

ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ



University of Mysore
(Estd.1916)

Master of Computer Applications

**Choice Based
Credit System
(CBCS)**



UNIVERSITY OF MYSORE
Department of Studies in Computer Science and
Technology
Manasagangotri, Mysuru-570006

Regulations and Syllabus
Master of Computer Applications
(Three-year semester scheme)

Under
Choice Based Credit System (CBCS)

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UNIVERSITY OF MYSORE

**GUIDELINES AND REGULATIONS LEADING TO
MASTER OF COMPUTER APPLICATIONS
(THREE-YEAR SEMESTER SCHEME UNDER CBCS)**

Programme Details

Name of the Department	: Department of Studies in Computer Science
Subject	: Computer Science and Technology
Faculty	: Science and Technology
Name of the Programme	: Master of Computer Applications
Duration of the Programme	: 3 years divided into 6 semesters

Master of Computer Application (MCA)

Programme Outcome:

After successful completion of MCA degree, the graduates will be able to:

- Apply the knowledge of Computer Science, Mathematics, Statistics and computing fundamentals to design and develop applications to provide creative solutions to various real life applications.
- Integrate and apply efficiently the contemporary IT tools and design applications with appropriate considerations for any specific need on societal and environmental aspects.
- Involve in perennial learning for a continued career development and progress as a computer professional upholding the ethics, social, cultural and cyber regulations.
- Function effectively both as a team leader and team member on multi disciplinary projects to demonstrate computing and management skills and also to effectively present technical information in oral and written reports.
- Apply the inherent skills with absolute focus to function as a successful entrepreneur.

H. S. Swamy

Programme Specific Outcome (PSO)

1. Understand the concepts and applications in the field of Computing Sciences like Web designing and development, Mobile application development, and Network and communication technologies.
2. Apply the learning from the courses and develop applications for real world problems.
3. Understand the technological developments in the usage of modern design and development tools to analyze and design for a variety of applications.
4. Communicate in both oral and written forms, demonstrating the practice of professional ethics and the concerns for social welfare.

Programme Pedagogy:

The various courses offered in the M.C.A. programme will have three major components such as Theory, Tutorial and Practical. Many courses have all the three components, some courses have only theory and tutorial/practical components and some courses have only theory components. So the nature of the course can be generally expressed as L:T:P model where L stands for lecture/theory, T stands for tutorial and P stands for practical.

The pedagogy to teach a particular course depends on the L:T:P model. In order to give a brief description about the pedagogy followed to teach a particular course, the courses with a particular L:T:P structure are grouped and the pedagogy followed to deliver the contents of the course is mentioned below:

For the courses that have theory and tutorial components (3:1:0), the theoretical concepts, principles and methods are explained with example analogy or use cases. Illustrative examples, theorem proving approaches, axioms, derivations, computing models and architectural descriptions are used to effectively demonstrate the ideas and to convey the philosophy of the course. Conventional black boards/white boards are used for writing and explanation. Smart boards, ICT tools such as power point, spreadsheet, word processing, database management and graphics are used for illustrations and descriptions of the concept. Animations, video clips and graphical illustrations are used whenever necessary to enhance the understanding of the concept. Group discussions, seminars and online demonstrations using specific tools are carried out to better understand the concepts.

For the courses that have theory and practical components (3:0:1), the theoretical concepts are taught as described in the previous paragraphs using conventional black/white board approach as well as smart ICT based approach. In addition, hands on experience will be provided through practical classes, where the students are allowed to use the computer and the related software tools to solve a particular problem, to provide a particular service as appropriate. With practical classes, students are exposed to current technology and gain an understanding how to solve a real time problem. A list of course specific assignments is used to practice and also to test the practical skills of the students.

For the courses that have all the three components i.e. Theory, Tutorial and Practical components, a blended mode of teaching, which includes conventional classroom teaching using black/white boards, smart classroom teaching using ICT tools, demonstrations through experiments and simulations followed by hands on experience with practical classes.

For the dissertation course, any real time/live projects will be selected and based on the nature of the project, field works for data collection, bridge courses for learning tools and technology needed to implement the solution to the problem undertaken are carried out. Further, internships at startups up companies/industries for more hands on experience with a particular platform will be encouraged.



Programme Structure:

NAME OF THE PROGRAMME: M.C.A Computer Application

COURSES OFFERED IN COMPUTER APPLICATION

LIST OF HARDCORE SUBJECTS

Sl. No.	Course Title	Credit Pattern	Total Credits
1.	Fundamentals of Data Structures	3:0:1	4
2.	Object-Oriented Programming with C++	3:0:1	4
3.	Real Time Operating Systems	3:1:0	4
4.	Database Management Systems	3:0:1	4
5.	Advanced Software Engineering	3:1:0	4
6.	Embedded Systems	3:1:0	4
7.	Analysis and Design of Algorithms	3:0:1	4
8.	Java Programming	2:0:2	4
9.	Data Communication and Networks	3:1:0	4
10.	Big Data Analytics	3:0:1	4
11.	Dissertation Work	2:2:8	12

