microprogrammed Control. Program control, CISC and RISC. Computer Arithmetic. I/O organization and Memory organization. Pipelining and Multiprocessors. Performance Analysis.

10. Fundamental of Algorithms (10B11CI411)

IV Sem (CSE/IT) VI Sem (ICT) Credits-4(3-1)

Review of Data Structure. Analyzing algorithm, designing algorithm. Growth of functions. Recurrences, divide and conquer algorithms, substitution method for solving recurrences, dynamic programming, greedy algorithm, backtracking. Decision tree, game tree. Index trees – IBST, TBST, AVL, and B Trees. Heaps. Graph algorithms - minimum spanning tree, shortest path, Hamiltonian cycle. String matching. Basic computational geometry.

11. Compilers and Assemblers

IV Sem (ICT) Credits-4(3-1)

Overview of Assemblers and Compilers, Lexical and Syntax analysis, Context free grammars, Top down parsing – Backtracking, LL (1), recursive descent parsing, Predictive parsing, Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing, handling ambiguous grammar, Semantic analysis and Symbol Tables, Code Generation & optimization

12. Operating Systems (10B11CI511)

V Sem(CSE/IT/ICT) Credits-4(3-1)

Introduction. Operating system structure (Monolithic systems, Layered systems, Virtual machines. Client-Server model). Process Management (IPC, RPC, Classical IPC problems). Process scheduling. Processor Allocation (Allocation Model, Design issues for processor allocation algorithms). Threads. Deadlock. Security. Memory Management. File System management. Input output management. Disk scheduling. Network OS. Distributed Operating Systems. Case Study of UNIX.

13. Software Engineering (10B11CI512)

V Sem(CSE/IT) Credits-4(3-1)

Interactive Systems. Usability. Software process models. PSP, TSP. Requirement Engineering, SRS. Formal system development techniques. Analysis and Modeling. Software Architecture and Design. UML. Software Estimation. Software Metrics. COCOMO model. Putnam Model .Coding standard and practices. Software Testing. Software Maintenance. CASE Tools.

14. Software Engineering Practices (13B22CI521)

V Sem(ICT) Credits-4(3-1)

Review of Software Engineering, Software Product, Process Improvement Framework, Software Process Models, Software Engineering Practice, Requirements Engineering, Design Engineering, Software Architecture, Component based Software, Engineering, User Interface Design, Software Construction, Case Study, Software Verification, Validation & Testing, Service Oriented Software Engineering, Software Metrics and Software, Reliability, Software Cost Estimation, Software Project Management, Web Engineering, Agile software Methodologies, Aspect Oriented Software, Development, Case Study

15. Theory of computation (10B11CI513)

V Sem(CSE) Credits-4(3-1)

Mathematical foundations for TOC, Finite Automata. Finite Automata with output. Regular languages. Pumping Lemma. Context free languages. Push down Automata. Turing Machines. Universal Turing Machines and LBAs .Halting Problem. Reducibility. Polynomial Time Algorithms and Non Deterministic Polynomial Time Algorithms.

16. Web Application Engineering (10B22CI521)

V Sem(IT), VI Sem(ICT) Credits-4(3-1)

Web enabled interactive software. Database driven websites. Online Games. Basic Web Architecture. Web Server. Application server. Markup Languages - SGML, HTML, XML and XHTML, DHTML. Cascading Style Sheets. Web Development Life Cycle. Java Script.

PHP. JDBC. Java Applets. Multi Threading. AWT. Layout Managers. Graphics in PHP, Java, and XML. XML DTD, Schema Definition Language. XSLT, XQUERY, and XPATH. DOM and SAX parsers.

17. Software Testing And Debugging(10B1WCI515)

V Sem(CSE/ IT) Credits-4(3-1)

Economics of Program Testing, Test Management & Software Development, Software Quality Assurance, ETVX Model, Testing Maturity Model, and Testing Life Cycle, Testing V-Model, Test Planning & Control, Test Completion Criteria, and Designing Test case templates, Static Software Testing & Techniques, Test Case Design, Black Box Testing, Equivalence Class Testing, Boundary Value Analysis, Decision Table Based Testing, Cause Effect Graphic Technique, Experience based techniques, State based or graph based testing, White Box testing, Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing, Fault Injection, Module Testing:, Higher Order testing, Object Oriented Testing, Web /GUI/Internet testing, Program Instrumentation, Debugging Techniques, Taxonomy of Bugs, Bug Life Cycle.

18. Fundamental of Algorithms for BI (10B11CI412)

V Sem (BI) Credits-4(3-1)

Review of Data Structure. Analyzing algorithm, designing algorithm. Growth of functions. Recurrences, divide and conquer algorithms, substitution method for solving recurrences, dynamic programming, greedy algorithm, backtracking. Decision tree, game tree. Index trees – IBST, TBST, AVL, and B Trees. Heaps. Graph algorithms - minimum spanning tree, shortest path, Hamiltonian cycle. String and sequence matching. Basic computational geometry.

19. Computer Networks (10B11CI611)

VI Sem(CSE/IT) Credits-4(3-1)

Network classification. Computer network examples. Layering concept of network. OSI network model and functions of layers. Data Link, Network, transport, session, presentation & application layers. Internet Protocols. TCP/IP suite. Local area networks. Other protocols. Basic performance issues. Network Standards.

20. Information Systems (10B22CI621)

VI Sem(IT) Credits-4(3-1)

Information System Theory & Modeling. Information system volatility & resources. Domain specific Information systems. Domain Analysis. Human Computer Interface. Decision Theory. Decision Support Systems. Information System effectiveness matrix. E-Governance. Governance enterprise architecture. Supply chain. Transaction Processing Systems. Functional Area Applications. Enterprise Resource Processing. E-Commerce. CRM. Basic GIS.

21. Data Mining (10B22CI622)

VI Sem(IT/ICT) Credits-4(3-1)

Introduction. Data Warehouse Software Engineering: Requirement Analysis, Data modeling, Design, Project Management, Building, and Testing. Hypothesis testing. Online analytical Process models. Query Access Architectures. Extraction Transformation Loading. OLAP. Data warehouse security. Metadata. Data mining Models. Statistical Data mining. Classification Techniques. Clustering Techniques. Association Rules.

22. Compiler Design (10B11CI612)

VI Sem(CSE) Credits-4(3-1)

Introduction. Lexical Analysis. Syntax Analysis. Top down and Bottom-up Parsers. Semantic Analysis. Symbol Table Management. Storage Management. Error Handling. Code Optimization. Code Generation.

23. Computer Organisation and Architecture (10B11CI613)

VI Sem(CSE), III Sem(ICT) Credits-4(3-1)

System level design, Register level design, Processor level design. Advanced data representation. Instruction set architecture level. Data-path Design. Hardwired control unit, micro-programmed control unit, pipeline control unit. Structured Memory Design. Bus System. System control. I/O Control. Performance analysis. Processor array. Multi-computer and Multi-processor.

24. Object Oriented Systems and Programming (10B11CI614)

VI Sem (ECE) Credits-4(3-1)

Interactive database driven software. Database Environment. Relational Model. SQL. PL/SQL. ER & EER Modeling. Normalization. Database Connectivity. Transactions Processing. 3-tier Architecture. O-O paradigm. Objects, Classes, Methods, Constructors and Destructors. File Handling. Friend Functions and Static members functions. Inheritance. Polymorphism and Virtual Functions. Interfaces in JAVA. Exception Handling in C++ and JAVA. Basic principals of Software engineering. System analysis, design, testing and debugging.

25. Computer Graphics (11B1WC1611)

VI Sem(CSE), V Sem(ICT) Credits-4(3-1)

Computer representation of image, Graphics programming , User – computer interface, Components of Graphics Systems, Output primitives, Area filling, Windowing and clipping, 3D object representation, 3D Transformation & viewing, Hidden surface and Hidden line, Illumination models and shading

26. Computer and Communication Networks (13B11C1615)

VI Sem(ICT) Credits-4(3-1)

Network architectures, protocol layers, service models, Application layer protocols such as HTTP, FTP, and SMTP, Peer-to-Peer File Sharing Protocols and Architectures, ISPs and Domain name systems, Socket API and network socket programming, Understanding reliable and unreliable transport-layer protocols, GBN and SR. TCP and UDP. Port numbers, Multiplexing and demultiplexing, Flow control and congestion control, Fairness, Delay, jitter, and loss in packet-switched networks, Bandwidth, throughput, and quality-of-service, Network layer services and protocols, Switching fabric, Routing and forwarding, Queues and buffering, Virtual-circuit and datagram networks, Internet protocol, IPv4 and IPv6, Tunneling, LS and DV algorithms, Routing in the Internet, RIP, OSPF, and BGP, Broadcast and multicast, Handling mobility, Understanding network layer services and protocols, Link-layer and its services, Ethernet, hubs, bridges, and switches, Link-layer addressing, Error-detection and error-correction, Parity, check-summing, CRC, Manchester encoding. ATM and MPLS, Local area networks and IEEE 802.11 wireless LANs, Multiple-access protocols, Random access, Efficiency of pure and slotted ALOHA. CSMA, CSMA/CD, and CSMA/CA, physical-layer services and systems and media, Coax, fiber, twisted pair, DSL, HFC, WiMax, cellular, satellite, and telephone networks, Bit transmission, Frequency division multiplexing, Time division multiplexing.