LIST OF SOFT-CORE SUBJECTS

Sl. No.	Course Title	Credit Pattern	Total Credits
1.	Essential Mathematics	3:1:0	4
2.	Computer Fundamentals and Organization	3:1:0	4
3.	C Programming	3:0:1	4
4.	Computer Graphics	2:1:1	4
5.	Theory of languages and Automata	3:1:0	4
6.	Numerical Techniques	3:0:1	4
7.	Operation Research	3:1:0	4
8.	Web Programming	2:0:2	4
9.	.Net with C#	2:1:1	4
10.	Pattern Recognition	3:0:1	4
11.	Artificial Intelligence	3:1:0	4

12.	Data Mining and Data Warehousing	2:1:1	4
13.	Communication Skills and Professional Management	3:1:0	4
14.	Computational Mathematics	3:1:0	4
15.	Compiler Construction	2:1:1	4
16.	Simulation and Modeling	2:1:1	4
17.	Fuzzy Sets and Theory	3:1:0	4
18.	Machine Learning	2:1:1	4
19.	Accountancy and Financial Management	3:1:0	4
20.	System Analysis and Design	3:1:0	4
21.	System Software and Operating System	3:1:0	4
22.	Computer Architecture	3:1:0	4
23.	Information System Management	3:1:0	4
24.	Probability and Statistics	3:1:0	4
25.	Mobile Communication	3:1:0	4
26.	E-commerce and E-governance	3:1:0	4
27.	Linux Programming	2:1:1	4
28.	Information Retrieval	2:1:1	4
29.	Digital Image Processing	3:0:1	4
30.	Graph Theory	3:1:0	4
31.	Cryptography and Network Security	3:1:0	4
32.	Distributed Computing	3:1:0	4
33.	Cloud Computing	3:1:0	4
34.	Mobile Application Design and Development	3:0:1	4
35.	Network and Information Security	3:1:0	4
36.	Internet of Things	2:1:1	4
37.	Enterprise Resource Planning	3:1:0	4
38.	Python Programming	2:0:2	4
39.	Software Project Management	3:1:0	4
40.	Data Clustering	2:1:1	4

LIST OF OPEN ELECTIVE PAPERS

1.	Computer Fundamentals And Programming Concepts	3:0:1	4
2.	E-Technology	3:0:1	4
3.	High Performance Computing	3:1:0	4

Scheme of Examination and Details of Course Patterns for M.C.A. Degree Course (CBCS) M.C.A.

LIST OF HARD CORE COURSES

COURSE-I: FUNDAMENTALS OF DATA STRUCTURES

Course Outcome:

- Understand the basic concepts of data structures and their importance in solving a problem.
- Understand the classification of data structures, their merits, limitations and applicability in problem solving.
- Acquire the knowledge and skills of implementing various data structures to solve few specific problems.

COURSE CONTENT:

UNIT –I

Introduction – Need for data structures, classification of data structures, Introduction to algorithm- Sequential, Selection and Iteration, Algorithmic notations, Concept and terminology for non-primitive Data structures

Arrays-Memory Representation of 1D and 2D, Operations on Arrays, Stacks- Definitions and Concepts, Operations on stacks, Applications of stacks- Recursion, Infix to postfix, and Evaluating postfix expressions.

UNIT –II

Queues- Linear, Circular and Priority Queues, Operation on queues, applications

Linked list : Pointers and Linked Allocation, Linked linear lists, Operations on Linear lists Circular linked lists- Memory Representation Doubly linked linear lists- Memory Representation.

UNIT –III

Nonlinear Data Structures

Trees - Definition and concepts, Operations on Binary Trees, Storage Representations of Binary Trees- Sequential and Linked, Tree Traversal, Binary Search Tree- Creation and Traversal.

UNIT –IV

Sorting and searching: Selection sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort, Radix sort, Sequential and Binary searching

Reference Books:

1. An Introduction to Data Structures with Applications 2nd edition - J.P.Trembly and Sorenson, McGraw Hill 2001.
2. Data structures using C, Aaron M Tenenbaum, Yedidyah Langsam, Pearson
3. Data Structures And Program Design In C, Robert L Cruse, Pearson
4. Systematic Approach to Data Structures Using C by Padma Reddy

COURSE –II: OBJECT ORIENTED PROGRAMMING WITH C++**Course Outcome:**

- Justify the philosophy of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism.
- Design, implement, test, and debug simple programs in an object-oriented programming language.
- Describe how the class mechanism supports encapsulation and information hiding.
- Compare and contrast the notions of overloading and overriding methods in an object-oriented language.

COURSE CONTENT:**UNIT –I****Introduction**

Procedure-oriented programming, Concepts of Object-oriented programming, benefits of OOP, Applications of OOP, Structure of C++ program.

Tokens, Keywords, Identifiers and constants, Basic Data Types, User-defined data types, Derived data Types, Symbolic constants, Type compatibility, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Member dereferencing operators, Memory management operators, Manipulators, Type cast operator, Expressions and their types, Special assignment expressions, Implicit conversions, Operator overloading, Operator precedence, Control structures.