27. JAVA Programming (10B11CI614)

VI Sem (ICT) Credits-2(2-0)

Java Fundamentals: Java I/O streaming, filter and pipe streams, Byte Code interpretation, Applets, Graphics, Event Handling, Multithreading. Java Beans and Swings: Bean concepts, Events in bean box, Bean customization, Persistence, Application deployment using swing, Advanced swing techniques, JAR file handling. Network Programming in Java: Sockets, secure sockets, custom sockets, UDP datagrams, multicast sockets, URL classes, Reading Data from the server, writing data, configuring the connection, Reading the header, telnet application, Java Messaging services. Applications in Distributed Environment: Remote method Invocation, activation models, RMI custom sockets, Object Serialization – RMI – IIOP implementation – CORBA – IDL technology – Naming Services – CORBA programming Models, JAR file creation. Multi-Tier Application Development: Server side programming, Servlets, Java Server Pages, Applet to Applet communication, applet to Servlet communication, JDBC – Applications on databases, Multimedia streaming applications, Java Media Framework. Enterprise Applications: Server Side Component Architecture – Introduction to J2EE – Session Beans – Entity Beans – Persistent Entity Beans.

28. Data Analysis and Simulation Techniques(16B22CI6211)

VI Sem(IT) Credits-4(3-1)

Introduction: Simulation Language, Overview of Basic Approaches: Monte Carlo Simulation, Queuing Network Simulation, Quasi-continuous Simulation, Discrete-event Simulation, Applications, Data Definition and Analysis Techniques : Elements, Variables,

and Observations, Levels of Measurement, Selecting Analytical Techniques, Evaluating the Analysis, and Observations.

Statistical Hypothesis Generation and Testing: Null and Alternate Hypotheses, Statistical Significance, Rejecting the Null Hypothesis, Problems with Statistical Significance, Types of Statistical Error, Guarding Against Statistical Error. Chi Square Test: Chi-Square Test, Chi-Square Test for Goodness of Fit, Performing a Goodness of Fit Test in Excel, Cross Tabulations and the Chi-Square Test for Independence, Performing a Test for Independence with Crosstabs in Excel. Correlation: Correlation, Obtaining a Correlation Matrix with the Analysis ToolPak. Simulation Basics: Basic Concepts: System, Attribute, State, Event, Process, Activity, Time, Parallelism, Model, Basic Mechanisms: Time Advance, Scheduling, Alternative Models: Activity, Process, Others. Stages of Simulation Model Development: Problem, System Analysis, Data Collection, Fitting Distributions to Data: Parameter Estimation, Goodness-of-Fit, Iterative Prototyping, Statistical Instrumentation, Verification, Validation Emphasized, Inference. Abstract Representation Techniques: Activity-cycle Diagrams, State-Transition Diagrams, Petri Nets. Random Number Distributions: Sources of Randomness, Random Number Generation, Random Variates: From Distribution Functions, From Empirical Data Evaluation of Simulation Modeling: Ethical Issues in Simulation, Benefits of Simulation, Limitations of Simulation. Introduction to simulators:- Introduction to some popular simulator :- ns2. Matlab or omnet++, simulation projects.

B.Tech. Courses(Theory- Elective Courses)

1. Cryptography and Network Security Techniques(10B1WCI735)

VII Sem (CSE/IT/ECE/BI) Elective Credits-3(3-0)

Network security, security system model, ITU TX-800, mathematical foundations for security, Classical cipher techniques, Block ciphers: DES, AES, stream ciphers, block cipher modes of operation, RC4, confidentiality, Key management for symmetric ciphers, public key cryptosystems, RSA, Diffie Hellman key exchange algorithm, elliptic curve cryptography, message authentication, hash and mac algorithms, digital signatures and authentication protocols, Kerberos, x.509, PKI, e-mail security, IP Sec, SSL, Web security, intruders, malicious software, Intrusion detection, firewalls.

2. Biometric Recognition Techniques (12B1WCI732)

VII Sem(CSE / IT) Elective Credits-3(3-0)

Biometric Authentication Systems, Commonly used Biometrics, Biometric characteristics Biometric Recognition: Verification /Identification, System Errors, System Evaluation, System Performance, Fingerprint Recognition, Sensing, Analysis, Representation, Matching, Classification and Indexing, Synthetic Fingerprint Generation, Fingerprint Individuality, Securing Fingerprint Systems, fingerprints databases. Face Recognition, Iris Recognition, Hand Geometry Recognition and Advances in Biometrics- Multibiometric

systems, Information Fusion, Biometric standards, Social and Cultural Implications, Ocular Biometrics, Remote Biometrics, Machine Learning Techniques for Biometrics, Inverse Problems of Biometrics, Biometric Data Analysis.

3. Artificial Intelligence (10B1WCI731)

VII Sem (CSE/IT) Elective Credits-3(3-0)

Introduction to Artificial Intelligence and Systems, Intelligent Agents: The Concept of Rationality, Solving Problems by Searching-Uninformed Search and Informed Search, Beyond Classical Search - Heuristics, Logical Agents, First-Order Logic, Knowledge Representation Techniques in Artificial Agents, Planning, Learning from observation, Knowledge in Learning, Expert Systems.

4. Advanced Java Programming (12B1WCI733)

VII Sem (CSE/IT/ECE/BI) Credits-3(3-0)

Java Applets. Graphics. Event handling. Multithreading. Graphic User Interface. Remote Method Invocation. Activation. Object serialization. Distributed garbage collection. Bean concepts. Events in bean box. Bean customization. Persistence. Application. Deployment using swing. Advanced swing techniques. JAR file handling. Servlets. Java Server Pages. JDBC. Session beans. Entity beans. Programming and deploying enterprise Java Beans. Java transactions.

5. Principles of Programming Languages (10B1WCI736)

VII Sem (CSE / IT) Credits-3(3-0)

Programming language introduction, history, syntax and Semantics, compilation and interpretation, structured programming, procedure activations, object - oriented programming, functional programming, lambda calculus, map-reduce functional programming model for data-intensive processing, concurrent and parallel programming, event – driven programming, script languages, exception handling, memory management, case studies – Java, PHP, LISP, Scheme, Prolog.

6. Software Agents (11B1WCI731)

VII Sem (CSE/IT) Credits-3(3-0)

Introduction to Software Agents; Abstract architectures for agents; Multi Agent Decision-Making, Agent Oriented Software methodologies like Prometheus, Gaia, Agent UML and others, Using Prometheus Design Tool (PDT), Developing Multi Agent Systems using JACK, Standards for Agent Development like FIPA; Agent Communication Standards; Agent Support technologies

7. Graph Algorithms and Applications(10B1WCI733)

VII Sem (CSE/ IT) Credits-3(3-0)

Graph Representation, Applications to Theoretical Computer Science, Applications of: Connectivity, Traversability, Trees, Matchings, Partitionings, Coverings, Colourability, Planarity, Digraphs, Flows.

8. Information Retrieval & Data Mining(11B1WCI832)

VII Semester (CSE) Credits-3(3-0)

Introduction to Data Mining, Data Preprocessing, Data Generalization, Data Warehousing, and On-line Analytical Processing, Association Rule Mining and Frequent Patterns, Classification and Prediction, Cluster Analysis, Introduction to Information Retrieval, Boolean Retrieval, Probabilistic Information Retrieval, Support Vector Machines, Pattern Matching Algorithm, Link Analysis.

9. Image Processing(10B1WCI737)

VII Sem (CSE/IT/ECE) Credits-3(3-0)

Digital Image Fundamentals, Image Transforms, Image Enhancement, Image Restoration, Image Compression, Image Segmentation, Representation and Description, Recognition and Interpretation, Elements of Image Analysis, Pattern and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

10. C# and VB.NET(12B1WCI734)

VII Sem(CSE/IT/ECE/BI) Credits-3(3-0)

Introduction to .NET framework. Features of VB.NET. Common Language Runtime. Versioning.Objects and Components.Namespaces.Data Access with ADO.NET .Windows forms.Web Controls.Data binding.Mobile Application development.C# introduction. Objects and Types. Inheritance. String and Regular expressions.Localization , Deployment and Manipulating XML. Working with Active directory.