UNIT –II**Functions**

The main function, Function prototyping, Call by Reference, Return by Reference, Inline functions, Default arguments, const arguments, Function overloading, Friend and Virtual functions.

Classes and Objects

Specifying a Class, Defining member functions, Making an Outside function Inline, Nesting of member functions, Private member functions, Arrays within a Class, Static data members, Static member functions, Arrays of Objects, Objects as function arguments, friendly functions, Returning Objects, const member functions, Pointers to members.

Constructors and Destructors

Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy constructor, Dynamic constructor, Constructing Two-dimensional arrays, const Objects, Destructors.

UNIT –III**Operator Overloading and Type Conversions**

Defining operator overloading, Overloading unary operators, Overloading Binary operators, Rules for overloading operators, Type conversions.

Inheritance and Polymorphism

Introduction, defining derived classes, single inheritance, making a private member inheritable, multilevel inheritance, hierarchical inheritance, hybrid inheritance, virtual base classes, abstract classes, constructors in derived classes, polymorphism – introduction, pointers, pointers to objects, this pointers, pointers to derived classes, virtual functions, pure virtual functions.

UNIT –IV

Console I/O Operations, Files and Templates

C++ streams, C++ stream classes, Unformatted I/O operations, Formatted I/O operations, managing output with manipulators.

Files: Classes for file stream operations, opening and closing a file, detecting end of file, more about open(): file modes, file pointers and their manipulations, sequential input and output operations.

Templates: Function templates, Class templates Exceptions

Reference Books:

1. Object Oriented Programming with C++ , M.T. Somashekara, D.S. Guru, H.S. Nagendraswamy, K.S. Manjunatha, PHI Learning, New Delhi, 2012
2. Object Oriented Programming with C++ by E. Balagurusamy
3. Object Oriented Programming in C++ by Robert LaforeTechmedia Publication.
4. The complete reference C – by Herbert shieldt Tata McGraw Hill Publication.

COURSE-III: REAL TIME OPERATING SYSTEMS

Course Outcome:

- Understand the principles and methods for resource-analysis for embedded- and real-time systems. Acquire good knowledge of the relevant mechanisms and methods in operating systems and hardware that have influence on real-time aspects, principles and methods for design and construction of embedded- and real-time systems.

COURSE CONTENT:

UNIT –I

Introduction to OS and RTOS

Architecture of OS (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of O. S. & hardware architecture, Evolution of operating systems, Batch, multi programming, Multitasking, Multiuser, parallel, distributed & real –time O.S.

UNIT –II

Process Management of OS/RTOS

Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept, Real Time Scheduling concepts.

UNIT –III

Process Synchronization

Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, software approaches, Semaphores and Mutex, Message Passing, Monitors, Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategies.

UINT –IV

Memory and I/O Management:

Memory Management requirements, Memory partitioning: Fixed, dynamic, partitioning, Buddy System Memory allocation Strategies (First Fit, Best Fit, Worst Fit, Next Fit), Fragmentation, Swapping, Segmentation, Paging, Virtual Memory, Demand paging, Page Replacement Policies (FIFO, LRU, Optimal, clock) ,Thrashing, Working Set Model.

I/O Management and Disk Scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), Disk Caches.

UINT –V

RTOS Application Domains

Comparison and study of RTOS: Vxworks and μ COS – Case studies: RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.

Reference Books:

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design," 2/e, Kindle Publishers, 2005.
2. Tanenbaum, "Modern Operating Systems," 3/e, Pearson Edition, 2007.
3. Jean J Labrosse, "Embedded Systems Building Blocks Complete and Ready-to-use Modules in C," 2/e, 1999.
4. C.M.Krishna and G.Shin, "Real Time Systems," McGraw-Hill International Edition, 1997.

COURSE-IV: DATABASE MANAGEMENT SYSTEM

Course Outcome:

- Understand the basic concepts and appreciate the applications of database systems; design principles for logical design of databases, including the E-R method and normalization approach; the basics of SQL and construct queries using SQL.
- Be familiar with a commercial relational database system (Oracle) by writing SQL using the system, the relational database theory, and be able to write relational algebra expressions for queries.
- Understand the basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing.
- Acquire the knowledge of working successfully in a team with the responsibility of designing and developing a database application.

COURSE CONTENT:

UNIT- I

Introduction to Database System Concepts and Architecture

Databases and Database Users, Characteristics of the Database Approach, Actors on the Scene, Advantages of Using a DBMS

Data Models, Schemas and Instances, DBMS Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment Data Modelling Using the Entity-Relationship Model

Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions and Design Aspects

UNIT- II

Transaction- Transaction Concepts, States, ACID properties, Concurrent executions, Serializability
Relational Data Model, Relational Constraints, and Relational Algebra
Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Basic
Relational Algebra Operations, Additional Relational Operations, Examples of Queries in Relational
Algebra.

UNIT- III

Normalization- Functional Dependencies, Transitive and Multivalued dependency, First Normal
form, Second Normal Form, Third Normal Form and Boyce Codd Normal Form, Advantages of
RDBMS- Codd's Rules.

UNIT-IV

SQL-The Relational Database Standard

Data Definition, SQL Data Types and Schemas, Constraints, Basic Queries in SQL, Insert, Delete,
and Update Statements in SQL, Set Operations, Aggregate functions, Views (Virtual Tables) in
SQL, Joins – Inner, Outer and Self, Additional Features of SQL, DCL-commit, Rollback, Save-point,
Grant privileges.

Reference Books:

1. Fundamentals of Database Systems by - Navathe and Elmasri –Pearson Education, Fifth Edition.
2. Database Systems Concepts, 3rd edition by - Abraham Silberschatz, Henry Korth and S. Sudarshan
McGraw Hill International Editions.
3. Introduction to Database systems by - CJ Date, Published by Addison-Wesley.
4. Principles of database systems by - Ullman, Computer Science press, 1984.

COURSE-V: ADVANCED SOFTWARE ENGINEERING

Course Outcome:

- Identify unique features of various software application domains and classify software applications.
- Choose and apply appropriate lifecycle model of software development.
- Understand the principles of agile development and distinguish agile process model from
other process models.
- Identify user needs and formulate software specifications, analyze requirements by applying
various modeling techniques, Translate the requirements model into the design model.
- Understand the importance of User-interface design principles in software development,
the concepts of clean room software development.
- Classify CASE tools and their applicability in software development.

COURSE CONTENT:

UNIT –I :

Introduction, professional and ethical responsibility, emerging system proportion, systems
engineering, legacy systems, systems dependability, availability, reliability, safety and security.
Software process models, process iteration, process activities, Project Management: Management
activities, project planning, project scheduling, risk management. Software requirements, SRS.

UNIT –II :

Requirement engineering process, System models and CASE workbenches. Software design:
Architectural design- system structuring, control models, modular decomposition, domain specific

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architectures. Object oriented design: objects and object classes, an object oriented design process, design evolution.

UNIT –III :

Verification and validation, Software testing – Different types of testing, Software cost estimation: productivity, estimation techniques, algorithmic cost modelling, project duration and staffing. Fundamentals of software quality management.

UNIT –IV :

Emerging Technologies: Security concepts, security risk management, design for security, system survivability. Service-oriented software engineering- services as reusable components, service engineering, software development with services. Aspect- oriented software development- The separation of concerns, aspects, join points and point cuts, software engineering with aspects.

References Books:

1. Software Engineering, Ian Sommerville, 8th Edition, Pearson Education Ltd.,
2. Software Engineering – A practitioners approach, Roger. S. Pressman, Tata-McGraw Hill 6th Edition.
3. Fundamentals of software engineering, Rajib Mall, Phi learning Pvt. Ltd, 3rd edition.

COURSE –VI: EMBEDDED SYSTEMS

Course Outcome:

- Understand the composition, design, and implementation of embedded systems, the basics of interfacing hardware and software.
- Be familiar with both medium level and high level languages appropriate for embedded systems development techniques; reading and understanding processor and component datasheets; driving use contexts, including human-computer interaction, environmental sensing and actuation, etc.,
- Be familiar with working on a team to create and apply embedded systems and be exposed to history of embedded interfaces.

COURSE CONTENT:

UNIT –I

Introduction to Embedded Systems: Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT –II

Embedded Networking: Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.

UNIT –III

Embedded Firmware Development Environment: Embedded Product Development Life Cycle-objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT –IV

RTOS Based Embedded System Design: Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion,priorityinheritance,comparisonofRealtimeOperating systems: Vx Works, μ C/OS-II, RT Linux.

UNIT –II

Embedded System Application Development: Case Study of Washing Machine- Automotive Application- Smart card System Application.

Reference Books:

1. Rajkamal, 'Embedded System-Architecture, Programming, Design', McGraw Hill, 2013.
2. Peckol, "Embedded system Design", John Wiley & Sons,2010
3. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013
4. Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill,2009.
5. Elicia White," Making Embedded Systems", O' Reilly Series,SPD,2011.
6. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning,2009.
7. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

COURSE-VII: ANALYSIS AND DESIGN OF ALGORITHMS

Course Outcome:

- Able to formulate the optimal solution to the problem and design efficient algorithms to solve the problem.
- Able to critically analyze the asymptotic performance of the designed algorithms.
- Understand and apply the appropriate algorithmic strategies to solve given problem.
- Perform the cost benefit analysis of solutions obtained by various methods.

COURSE CONTENT:

Unit-1

Algorithms- Analysis, Design, Complexity Analysis, Analysis and Profiling, Deriving detailed expression, Expressing in Order notations, Establishing Bounds, Review of Data Structure based algorithms, Sets-Union and Intersection, Matrices, Case studies- Base conversion, Prime and Fibonacci numbers, Array histograming.