11. Parallel Computing Algorithms (11B1WCI833)

VIII Sem (CSE/IT/ICT) Credits-3(3-0)

Introduction to Parallel Computing. Principles of Parallel Algorithm Design. Basic Communication Operations. Analytical Modeling of Parallel Systems. Programming Using the Message Passing Paradigm. Programming Shared Address Space Platforms. Dense Matrix Algorithms. Sorting Algorithms for Parallel Computers. Graph Algorithms. Search Algorithms for Discrete Optimization Problems. Dynamic Programming

12. Cloud Computing (12B1WCI731)

VIII Sem (CSE / IT/ICT) Credits-3(3-0)

Cloud computing – Definition, Terminologies, architecture and service models, utility computing, grid computing, cluster computing and Google cluster architecture, data – intensive computing concepts, MapReduce and graph algorithms, Apache Hadoop, Google's PageRank algorithm and its implementation with MapReduce, virtualization

technology, Xen hypervisor, server virtualization, desktop virtualization, storage virtualization, workloads and software infrastructure for a datacenter, datacenter hardware, energy and power efficiency in a datacenter, Mobile cloud computing, disaster recovery in cloud, security and privacy issues with cloud computing, case studies – Google File System (GFS), Google BigTable Data Storage system, Amazon EC2 and S3, Microsoft's Azure.

13. E-Commerce(11B2WCI851)

VIII Sem (CSE/IT) Credits-3(3-0)

Web site engineering methods and processes to support e-commerce development. Web site engineering life cycle and user-centered design, site goals, business models, value propositions, user analysis, information architecture, interface and navigation design, usability guidelines, database, testing, hosting strategies, usage metrics, and collaborative development. Technologies for e-commerce, shopping cart, digital payments, promotion strategies, and security issues. Building fully functional Web sites using database and client- and server-side technologies.

14. Parallel Processing(11B1WCI834)

VIII Sem(CSE/IT) Credits-3(3-0)

Models of Parallel Computing, Interconnection networks, Basic Computing and Communication Primitives, Performance Modeling, Dense Matrix Algorithms, Searching and Optimization: Dynamic Programming, Branch and Bound, Backtrack, Sorting, Graph Algorithms, Fast Fourier Transforms.

15. Embedded Systems and Applications(11B1WCI831)

VIII Sem (CSE/IT) Credits-3(3-0)

Introduction to Embedded systems. ARM Overview and its architecture. ARM instruction set. Processor cores. Memory Hierarchy. Architectural Support for OS. ARM CPU cores. Free Scale Microcontrollers and its Applications, Application development for embedded systems.

16. Network Management(11B1WCI836)

VIII Sem(CSE/IT/ECE/BI) Credits-3(3-0)

SNMP and OSI NM standards and technologies, SNMPv1,SNMPv2,SNMPv3, RMON, ATM networks and management, TMN network management, Broadband access network technologies and their management, NM tools and systems, Web based NM systems.

17. Storage Networks(11B1WCI835)

VIII Sem(CSE/IT) Credits-3(3-0)

Data proliferation, storage infrastructure, Information Lifecycle Management,Technologies for Storage Networks,Disk Subsystems, Architecture of Intelligent Disk, JBOD,RAID, RAID Levels, Hot Sparring, Hard Disks and Internal I/O Channels, Caching,Acceleration of

Hard Disk Access, I/O Techniques, DAS, SAN, NAS, IP SAN elements, standards (iSCSI, iFCP, mFCP, FCIP and iSNS), Migration from SCSI and Fibre Channel to IP storage, Network attached Storage: elements & connectivity, Management of Storage Network Management Interfaces, Standardized and Proprietary Mechanisms, In-band & Out-band Management, Storage Virtualization, Symmetric & Asymmetric Storage virtualization, Performance of SAN virtualization, scaling storage with virtualization.

18. Simulation Techniques(14B1WCI831)

VIII Sem(CSE/IT) Credits-3(3-0)

This course introduces some of the core tools used to analyze data and simulation techniques including model design and development, comparison to analytical models, input data preparation, random number generation, output statistical analysis, and model validation. Using these techniques, students will: model real-world systems, implement the model as a computer program, and evaluate the performance of real-world systems by analyzing the output of the model under various conditions.

19. Intelligent System Architecture and Design(15B1WCI832)

VIII Sem(CSE/IT) Credits-3(3-0)

This course will provide students with all the information they need to design and create their own Internet of Things (IoT) applications using the Arduino platform. More specifically, they will learn: 1. About the Internet of Things and Cloud Computing concepts About open platforms that allow students to store their sensor data on the Cloud (like Cosm, Nimbits and many more) 2. The basic usage of Arduino environment for creating their own embedded projects at low cost 3. How to connect their Arduino with their Android phone and send data over the Internet 4. How to connect their Arduino directly to the Internet and talk to the Cloud 5. How to reprogram their Arduino microcontroller remotely through the Cloud.

20. Service Oriented Architecture(13B1WCI831)

VIII Sem(CSE/IT) Credits-3(3-0)

SOA and Web Services represent a groundbreaking evolution in distributed computing. The concepts are not altogether new, but the application of them, and the unanimous acceptance of core standards like HTTP, XML, SOAP, WSDL, BPEL and UDDI, has paved the way for XML based web services and service-oriented architecture. Students are introduced to the core standards that enable Web Services, and are required to apply this knowledge through a series of design and programming exercises in a hands-on lab. These exercises involve SOA design, computer programming, system installation and testing. Service oriented architecture as a step towards cloud computing. Cloud computing paradigm is growing in popularity. A 'good' cloud computing solution provides hardware-as-a-service, infrastructure-as-a-service, platform-as-a-service, software and applications as-a-service, security-as-a-service, cloudlets and cluster computing as-a-service, high-performance computing as-a-service, and so on. Students will learn how to construct and secure a private cloud computing environment based on open source VCL

solutions, and how to federate it with external clouds, such as public EC2 offering, and some other solutions. Performance, security, cost, usability and utility of cloud computing solutions will be studied both theoretically and in a hands-on lab.

21. Mobile Computing(15B1WCI731)

VII Sem (CSE/IT)

Introduction to the emerging technology • Architecture • Installation Setup • The Activity Class • The Intent Class • Permissions • Creating the UI • Storing and Retrieving Data • User Notifications • Broadcast Receivers • Networking • Location and maps • Sensors. Introduction to Windows Operating Systems • Architecture • Installation Setup • Introduction to XAML • Understanding the Navigation Model • Understanding the apps lifecycle and managing states • Building UI • Sensors • Storing and Retrieving data. Mid Sem project demo . WiFi • Physical Layer • Channel Coding • How the physical layer works • Link Layer MAC Protocols • Link Adaption Protocols • Energy Efficiency in WiFi • Cellular Systems. Mobile IP • Mobility in Network Layer • Internet protocols for Mobile Applications • Single Hop Mobility • Mobile IP and Issues.

22. Big Data Analytics(15B1WCI833)

VIII Sem (CSE/IT)

Hadoop (Implementation specific), Mining of Massive Data Sets, Hadoop Ecosystem: Advanced MapReduce Techniques, Relational View with Hive, Programming with Pig, Programming with Oozie, Programming with HBase & Zookeeper, . Cloud Deployment, . Case Studies.

B.Tech. Courses(Labs- Core Courses)

1. C Programming Lab(10B17CI171)

I Sem (All) Credits-2

Basic Programming, Programs on Control Structures, Functions, Arrays, Pointers, Strings and Characters, Structure and Unions and File I/O.

2. Basic Computer Programming Lab(10B17CI281)

I Sem (BT) Credits-2

Introduction to C programming , Structured Program Development in C , Flowchart and Algorithm , C Program Control , C Functions , C Arrays, C Pointers, C Characters and Strings, C Structures, Unions, Bit Manipulations and Enumerations, C File Processing.

3. Data Structures Programming Lab (10B17CI271)

II Sem (CSE/IT/ICT/ECE/BI/BT/BTDD) Credits-2

Arrays and Strings, Structures, Recursion, Pointers and Dynamic memory allocation, Operations on Linear Linked List, Doubly and Circular Linked List (Creation, insertion, deletion, sorting, traversing, reversing etc), Operations on Stacks (Creation; pushing; popping; testing underflow, overflow; prefix and postfix), Operations on Queues (Creation; enqueue; dequeue; testing underflow, overflow), Operations on Tree or BST

(Creation; Traversing like pre-order, post-order and in-order; Searching element; finding height etc.), Implementation of Insertion Sort and Selection Sort Algorithm with arrays using dynamic memory allocation, Implementation of Bubble Sort and Merge Sort Algorithm with arrays using dynamic memory allocation, Implementation of Radix Sort and Quick Sort Algorithm with arrays using dynamic memory allocation, Operation on Heaps and Heap Sort, Implementation of Linear Search Algorithm and Binary Search Algorithm using dynamic memory allocation, Operations on Graphs (Creation; entering info; printing Output and deleting; traversal of BFS and DFS algorithm etc.)