Unit-2

Repetitive, Iterative and Recursive algorithms, Accuracy aspects, Series representations, Sorting Algorithms- Selection, Exchange, Insertion, Greater Common Divisor, Least Common Multiple, Binary tree structures, Heaps-check, insertion, creation, deletion, sorting. Complexity analysis and Profiling of the algorithms.

Unit-3

Divide and Conquer- Binary search, Max-Min search, Merge sort, Quick sort, Transfer and Conquer – solution to simultaneous equations by triangularization, diagonalization algorithms.

Greedy Algorithms- Tape filling, Knapsack, Job sequencing, Optimal merge pattern, Single source shortest paths.

Unit-4

Backtracking and Branch-Bound, Shortest path, Monotonic subsequences, sum of subsets, 8 Queen Problem.

Dynamic Programming – Shortest paths, Single source/single destination shortest paths

Complexity issues- P type, NP type, Two stage algorithm approach for NP problem

References

1. Computer Algorithms by Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran
2. How to solve it by Computer by R.G.Dromey
3. Introduction to the Design & Analysis of Algorithms by Anany V. Levitin
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein.

COURSE-VIII: JAVA PROGRAMMING

Course Outcome:

- Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
- Read and make elementary modifications to Java programs that solve real-world problems.
- Validate input in a Java program, Identify and fix defects and common security issues in code.
- Document a Java program using Javadoc.
- Use a version control system to track source code in a project.

COURSE CONTENT:

UNIT –I

Introduction to Java:Origin and features of Java. Java Program Structure, Java Tokens, Java statements, Java Virtual machine, Command Line Parameters, Java Variables and Data Types, Operators, Decision Making, Branching and looping statements.

Classes, Objects and Methods used in Java: Class fundamentals, Methods, Constructors, Overloading, Inheritance, Interfaces, One and two dimensional arrays, Vectors, Strings, Wrapper Classes.

UNIT –II

Java Packages: API packages, system packages, naming conventions, creating and accessing a package, adding a class to a package, hiding classes.

Multi-threads Programming: Java thread Model, Main Thread, creating a Thread, Creating Multiple Threads, Extending the thread class, Stopping and blocking a thread, Life cycle of a thread, Managing Errors and Exceptions.

UNIT –III

Applet Programming: Introduction, how applet differ from application, Applet life cycle, Applet tag, passing parameters to applet. Abstract Windows Toolkit: Components, Container, Panel, Label, Button, Checkbox, CheckboxGroup, Choice, List, TextField, TextArea, Scrollbars.

Graphics Programming: The Graphics class, Lines and Rectangles, Circles and Ellipses, Drawing Arcs, Drawing Polygons, Line Graphs, Using Control Loops in Applets.

UNIT –IV

Managing Input/output Files in Java: Stream Classes, Byte Stream Classes, Character Stream Classes, Creation of Files, Reading/Writing characters, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files.

Networking: InetAddress, TCP/IP Client Sockets, TCP/IP Server Sockets, URL, URLConnection, JDBC connectivity

Reference Books:

1. Programming with Java – A PRIMER by - E.Balagurusamy, Tata McGraw-Hill 3rd Edition
2. The Complete Reference - Java-2 by- Patrick Naughton and Herbert Schildt Published by Tata McGraw-Hill India.
3. The Complete Reference – J2EE by - Jim Keogh, published by Tata McGraw-Hill.

COURSE –IX: DATA COMMUNICATION AND NETWORKS**Course Outcome:**

- Understand the data communications system and its components.
- Summarize signal conversions techniques for digital communication.
- Identify and categorize various types of transmission media.
- Understand various analog and digital services for data communication.
- Evaluate bandwidth utilization using multiplexing techniques.
- Implement advanced technique such as Data encoding and Compression for Image processing Applications.

COURSE CONTENT:**UNIT –I**

Data Communication, Component and Basic Concepts – Introduction, Characteristics – Delivery, Accuracy, Timeliness and Jitter, Components
Topology – Mesh, Star, Tree, Bus, Ring and Hybrid
Topologies Transmission modes – Simplex, Half Duplex, Full
Duplex Categories of networks – LAN, MAN, WAN
Network Components – Signal Transmission – Analog Signaling, concept of ASK, FSK, PSK, Digital Signaling, concept of Unipolar, Polar, Return-to-Zero(RZ), Biphase,

UNIT –II

Manchester, Differential Manchester, Non-Return-to-Zero (NRZ), Bit Synchronization, Asynchronous Bit Synchronization and Synchronous Bit Synchronization, Baseband and Broadband Transmissions.
Transmission Media - Guided Media – Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable
Unguided Media – Radio Wave Transmission Systems, Microwave Transmission Systems, Infrared Transmission Systems and Satellite Communication System.

UNIT –III

The OSI Model – Functions of all the Seven Layers
Networking Devices – Functions and Applications of Hub, Switches, Bridges, Repeaters
Internetworking Devices – Functions and Applications of Routers and Gateways
IP Addressing – Dynamic IP Addressing, Static IP Addressing, Types of IP Addresses
Protocols –ICP, UDP, IP, IPV4, IPV6, TCP/IP Suite, SMTP,ARP, RARP, OSPF, BGP, ALOHA

UNIT–IV

Packet Switching Networks – Network Services and Internal Network Operations, Packet Network Topology, Datagrams and Virtual Circuits, Connectionless Packet Switching, Virtual Circuit Packet Switching.

Routing Concepts – Routing Tables, Dijkstra’s Shortest Path Routing Algorithm, Flooding, Distance Vector Routing, Congestion Control Algorithms-Leaky Bucket Algorithm.
Data Link Issues –Single bit error and Burst Error, concepts of Redundancy, Checksum, Single Bit Error correction and Hamming Code correction method.

Reference Books:

1. Introduction to Data Communications and Networking by BehrouzForouzan.
2. Computer Networks by Andrew S Tanenbaum.
3. Networking Essentials – Third Edition – Jeffrey S. Beasley, PiyasatNilkaew

COURSE –X: BIG DATA ANALYTICS

Course Outcome:

- Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
- Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
- Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

COURSE CONTENT:

UNIT –I

Introduction to Big Data Analytics: Big Data Overview, State of practice in analytics, Role of Data Scientists, Examples of Big Data Analytics, Data Analytics Lifecycle, Components of Hadoop, Analyzing Big data with Hadoop, Design of HDFS, Developing a Map reduce Application.

UNIT-II

Map Reduce: Distributed File System(DFS), Map Reduce, Algorithms using Map Reduce, Communication cost Model, Graph Model for Map Reduce Problem.

UNIT –III

Hadoop Environment: Setting up a Hadoop Cluster, Hadoop Configuration, Security in Hadoop, Administering Hadoop, Hadoop Benchmarks, Hadoop in the cloud.
Big Data Analytics Methods using R: Introduction to R-Attributes, R Graphical user interfaces, Data import and export, attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis.

UNIT –IV

Statistical methods for evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and Type II errors, power and sample size, ANOVA.
Advanced Analytics - technologies and tools: Analytics for unstructured data, The Hadoop ecosystem – pig – Hive- HBase- Mahout- NoSQL.

Reference Books :

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services, 2015, publishing.

2. Anand Raja Raman and Jeffrey David Ullman, Mining of Massive Datasets, 2012, Cambridge University Press.
3. Tom White, Hadoop: The Definitive Guide, 3rd Edition, O'Reilly Media

COURSE-XI: DISSERTATION WORK

Course Outcome:

- Able to identify and formulate the real time problem (application development of research related) by extensively studying the recent literature and identifying the research or application gap.
- Understand and get the practical exposure to the tools and technology needed to implement the solution to the problem defined.
- Critically evaluate the performance of the application/algorithm designed by conducting extensive experiments on various test cases and comparing the results with the state-of-the art applications/algorithms.
- Able to learn how to precisely document the dissertation work carried out using the various documenting and diagrammatic tools.

Reference Books:

1. Recent literature available in various portals/websites.
2. Books/Manuals related to the problem domain and implementation platform.
3. Research articles published in various journals and conferences.

LIST OF SOFT CORE COURSES

COURSES -I: ESSENTIAL MATHEMATICS

Course Outcome:

- Understand the Complex Trigonometry, Complex number and functions, Differential Calculus, Basic concepts of set theory, principles of inclusion and exclusion, mathematical induction, Relations, Recurrence relations and generating functions.

COURSE CONTENT:

UNIT –I

Complex Trigonometry: Revision of plane trigonometry – trigonometrical ratios, expressions for relation between allied angles and trigonometrical ratios, addition formulae for trigonometrical ratios and simple problems. Complex number and functions – definition, properties, De Moivre's theorem (without proof), roots of complex a number, expansions of $\sin(nA)$, $\cos(nA)$ in powers of $\sin A$ and $\cos A$, addition formulae for any number of angles. Complex functions – real and imaginary parts of circular and hyperbolic functions, logarithmic function of a complex variable and simple problems.

UNIT –II



Differential Calculus: Limits, Continuity and derivative of a function (definition only), Rules of differentiation, derivatives of (i) standard functions, (ii) function of a function and (iii) parametric form functions. Introduction to Integration, methods of integration, definite integrals and simple problems.

UNIT –III

Set theory: Basic concepts of set theory, principles of inclusion and exclusion, mathematical induction. Counting principles – rules of sum and products, permutations and combinations, pigeon hole principle- simple problems. Relations – properties, relation matrix and digraph of a relation, partition and covering, equivalence relation, compatibility relations, composition of binary relations, manipulation of relations, transitive closures, Warshall's algorithm –related problems.

UNIT –IV

Recurrence Relation and generating functions: Introduction, linear recurrence relation with constant coefficient (LLR)- backtracking method, homogeneous solutions, particular solutions, manipulation of numeric functions and generating functions. Solution of LLR by using generating function –problems. Functions: Defining and introduction, various types of functions, composition of functions, inverse function, characteristic function of set, permutation function, hashing function, recursive functions-problems.