4. Basic Data Structures and Computer Programming Lab(14B27CI271)

II Sem (BT) Credits-2

Getting acquainted with Arrays and Strings, Structures, Recursion, Pointers and Dynamic memory allocation, Operations on Linear Linked List, Doubly and Circular Linked List Creation, insertion, deletion, sorting, traversing, reversing etc, Operations on Stacks Creation; pushing; popping; testing underflow, overflow; prefix and postfix) , Operations on Queues (Creation; enqueue; dequeue; testing underflow, overflow), Operations on Tree or BST (Creation; Traversing like preorder, post-order and in-order; Searching element; finding height etc.), Implementation of Insertion Sort and Selection Sort Algorithm with arrays using dynamic memory allocation. Implementation of Bubble Sort and Merge Sort Algorithm with arrays using dynamic memory allocation. Implementation of Radix Sort and Quick Sort Algorithm with arrays using dynamic memory allocation. Operation on Heaps and Heap Sort, Implementation of Linear Search Algorithm and Binary Search Algorithm using dynamic memory allocation. Operations on Graphs (Creation; entering info; printing.

5. Object-Oriented Programming Lab (10B17CI371)

II Sem (ICT), III Sem CSE/IT, IV Sem BI Credits-1

Review of Structured programming in C, Objects, Classes, Methods, Constructors and Destructors, File Handling in C++, Friend Functions, Static members function, Complex Objects and Classes, Inheritance and its form and Multiple Inheritance in C++, Polymorphism and Virtual Functions in C++, Function and Operator overloading in C++, RTTI, Namespace, STL and Templates in C++ , Object-Oriented Concepts in Java.

6. Database Systems Lab (10B17CI372)

III Sem(CSE/IT) Credits-1

The Databases System lab provides a basic overview about what databases are, how they should be designed and how to query them. It provides an introduction to SQL -- a language used to query and manage databases. The list of experiments includes: ER Model, Enhanced ER Model, Relational Model, Various Normal Forms, Creating a table, Deleting a table, Creating indexes on tables, Changing the schema of the table, Applying primary key and foreign key constraints on a table, Inserting data into table, Query data from the table, Updating data into the table, Deleting data from the table, Modification of

data into the table, Applying the access control methods, Aggregate functions, Sub queries, and PL/SQL.

7. Database Management Systems Lab (13B22CI381)

III Sem(ICT) Credits-1

E-R Modelling, Relational Algebra by hand written queries, SQL Queries, Operations on Relations-I in Algebra and SQL, Operations on Relations-II in Algebra and SQL, Database application development (Java), Programming with JDBC, Functional Dependencies and Normalization, SQL views, Programming – embedded SQL

8. Multimedia Development Lab-I(10B28CI408)

III Sem (ECE/ ICT) Credits-1

Introducing the Flash Interface, Layer Folders & Properties, Creating New Layers & Moving Items between Layers, Basic Animation Techniques, Keyframes and Frames concepts for various motion objects.

9. Multimedia Development Lab-3(13B22CI382)

III Sem (ICT) Credits-2

Introducing the Flash Interface, Layer Folders & Properties, Creating New Layers & Moving Items between Layers, Basic Animation Techniques, Keyframes and Frames concepts for various motion objects. Animation and motion graphics, cutting and splitting videos, adding effects, arranging clips, graphic importation and conversion, Creating Movie Clips, import graphics from other applications, work with text, use layers and frames, use masks, import Video

10. Unix Lab (10B17CI307)

III Sem (CSE/IT/ICT), IV Sem (ECE) Credits-1

UNIX Diversion: UNIX System Kernel and Utilities, File & Directions, Single & Compound Statement Command Library and Include files. UNIX System Administration: File System Mounting & Unmounting, System Booting, Shutting Down, Handling User Account, Backup, Recovery, Security, Terminals, Printer and Modem. Different Tools & Debugger: System Development Tool, Lint, Make, SCCS (Source Code Control, system), UNIX Shell and Network Programming: Bourne Shell, Korn Shell and C shell. Shell Meta characters, Shell Variable and Scripts, Facilities and Command, Environment, Integer Arithmetic and String Manipulation. Basic Client Server Program and Network Programming

11. Algorithms Lab(10B17CI471)

IV Sem(CSE/IT), VI Sem(ICT) Credits-1

Introduction to TIME.H library. Computing time of basic exponential program for large prime number, euclids algorithm, Implementation of sorting algorithms and comparison of their time graph, Iterative Approach, Divide and Conquer Approach, Implementation of

searching algorithms and comparison of their time graph Advanced Search Trees, Adjacency matrix and list, implementation for large graph, Implementation of graph algorithms and comparison of their time graph, Implementation of real problems using dynamic programming and comparison of time graph between with and without dynamic programming. Greedy Algorithms, Implementation of NP algorithms for small inputs, Backtracking, Branch and Bound Approach, String Matching Algorithms.

12. Computer Organisation Lab(10B28CI481)

IV Sem(IT) Credits-1

8086 Assembly programming using MASM, Interrupts, String manipulations, Arithmetic operations, implement a 8086 assembler in C/C++ and Java.

13. Microprocessor and Controllers Lab (10B11CI407)

IV Sem(CSE), V Sem (EC) Credits-1

Exploring Register Architecture through Debug, 8086 Assembly programming for MASM611, DOS I/O interrupts, Video I/O Interrupts, String manipulation, Arithmetic operations, Program Control instructions, File I/O, Menu Structures, High precision Computation, Application development, I/O device interfacing.

14. BI Algorithms Lab(10B17CI472)

V Sem (BI) Credits-1

Introduction to TIME.H library. Implementation of sorting algorithms and comparison of their time graph, Iterative Approach, Divide and Conquer Approach, Implementation of genetic searching algorithms and comparison of their time graph Adjacency matrix and list, implementation for large graph, Implementation of graph algorithms and comparison of their time graph, Implementation of real problems in bioinformatics using dynamic programming and comparison of time graph between with and without dynamic programming. String and sequence matching algorithms, Matrix computation and microarray data handling.

15. Software Testing And Debugging Lab (10B17CI701)

V Sem (CSE/ICT) Credits-1

Revision of Java Programming, Introduction to Eclipse, Developing Black Box Testing Test cases, Boundary Value Analysis, Developing White Box Testing Test cases, Generating CFG, Computing McCabe Cyclomatic Complexity, Designing Unit Test Cases, performance testing, Fault Injection, Regression Testing, test case Prioritization, Web Testing, load Testing, GUI Testing.

16. Web Technology Lab (10B28CI581)

V Sem (CSE & IT) Credits-1

Basic HTML Concepts- Frame, Table, Form, Image Positioning, Implementation of CSS in/with HTML, Java Script, JAVA, DHTML, XML, XHTML, Server Side Scripting Languages- PHP and JSP.

17. Software Engineering Lab(10B17CI572)

V Sem CSE& IT Credits-1

Software Project Management, Requirement Engineering, Analysis Modeling and Design, UML Tools, Software Architecture, User Interface Design, Software Metrics, Reengineering, Project.

18. Operating Systems Lab(10B17CI571)

V Sem (CSE& IT) Credits-1

Design and implementation of an operating system, basic operations, OS subsystems, process management, processes, threads, CPU scheduling, synchronization, and deadlock, memory management, segmentation, paging, swapping, file systems. The course programming assignments are in C.

19. Object-Oriented Systems and Programming Lab (10B17CI674)

VI Semester (ECE) Credits-2

Unified Modeling Language: (Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, Activity Diagrams), Objects, Classes, Methods, Constructors and destroying objects in C++ , Friend Functions, Static data and member functions, const data and functions, inline functions, Inheritance in C++ and Java, File Handling in C++ and Java, Polymorphism and Abstract classes in C++ and Java, Interfaces and Packages in JAVA, Exception Handling in C++ and Java, SQL, PL/SQ Database Connectivity

20. Data Mining Lab (10B22CI622)

VI Sem (IT) Credits-1

Pattern Search, Mean, Median, Mode and Standard Deviation Computation, Redundancy Analysis: Correlation Analysis, Normalization Techniques: Min-Max, Z-Score and Decimal Scaling Normalization, Noise Removal using Binning: Mean, Mode and Min-Max Bin, PCA (Principal Component Analysis), Single and Multiple Linear Regression, Bayes Classification, Iterative Dichotomiser 3, K-means Clustering.

21. Computer Networks Lab(10B17CI671)

VI Sem (CSE/ICT) Credits-1

Socket programming, Network Representation, Topology, MAC, Routing, TCP, UDP, Application Layer, Network security, Project.

22. Computer Graphics Lab(11B1WCI671)

VI Sem(CSE &ICT) Credits-1

Setting the VC++ environment for OpenGL, Architecture of OpenGL as a Renderer , Related APIs GLUT (Graphics Language Utility Toolkit), Display-Window Management, Initialization Functions, Setting size, position, colors, displaying mode, Writing a simple displaying function, Drawing Primitives Points, Lines, Polygons, Animation & Event Handling using Mouse and KeyBoard, Line & Circle Drawing Algorithms, Line Slope Intercept, DDA, Bresenham, Circle Drawing Algorithms, Direct equation, Midpoint Algorithm, 2D Transformation, OpenGL Transformation, 3D Shapes in OpenGL.

23. Compiler Design Lab (10B17CI672)

VI Sem (CSE) Credits-1

Implmeting programs for generating token, lex ckecking on LEX, Implementing programs for parser genrator, syntax checker on YACC, combining LEX and YACC programs to implement scientific calculator, creating symbol table, optimizing code, implementing mini compiler.

24. System and Network Programming Lab(10B17CI673)

VI Semester(CSE) Credits-2

TCP/IP using Berkley Sockets, Client/server models, protocols, processes, threads, Semaphores programming. Designing and implementation of network applications, WIN32 programming, UNIX programming.

25. Data Analysis and Simulation Techniques Lab (16B28CI681)

VI Semester(IT) Credits-1

A laboratory course designed to provide a hands-on introduction to the development and application of simulation. Topics include an introduction to one or more discrete event simulation tools, common modelling constructs, data gathering and input data modelling, design of simulation experiments, output data analysis, and verification and validation. The design and implementation of a series of increasingly complex simulations of various discrete event systems are conducted.

26. Information Systems Lab(10B28CI681)

VI Sem(ICT) Credits-1

Introduction to advanced JAVA programming, Introduction to Netbeans IDE, designing and developing Servlets, MySQL database connectivity with servlets, JSP, JSP database connectivity, EJB 3.0, developing session beans, developing entity beans, Introduction to J2ME, Developing Android applications, developing a mini project uses above technologies.

27. Multi Media Lab-2(10B28CI683)

VI Sem(IT) Credits-1

Animation and motion graphics, cutting and splitting videos, adding effects, arranging clips, graphic importation and conversion, Creating Movie Clips, import graphics from other applications, work with text, use layers and frames, use masks, import Video.

28. Computer and Communication Networks Lab(13B28CI684)

VI Sem(ICT) Credits-1

Network Socket Programming using C/Java, Multi-threaded Web Server, E-Mail Client, UDP Pinger, Web Proxy Server, Reliable Transport Protocol, Packet Sniffer Lab Experiments, Exploring HTTP, Exploring DNS, Exploring TCP, Exploring UDP, Exploring ICMP, Exploring Ethernet and IEEE 802.3.

29. JAVA Programming Lab(13B28CI685)

VI Sem (ICT) Credits-2

Classes and Objects. Inheritance. Polymorphism. Packages. Interfaces. Wrapper Classes. Strings and Characters. Exception Handling, Multithreaded Programming. I/O in Java.. Applets. Event Handling. Abstract Windowing Toolkit, Swings. Network Programming.

30. Web Application Engineering Lab (13B28CI686)

VI Sem (ICT) Credits-1

Basic HTML Concepts- Frame, Table, Form, Image Positioning, Implementation of CSS in/with HTML, Java Script, JAVA, DHTML, XML, XHTML, Server Side Scripting Languages- PHP and JSP.AJAX, JOOMLA, Cake PHP, Wordpress, Drupal, Magento.

31. High Performance Computing Lab (13B28CI771)

VII Sem (ICT) Credits-1

CUDA programming, code optimizations, performance evaluation.

32. Net Centric System Programming Lab (13B28CI871)

VIII Sem (ICT) Credits-1

Servlets, JSP,RMI, Hibernate, Struts, Netbeans, Android,EJB, Ajax, Silver Light

M.Tech. Courses(Theory- Core Courses)

1. Advanced Data Structure (10M11CI111)

I Sem (CSE) , I Sem Elective (ECE) Credits-4(3-1)

Dynamic optimality,Splay trees, Tango tree, Advance dictionary data structures Skip lists, Cuckoo hashing, Locality sensitive hashing, Bloom filter, Multi-dimensional data structures, K-d tree, Oct-tree, R-Tree, Geometric data structures, orthogonal range

queries, range trees, interval trees, segment trees, ray shooting and partition trees, External memory/cache-oblivious models, B-trees, ordered-file maintenance, list labeling, order queries, priority queues, Distributed data structures, distributed hash table, distributed trees, distributed stack and distributed lists, Streaming data structures, synopsis, sketches, histogram, fingerprint, wavelets and sliding windows.

2. Advanced Computer Networks (10M11CI112)

I Sem(CSE) Credits-4(3-1)

Review of computer Networks. IPv6. Security issues in IPv6. TCP/IP details. Voice over IP. Real time communication protocols. High speed local and wide area networks. Virtual networks. Network security. Broadband networks. Introduction to intelligent networking. Performance analysis of networks.

3. Advanced Database Systems(10M11CI113)

I Sem (CSE) Credits-4(3-1)

Review of Database systems. Web-enabled database systems. Storage and file structures. Indexing and Hashing. Query Processing. Query Optimization. Object oriented DBMS. Extended relational model. Distributed Databases. Active Databases. Temporal Databases, Spatial Databases. Multimedia databases. Deductive Databases. Emerging databases technologies.

4. High Performance Computer Architecture (10M11CI114)

I Sem(CSE), III Sem Elective (ECE) Credits-4(3-1)

Performance analysis and scalability. Modeling performance. Pipelined Systems. Interconnection networks. Processor array. Multicomputers. Multiprocessors. Systolic Array. Vector processor. Structured memory design for parallel systems – symmetric shared, distributed shared and synchronization. Parallel Programming Concepts and Design Patterns Theoretical Analysis of Parallel Algorithms , Amdahl's law, Memory Hierarchy Models, Communication Models, CUDA Hardware, CUDA Programming, CUDA Threading Model, CUDA Communication and Memory Model, CUDA Performance Monitoring and Optimizations.

5. Fundamentals of Algorithms and Statistical Analysis(11M12CS111)

I Sem (CB) Credits-4(3-1)

Review of Data Structure. Analyzing algorithm, designing algorithm. Growth of functions. Recurrences, divide and conquer algorithms, substitution method for solving recurrences, dynamic programming, greedy algorithm, backtracking. Decision tree, game tree. Index trees – IBST, TBST, AVL, and B Trees. Heaps. Graph algorithms - minimum spanning tree, shortest path, Hamiltonian cycle. String and sequence matching. Basic computational geometry.

6. Advanced Algorithms (10M11CI211)

II Sem (CSE), IV Sem Elective (ECE) Credits-4(3-1)

Review of Algorithms. Algorithm correctness and efficiency. Growth of functions. Algorithm analysis methods, recurrences, divide and conquer, backtracking, dynamic programming. Sorting. Search pruning. Heuristic methods. NP – completeness. Matrix operations. String matching. Computational geometry. Approximation algorithm. Linear programming.

7. Advanced OS (10M11CI212)

II Sem (CSE), II Sem Elective (ECE) Credits-4(3-1)

Review of OS principles. Synchronization mechanisms. Process deadlocks. Resource models. Theoretical foundations. Inherent limitations of distributed operating systems. Event ordering. Timestamps. Distributed mutual exclusion. Token and non-token based algorithms. Comparative performance analysis. Concurrency control. Agreement protocols for handling processor failures. Coordination of processes and related algorithms. Failure handling and recovery mechanisms. Multiprocessor operating systems and related thread handlings.

8. Advance Software Engineering (10M11CI213)

II Sem (CSE) Credits-4(3-1)

Review of software Engineering. PSP.TSP. Usability. Agile Methods. Agile Development. Iterative Scrum. Extreme Programming. Unified Process. Evolution. Requirements engineering. Meta Modeling. Software Architecture and Design Patterns Software Metrics and Software Reliability. Testing Strategies. Planning and Automated Testing. Aspect Oriented Programming (AOP).