Reference Books:-

1. Higher Engineering mathematics (35th edition) -by Dr. B.S Grewal, Khanna Publishers.
2. Elementary Engineering mathematics (6th edition)- by Dr. B.S Grewal, Khanna publishers
3. Discrete Mathematical structure with Applications to computer science by-tremblay and Manohar(McGraw-Hill publications).
4. Elements of discrete mathematics -by C. L. Liu (tataMcgraw-hill publications).

COURSE –II: COMPUTER FUNDAMENTALS AND ORGANIZATION

Course Outcome:

- Understand and describe the basics of various digital components.
- Understand the principles of designing combinational and sequential logic circuits using basic components.

COURSE CONTENT:

UNIT –I

Introduction to Computers: History, Generations of Computers, Overview of the Computer system, Applications of computer, Classification of computers, Input and Output devices, The monitor, Printers, Sound systems. Types of storage devices - Magnetic storage devices, Optical Storage devices
Number Systems: Binary, Octal, Decimal and Hexadecimal, conversion from one base to another, complements, addition and subtraction of numbers using complements, representations of negative numbers, binary storage and registers, binary logic.

UNIT –II

Boolean algebra and logic gates: Axioms and basic theorems, functions, canonical and standard forms, digital logic gates, Introduction to TTL, CMOS and ECL logic families. Simplification of Boolean functions: Map method – up to 4 variables functions, sum of products and product of sums simplifications. NAND, NOR, implementations, taking care of Don't care conditions

UNIT –III

Combinational logics: Design procedure, adders, subtractors, code conversion, multilevel NAND and NOR circuits, EXOR and Equivalent functions. Parallel adders, decimal adders, comparator, decoders, multiplexers, ROM and PLA.

UNIT –IV

Introduction to sequential logic: Flip flops, triggering, design of synchronous and asynchronous counters, registers, shift register, memory unit, RAM's.

Digital to analog conversion: Interfacing with analog world – basic blocks, design of simple DAC circuits, meaning of resolution, binary weighted resistor DAC, R2R DAC, Analog to digital conversion, general circuit, digital ramp ADC.

References Books:

1. Peter Norton's 'Introduction to Computers', Second edition, TMH.
2. Moris Mano, "Computer System Architecture", PHI Publications, 2002.
3. V. Rajaraman : Computer Fundamentals (PHI).
4. Thomas C Bartee, Digital Computer Fundamentals, Tata McGraw Hill

COURSE-III: C PROGRAMMING

Course Outcome:

- Describe the basic concepts of programming.
- Distinguish various control structures used in programming.
- Describe and apply the concepts of functions.
- Design, implement debug and document a program for a given problem statement.

COURSE CONTENT:

UNIT-1

Overview of C- Importance of C, Basic structure of C Programs, Basic programming constructs-character set, tokens, Constants, Variables, and Data Types, Keywords and identifiers, symbolic constants

Operators and Expression – Arithmetic, relational, logical, increment and decrement, conditional, bitwise, Expression, precedence of operators, type conversion and casting, mathematical functions, Managing Input and Output Operations - Reading a character, writing a character, formatted input, formatted output

UNIT-II

Decision Making and Branching – If statement – Different forms of if statement, , switch, break and continue, Looping statements in C – For, while and do while, nested loops, Structured data types in C – Array – One dimensional and two dimensional array, String, Structures and union

UNIT-III

User-Defined Functions – Need for user defined functions, multi function program, general form of C function, Category of functions, Handling of non-integer functions, Nesting of functions, Recursion. Functions with arrays and Structures, The scope and lifetime of variables in functions.

UNIT-IV



Pointers and File Handling - Understanding pointers. Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer. File Handling- Definition and need of file. Defining, Opening, and Closing a file. Input and output operations on files. Random access to files with example programs.

References Books:

1. C programming Language by Kernigham and Ritchie, 2nd Edition, PHI Publications
2. Programming in ANSI C 2nd Edition by E Balaguruswamy Published by Tata McGraw Hill.
3. Let Us C – Yashwant Kanetkar, 13th Edition, BPB publication
4. Problem Solving with C, M.T. Somashekara, PHI Learning, New Delhi, 2009

COURSE –IV: COMPUTER GRAPHICS

Course Outcome:

- Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
- Learn various algorithms for scan conversion and filling of basic objects and their comparative analysis.
- Use of geometric transformations on graphics objects and their application in composite form, extract scene with different clipping methods and its transformation to graphics display device, explore projections and visible surface detection techniques for display of 3D scene on 2D screen. Render projected objects to naturalize the scene in 2D view.

COURSE CONTENT:

UNIT –I

Introduction – applications of computer graphics, operations of computer graphics, graphics software packages. Graphical input – output devices- graphical input devices, graphical output devices Raster and random scan devices,

Scan conversion – scan conversion methods, polynomial method for line, polynomial method for circle, DDA algorithm for line, circle and ellipse, Bresenham's algorithm for line drawing and circle. Midpoint methods for line and circle.