9. Multimedia Systems(10M11CI214)

II Sem (CSE/ECE) Credits-4(3-1)

Introduction. Multimedia Data Encoding (Audio, Image, Video, and Animation). Quality of Service. Multimedia Operating Systems: Process Management. Inter-process Communication and Synchronization. Memory Management. Device Management. Media Server Architecture and Storage Management. Networks Services, Protocols, Layers, and Synchronization.

M.Tech. Courses(Theory- Elective Courses)

1. System and Network Security Techniques(09M11CI421)

I Sem CSE Credits-3(3-0)

Introduction to System security, network security, security system model, ITU TX-800, mathematical foundations for security, classical cipher techniques, Block ciphers: DES,

AES, stream ciphers, block cipher modes of operation, RC4, confidentiality, Key management for symmetric ciphers, public key cryptosystems, RSA, Diffie Hellman key exchange algorithm, elliptic curve cryptography, message authentication, hash and mac algorithms, digital signatures and authentication protocols, Kerberos, x.509, PKI, e-mail security, IP Sec, SSL, web security, intruders, malicious software, firewalls.

2. Data and Communication Network Management(11M1WCI231)

II Sem CSE Credits-3(3-0)

Review of Data and communication networks, Network management concept and models, ASN.1, SNMPv1, SNMPv2, SNMPv3, RMON, ATM network management, TMN, Access network management, Network management tools and applications, Web based network management.

3. Advanced Image Processing Techniques(09M31CI422)

III Sem M.Tech CSE Credits-3(3-0)

Digital Image Representation, Steps in Image Processing, Sampling and quantization, neighbors, connectivity, Distance measures, Imaging Geometry. Image Transforms, Image Enhancement, Image Restoration, Image Compression, Image Segmentation, Representation and Description, Applications , JPEG 2000

4. Advanced Storage Networks(09M31CI423)

III Sem CSE Credits-3(3-0)

Storage I/O Techniques, DAS, SAN, NAS, RAID, RAID levels, Derived RAID levels, RAID controller, Data Protection and Restoration, Consistency, Data management, B2D, VTL, Snapshots, Data Deduplication, CDP, Backup replication, Storage Virtualization, Symmetric & Asymmetric Storage virtualization, Performance of SAN virtualization, scaling storage with virtualization, Data Center design, Architecture, Structure, Energy use, characteristics, heat removal, Green Data centers, Data center transformation, File Systems, Clustering, Snapshots & Clones, File tiering, SSDs and file systems, Distributed Storage Networks, Architecture, Protocols, Business Continuity & Disaster recovery, Risk assessment and analysis, Vulnerability,

5. Performance Evaluation of Networks(11M1WCI432)

IV Sem CSE Credits-3(3-0)

Mathematical foundations for performance evaluation, Random variables, probability distributions, expected value, Important distributions, Queuing Systems, High performance networks, multistage ATM switches, Performance Evaluation Parameters, QOS, Availability, Reliability, Packet Drop/Data Loss, Latency, Jitter, Throughput, Software overheads, Performance Measures of Different Protocols, Numerical solution of Markov chains, Markov and reliability models for Network system, Performance Enhancement techniques, parallelism, self-routing, modularity, constant delay, in-order

delivery, VLSI implementation, Generation of representative Web workloads for network and server performance evaluation, Capacity planning of servers, proxies and networks.

6. Advanced Web Mining(11M1WCI431)

IV Sem CSE Credits-3(3-0)

Basic Search Engines and information retrieval, Architecture of a Search Engine. Crawling the Web, Directory Crawling, Storing the Documents, Processing Text, From Words to Terms, Text Statistics, Vocabulary Growth, Document Parsing, Tokenizing, Stopping, Stemming, Phrases and N-grams, Inverted indexes, Documents, Counts, Positions, Fields and Extents, Scores, Ordering, Compression. Ranking with Indexes, Abstract Model of Ranking, Link Analysis, Anchor Text, PageRank, Link Quality, Information Extraction, Internationalization, Document Categorization, Naive Bayes, Support Vector Machines and K Nearest Neighbor classifiers, Hierarchical and K-Means Clustering, Evaluation, Evaluation, Semantic web, XML, XML schema, RDF, RDF schema, OWL, Social Search, Social network mining, Web graph mining, opinion mining and sentiment analysis, Searching With Communities, Filtering and, Recommending.

7. Machine Learning(13M1WCI331)

IV Sem CSE Credits-3(3-0)

Introduction, Inductive Classification, The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Decision Tree Learning, Experimental Evaluation of Learning Algorithms, Comparing learning algorithms, Rule Learning: Propositional and First-Order: Translating decision trees into rules. Artificial Neural Networks, Perceptrons, Multilayer networks and back propagation. Overfitting, learning network structure, recurrent networks. Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies. Instance-Based Learning: Case-based learning Clustering and Unsupervised Learning Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabeled data.

8. Distributed Algorithms(13M1WCI332)

IV Sem CSE Credits-3(3-0)

Causality; Ordering of events, Logical Clocks (timestamps), Causal communication; Distributed snapshots; Detecting stable properties; Diffusing computation; Modeling a distributed computation; Expressing correctness properties of a distributed algorithm; Failures in a distributed system; Synchronization; Distributed agreement; Replicated data management; Check-pointing and recovery.

9. Advanced Computational Techniques in Engineering(15M1WCI432)

IV Sem CSE Credits-3(3-0)

Data Distributions, Data Transforms, Fourier, Wavelet and Anamorphic transforms, Gaussian Elimination and Its Variants, Sensitivity of Linear Systems, Vector and Matrix Norms, A Posteriori Error Analysis Using the Residual, Roundoff Errors; Backward

Stability, Propagation of Roundoff Errors , Backward Error Analysis of Gaussian Elimination , The Least Squares Problem, The Discrete Least Squares Problem, Orthogonal Matrices, Rotators, and Reflectors, Solution of the Least Squares Problem, The Gram-Schmidt Process, Geometric Approach, Updating the QR Decomposition, The Singular Value Decomposition, Eigenvalues and Eigenvectors, Systems of Differential Equations, The Power Method and Some Simple Extensions, Similarity Transforms, Reduction to Hessenberg and Tridiagonal Forms, The QR Algorithm, Implementation of the QR algorithm, Use of the QR Algorithm to Calculate Eigenvectors, Eigenspaces and Invariant Subspaces, Subspace Iteration, Simultaneous Iteration, Methods for the Symmetric Eigenvalue Problem, The Generalized Eigenvalue Problem; Iterative Methods for Linear Systems, A Model Problem , The Classical Iterative Methods, Convergence of Iterative Methods , Descent Methods; Steepest Descent, Preconditioners, The Conjugate-Gradient Method, Derivation of the CG Algorithm, Convergence of the CG Algorithm, Indefinite and Nonsymmetric Problems,

M.Tech. Courses(Labs- Core Courses)

1. Software Systems Lab – I(10M17C1171)

I Sem (CSE) Credits-2

UNIX Commands, Shell Programming, Working with files, Working with Makefile and Debugging, Process model, Process environment, Process creation and termination, Process synchronization, Threads, Inter-process communication, pipe and FIFO, Working with Semaphores and shared memory, Socket Programming, Compiler design

2. Objected Oriented Programming Lang Lab(11M12CS173)

I Sem (CB) Credits-2

Objects, Classes, Methods, Constructors and Destructors, File Handling in C++, Friend Functions, Static members function, Complex Objects and Classes, Inheritance and its form and Multiple Inheritance in C++, Polymorphism and Virtual Functions in C++, Function and Operator overloading in C++, RTTI, Namespace, STL and Templates in C++ , Object-Oriented Concepts in Java.

3. Algorithms and Data Analysis Lab(11M12CS172)

I Sem (CB) Credits-2

Algorithms for Computational Biology, TIME.H library. Implementation of sorting algorithms and comparison of their time graph, Iterative Approach, Divide and Conquer Approach, Implementation of genetic searching algorithms and comparison of their time graph Adjacency matrix and list, implementation for large graph, Implementation of graph algorithms and comparison of their time graph, Implementation of real problems in computational biology using dynamic programming and comparison of time graph

between with and without dynamic programming. String and sequence matching algorithms, Matrix computation and microarray data handling.

4. Software Systems Lab – II(10M17CI271)

II Sem (CSE) Credits-2

Windows socket programming, Network Programming, Mini lab project-1 to implement the concept of Socket and Network programming, XML, XML parsing, designing of compiler, Introduction to distributed computing, EJB3.0, Mini lab project-2 to implement the concept of distributed computing.

5. Research software systems Lab(16M17CI172)

PG/Research Scholars

MATLAB Programming, CUDA Programming, Parallel and Concurrent Computing, IOT

Other Department Courses(HSS/ECE/PHY/MATH/ENV)

Department of Mathematics

1. Mathematics-I(10B11MA101)

Sem-I Credits-4

Partial differentiation., Taylors series, Maxima and minima, Jacobians, Double integrals, Equations to a line, plane, curve and surfaces, Line and surface integrals, Gradient, divergence and curl. Normal and tangent to a surface, Gauss and Stokes theorems, Differential Equations with constant coefficients, Laplace Transform, Algebra of matrices, Determinants, Gauss elimination method, Rank, Eigenvalues and vectors, Quadratic forms.

2. Mathematics -II (10B21MA102)

Sem-II Credits-4

Second order linear differential equations, Convergence of series, Solution in series, Bessel and Legendre functions, Chebyshev polynomials, Partial differential equations, Equations of vibrating string, One dimensional wave and heat conduction equations, Functions of a complex variable, Analytic functions, Cauchy-Riemann equations, Conformal mapping, Poles and singularities, Complex Integration, Taylor's and Laurent's series, Cauchy residue theorem and applications.

3. Probability and Statistics (10B31MA104)

Sem-III Credits-4

Classification of data, Measures of central tendency and dispersion. Sample space and events, Axioms of probability, Conditional probability, Baye's theorem, Independent events, Random Variable, Discrete and continuous distributions, Mean and variance of a random variable, Binomial, normal and Poisson distributions, Elementary sampling theory, distribution of means, Statistical decision theory, Test of hypothesis and significance, Chi-square test, Curve fitting by the method of least squares, Correlation and regression, Covariance, Time Series Analysis and Moving Averages.

4. Discrete Mathematics (10B21MA103)

Sem-IV Credits-4

Basics of set theory, Mathematical induction. Relations, Equivalence relation, partial ordered relation, algorithms and functions. Big O notation, Proposition, Basic logical operators, Propositional functions and quantifiers, Graphs and related definitions, Eulerian and Hamiltonian graphs, Trees, Graph colorings. Algebraic expressions and Polish notation, Shortest path. Algebraic Systems. Languages, Finite State Automata and Machines. Grammars, Lattice and Boolean algebra.

5. Probability Theory and Random Processes (10B41MA105)

Elective

Probability, Sample space, Baye's Theorem. One dimensional random variable (discrete and continuous), Bivariate random variables, joint, marginal, and conditional distributions, Covariance and correlation. Characteristic functions, probability distributions, Reliability and hazard rate function. Random processes, Stationary processes. Autocorrelation function, Random walk and Weiner process, Ergodic process, Power spectral density function. Gaussian processes, Poisson processes, Markov chain .

6. Numerical Methods (10B31MA106)

Elective

Solution of linear systems of equations - Direct and iterative methods, Eigenvalues and Eigenvectors, Jacobi and Householder methods, Interpolation and Approximation, Numerical differentiation, Numerical integration, Gauss quadrature. Solution of a single and a system of non-linear equations, Initial and boundary value problems in ODE, Numerical solutions of partial differential equations by finite difference method, Method of weighted residuals (MWR).

6. Biostatistics(10B41MA107)

Elective

Multiple linear regressions, Prediction and estimation, Non parametric tests for the analysis of non-normal data. Classification and clustering of data from different sources, Stochastic processes and applications of Markov Chains in Bio-informatics, The applications of Markov Chains in modeling the DNA sequence, Simple random walk, Brownian motion.

Department of Physics and Material Science Engg

1. Physics-I (10B11PM101)

Sem-I Credits-4

Interference, Diffraction and Polarization , Special theory of Relativity, Lorentz transformations and Mass-Energy equivalence, Laws of Radiation, Compton scattering, Atomic spectra, Angular momenta, Atoms in magnetic field, Classical and Quantum statistical distributions, Principle and working of different types of Lasers.

2. Physics-II (10B21PM102)

Sem-II Credits-4

Gauss's law and applications, Laplace and Poisson's equations, Maxwell's equations, Electromagnetic waves, Propagation of electromagnetic waves in free space and in dielectric media, Laws of Thermodynamics, Carnot's engine, Entropy and information, Clausius Cleyperon equation, Matter waves, Uncertainty principle, Schrödinger equation, Particle in a box, Tunneling through potential barrier, Harmonic oscillator, Bonding, Crystal structure, Band theory, Metals, Semiconductors and Insulators, Electronic conduction, Hall effect.

3. Materials Science (10B61PM105)

Sem-IV Credits-4

Dielectric materials, Polarization mechanisms, Dielectric Loss, Piezoelectricity and its Applications, Magnetic materials, Properties and applications, Magnetic Storage Devices, Polymers and Ceramics, Processing, Properties and Applications, Superconducting materials, Meissner effect, High temperature Superconductors and their applications, Optical fibers, Types of fibers, Light propagation and losses in a fiber, Display Devices and Fluorescent materials, Science of Nanomaterials.

4. Nanoscience and Engineering (10M21PM105)

Review of nanoscience and engineering, Quantum dots, Wires and Wells, Fullerene, Fabrication of nanoparticles and nanotubes by Top-down and Bottom-up approaches, Physical and chemical synthesis of 0 d, 1d and 2d nanostructures, Quantum confinement, Oscillator strength, Density of states (DOS) and surface states of low dimensional structures, Optical, electrical, magnetic and mechanical properties, Characterization of nanomaterials by STM, AFM, TEM and XRD, UV-Vis, FTIR, PL spectroscopy, Application of nanomaterials, Single electron transistor (SET), Spintronics. Optoelectronic devices for display, Storage and sensing, NEMS.

Department of Electronics & Communication Engineering

1. Electrical Circuit Analysis (10B11EC101)

Sem-I Credits-4

Electrical sources – DC, AC, Voltage, current and power sources, electrical components - passive and active. Basic circuit laws, AC waveforms-frequency, phase, amplitude, peak, rms, calculation of power, response of passive components on AC waveforms- impedance, RLC circuit, steady state analysis of circuits, network theorems, two port networks, resonance, electrical filters, transmission line parameter, transient analysis of electric circuits, concept of poly-phase systems.

2. Basic Electronic Devices And Circuits (10B21EC102)

Sem-II Credits-4

Semiconductor basic theory, PN junctions, transistor theory, PN junction diodes, BJTs, FETs:- characteristics, biasing, different configuration. Review of two port network theory – h and other parameters, equivalent circuits, BJT, FET amplifiers-frequency response, negative and positive feedback, operational amplifiers and their applications. Oscillators. Boolean algebra, logic circuits and gates, FLIP FLOPS, shift registers, counters, timers.

3. Signals And Systems (10B31EC104)

Sem-IV Credits-4

Signal types and their representation- Time Domain, Frequency Domain. Discrete and Continuous Transforms- Laplace, Fourier and Z- Transforms. Introduction to Random Signals. Systems- Linear and Non-Linear, Continuous and Discrete Systems. System Characterization- Time Domain and Frequency Domain. System Analysis. Systems Stability Criterion. Introduction to DSP.

4. Communication Systems (10B51EC241)

Sem-V Credits-4

Concept of spectra and BW, Communication system applications and model. Analogue modulation techniques – amplitude, angle modulation and variations. Sampling and Pulse

modulation. Speech coding – PCM, PCM hierarchy. Digital modulation techniques – binary and quaternary. Base band digital transmission – bit rate and bandwidth of digital signals. Line codes. Effect of noise. Bit error rate, example of a digital radio system – mobile communication.

Department of Civil Engineering

Environmental Studies (10B11GE411)

Sem IV Credits-3

The Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness, Types of Ecosystems, World Biomes, Ecosystem functioning, Biogeochemical cycles. Natural resources, their consumption & Protection: Water, Land Energy (Renewable, non-renewable, wind, solar, hydro, Biomass), Mineral, Forest, & Food resources, Role of an individual in conservation of natural resources, Equitable use of resources. Pollution- a threat to environment: Air, Water & Land pollution, sources & causes, Space pollution, causes & effects, toxicity limits of pollutants. Critical issues concerning global Environment (Urbanization, population growth, global warming, climate change, acid rain, ozone depletion etc.) and the Roots in: Cultural, Social, Political, Commercial, industrial, territorial domains. Biodiversity loss: Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity

Environmental Impact assessment: Objectives of impact assessment, Study of impact parameters, Methods for impact identification, Economics. Environmental standards & Quality: Air, Water & Soil Quality, Pollutant sampling, pollution control systems. Green Chemistry and its applications. Sustainable building, Urban planning, Disaster Management and Contingency Planning, Modern safety systems. Waste land reclamation, consumerism and waste products, eco-consumerism, dematerialization, green technologies, eco-tourism. water conservation, rain water harvesting, watershed management Environment protection act, Air (prevention and control of pollution) act; Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation National Environmental Policy; Function of pollution control boards (SPCB and CPCB), their roles and responsibilities, Eco-mark Scheme, Laws relating to Urbana and Rural land use, Ethics Fire Crackers and Environment: Impact and Safety Case studies: Industry – Environment interface Field Work: Explore the surrounding flora & fauna (Study of common plants, insects, birds document environmental assets), documentation of industries in local region and their possible effects, measure of water, air and land quality, Visit to a local polluted site-Urban/Rural /Industrial /Agricultural, Study of simple ecosystems-pond, river, hill slopes etc.

Department of HSS Courses

1. Presentation and Communication Skills (10B11PD111)

Sem I Credits -3

Communication process and barriers. Listening skills. Speaking skills – phonetics, stress, rhythm and intonation, linguistic and para-linguistic skills, content organization and coherence. Reading skills – intensive and extensive reading, SQ3R technique, vocabulary, morphology. Writing skills – clear writing, abridgment, précis writing, letters, circulars, agenda, minutes, report. Presentation skills.

2. English (10B11PD302 Audit Course)

Functional english grammar - tenses, voice, punctuation, concord, direct-indirect speech, common errors in sentences. Vocabulary – commonly confused and misused words, synonyms, antonyms, spelling, homophones, one word substitute. Comprehension. Conversational skills – interactive sessions. Compositions - **paragraph writing, story writing, dialogue writing**, letter writing, message, notice.

3. Group and Co-operative Processes (10B11PD211)

Sem II Credits -3

Group – behavior, development, structure and processes. Teams – types and contemporary issues. Individual - personality, learning, perception, values, attitudes and job satisfaction. Assertiveness - communication styles, self expression, social boldness. Emotional intelligence. Transactional analysis - ego states, life positions, transactions, stroking. Motivation. Leadership. Conflict and negotiation.

4. Managerial Economics (10B11PD311) **Sem III Credits -3**

Introduction to managerial economics. Basics of demand, supply and equilibrium. Demand theory and analysis. Theory of consumer choice. Business and economic forecasting. Production theory and analysis. Cost theory and analysis. Market structures - perfect competition, monopoly, monopolistic competition, oligopoly and barriers to entry.

5. Financial Management (10B11PD411) **Sem IV Credits -3**

Introduction, scope and objectives, basic financial concepts. Time value of money. Capital budgeting - techniques, cash flows. Long term sources of finance. Concept and measurement of cost of capital. Leverages, EBIT-EPS analysis. Working capital management. Inventory management. Financial statement analysis.

6. Social and Legal Issues (10B11PD511) **Sem V Credits -3**

Introduction to Indian law - company act, consumer laws, laws of patent. Business ethics & values. Corporate governance - the role of top management, legal provisions and SEBI code, corporate governance in India. Intellectual property issues, copyright in cyberspace, liability of service providers. Cyber crimes & the laws - computer crimes, digital forgery, cyber terrorism, wiretapping. IT laws- IT Act 2000, ICE Bill.

7. Project Management (10B11PD611) **Sem VI Credits -3**

Concepts, project life cycle, roles and responsibilities of project manager. Project selection - criteria and models. Project planning. Project strategy - risk management, budgeting and cost estimates. Scheduling - network techniques, Gantt charts. Resource allocation. Monitoring and information system. Project control, auditing, completion & development and process improvement.

8. Entrepreneurial Development (10B71PD601) **Elective**

Foundations of entrepreneurship. Strategic management and the entrepreneur. Forms of business ownership and franchising. Buying an existing business, sources of funds, building a marketing plan. E-commerce, integrated marketing communications and pricing strategies. Managing cash flows, creating a successful financial plan. Leading the growing company and planning for management succession. Global aspects of entrepreneurship, opportunities for entrepreneurs.

9. Managing and Marketing of Technology(10B71PD602) **Elective**

Introduction. Analysis of the macro environment. Corporate and division strategic planning. Product, services and branding strategies. New product development and product life-cycle strategies. Pricing strategies. Marketing channels and supply chain management.

Advertising, sales promotion, personal selling and direct marketing. Creating customer value and loyalty, cultivating customer relationship. Buying decision process. Creating competitive advantage. The global marketplace. Social responsibility and marketing ethics. Managing a holistic marketing organization.

10. Total Quality Management (10B81PD603)
Elective

Concepts, dimensions and evolution. Fundamentals of TQM, employees & customers satisfaction and supplier relationship. Quality gurus, awards, standards and certifications. Cost of quality and tools of TQM. Statistical process control. Variable and attribute control charts. Six sigma, kaizen, poka yoka. TQM implementation and challenges.

11. Knowledge Management (10B81PD604)
Elective

Introduction. Types of knowledge, knowledge workers, valuing knowledge. Communities of practice. Content management, creativity and innovation. Knowledge management strategies. Business processes and the process-oriented organisation. Information and communication technologies (ICT). Management of intellectual capital. Different levels of knowledge management. Organisational culture, developing human capital. Building and managing the knowledge repository.

Other Department Lab Courses

1. Physics Lab-I (10B17PH171)
SEM-1 Credit-1

Interference: To determine the wavelength of sodium light by measuring the diameters of Newton's Rings

Interference: To find the wavelength of sodium light using Fresnel's biprism.

Diffraction: To measure the wavelengths of certain lines in the spectrum of the mercury lamp using plane transmission grating.

Dispersion: To determine the dispersive power of the material of prism with the help of a spectrometer.

Magnetism: To determine the magnetic susceptibility of a given paramagnetic liquid using Quinck's method.

Polarization: To find the specific rotation of sugar solution by using a half shade polarimeter.

Polarization: To find the specific rotation of sugar solution by using a biquartz polarimeter.

2. Physics Lab-II(10B17PH271)
SEM-II Credit-1

Optical Fiber: To determine the numerical aperture, losses, attenuation coefficient, E-O and O-E converter characteristics of an optical fibre using LED as the light source.

Solid state Physics: To measure resistivity of semiconductor and band gap of the semiconductor using four probe method.

Solid state Physics: To study Hall effect in semiconductor and determination of its allied parameters.

Electromagnetism: To Calculate the e/m ratio for an electron using Thomson method/Bar magnet method

Solid state Physics: To study magnetostriction in magnetic materials using He-Ne lasers.

Solid state Physics: To study the coercivity, saturation magnetization, retentivity of given materials.

Solid state Physics: Experimental Determination of Planck's constant using Light Emitting Diodes (LEDs) and Photoelectric Effect.

3. ELECTRICAL CIRCUIT ANALYSIS LAB(10B17EC171)
Sem -I Credit-1

Introduction to Power supply & Multimeter.

To determine the equivalent resistance of a circuit using color code and to verify it using a multimeter
To verify Voltage dividing rule and Kirchoff's Voltage Law (KVL)
To verify Current dividing rule and Kirchoff's Current Law (KCL)
To verify Superposition Theorem
To verify Thevenin's Theorem
To verify Norton's Theorem
To verify Maximum Power Transfer Theorem
To verify reciprocity theorem
To study CRO & Function Generator
To study the transient response of series RC circuits using different values of R and C

4. BASIC ELECTRONICS LAB (10B17EC217) **SEM-2 Credit-1**

To plot the characteristics of a diode in forward and reverse biased conditions.
To plot the zener diode characteristics and find the zener voltage.
To plot its transfer characteristics for a given load.
To implement a Half-Wave Rectifier circuit with and without a capacitive filter and to calculate its ripple factor.
To implement a full-Wave Rectifier circuit with and without a capacitive filter and to calculate its ripple factor.
To implement diode clipper circuits and observe the output waveforms on the CRO
To implement diode clampers circuits and observe the output waveforms on the CRO.
To plot input and output characteristics of a transistor in Common-Base configuration.
To plot input and output characteristics of a transistor in Common-Emitter configuration.
To compare the performance of fixed bias, emitter stabilized bias and voltage divider bias circuit.
To plot the drain and transfer characteristics of a JFET in common-source configuration.
To implement and verify the operation OP-AMP based adder and subtractor circuit using 741 IC.
To implement and verify the operation OP-AMP based Integrator and Differentiator circuit using 741 IC.

5. COMMUNICATION SYSTEMS LAB(10B17EC574) **Sem V Credit-1**

To study Amplitude modulation and demodulation
To study Frequency modulation and demodulation.
To study Pulse Amplitude modulation and demodulation.
To study Pulse Width modulation.
To study Pulse Position modulation.
To study Delta Modulation.
To study Amplitude Shift Keying.
To study Frequency Shift Keying.
To study Phase Shift Keying.
To study various Line Coding techniques.
To study a Phase Locked Loop (PLL)