UNIT –II

Scan conversion for solids- solid areas or polygons, inside-outside test – odd even method, winding number method. Solid area filling algorithms- boundary fill algorithm, scan line fill algorithm, scan line seed fill algorithm, ordered edge list algorithm.

2D geometrical transformations – basic 2d transformations- translation, rotation, scaling, homogeneous co-ordinate system – transformations in homogeneous notation, Other transformations – reflection about any arbitrary line, shearing, combined transformation- computational efficiency, visual reality, inverse of combines' transformations.

UNIT –III

3D geometrical transformations- basic 3D transformation- 3D translation, 3D scaling, 3D rotation, rotation about an arbitrary axis in space, other 3D transformations- 3D reflection, reflection about any arbitrary plane, 3D shearing.

Projection – introduction, parallel projection and perspective projections. Image formation inside a camera.

UNIT –IV

2D viewing and clipping- windows and viewports, viewing transformation, clipping of lines in 2D-cohen-sutherland clipping algorithm, midpoint subdivision method, polygon clipping – Sutherland – hogman polygon clipping.**Curve design** – classical techniques for designing curves and object surfaces, modern curve representations.

REFERENCES BOOKS:

1. Computer Graphics, Donald Hearn, M. Pauline Baker, Prentice-Hall
2. Computer Graphics, Roy A. Plastock, Gordon Kalley, Schaum's Outlines, McGraw Hill
3. Computer Graphics : Principles and Practice in C, Andries Van Dam, F. Hughes John, James D. Foley, Steven K. Feiner, 2nd Edition, Pearson Education
4. Computer Graphics 2nd Edition (Paperback) by Steven Harrington, Tata McGraw Hill

COURSE –V: THEORY OF LANGUAGES AND AUTOMATA

Course Outcome:

- Explain and manipulate the different concepts in automata theory and formal languages such as formal proofs, deterministic automata, regular expressions, regular languages, context-free grammars, context-free languages, Turing machines;
- Explain the power and the limitations of regular languages and context-free languages.
- Differentiate and manipulate formal descriptions of languages, automata and grammars with focus on regular and context-free languages, finite automata and regular expressions.

COURSE CONTENT:

UNIT –I

Introduction: Strings, alphabets and languages, graphs and trees, inductive proofs, set notation, relations. Finite state systems, basic definitions, non-deterministic finite automata.

UNIT –II

Finite Automata and Regular Expressions: finite automata with ϵ - moves, regular expressions, two-way finite automata, finite automata with output, applications of finite automata.

Properties of Regular Sets: The pumping lemma for regular sets, closure properties of regular sets, decision algorithms for regular sets

UNIT –III

Context Free Grammars: Motivation and Introduction, Context free grammars, derivation trees, simplification of context-free grammars, Chomsky normal form, Greibach normal form, the existence of inherently ambiguous context-free languages.

UNIT –IV

Pushdown Automata: Definitions, Pushdown automata and context free languages, Properties of Context-Free Languages (CFL): The pumping lemma for CFL's, closure properties of CFL's, decision algorithms for CFL's.

Reference Book:

1. Introduction to Automata Theory, Languages, and Computation - J D Ullman, J E Hopcraft, Narosa Publishing House.

COURSE –VI: NUMERICAL TECHNIQUES

Course Outcome:

- Analyze a mathematical problem and determine which numerical technique to use to solve it.
- Demonstrate knowledge and understanding of numerical methods to solve systems of linear equations, to compute quadratures and to solve Ordinary and Partial Differential Equations.
- Use the knowledge of a programming language such as C or Python to implement the algorithms designed.
- Learn logical thinking in coding a mathematical problem in algorithmic form.

COURSE CONTENT:

UNIT –I

Computer Arithmetic: Floating point representation of numbers, arithmetic operations with normalization, consequences of normalized floating point representation of numbers, Errors in numbers

Finding the roots of an equation: Iterative method: Introduction, Beginning an iterative method, Bisection method, Newton Raphson method, RegulaFalsi method, Secant Method. Comparison of Iterative methods, Order of Convergence of Newton Raphson Method and Secant Method.

UNIT –II

Ordinary differential equations: Euler's method, Taylor series method, Range Kutta II and IV order methods.

Numerical Integration: Simpson's 1/3 and 3/8 rule, Trapezoidal rule.

UNIT –III

Solving simultaneous linear equations: Introduction, Gauss Elimination method, pivoting, illconditioned equations, Gauss Jordan method, LU Decomposition method and Gauss-Seidel iterative method. Comparison of direct and iterative methods.

UNIT –IV

Interpolation: Introduction, Lagrange interpolation, Difference Tables- Newton-Gregory Forward and Backward interpolation, Truncation error in interpolation.

Statistical methods: Introduction, definitions, classifications, frequency distribution, mean-arithmetic mean for grouped and ungrouped data, continuous frequency distribution(step deviation method), Geometric mean for grouped and ungrouped data.

References Books:

1. Computer Oriented Numerical Methods by Rajaraman. V.
2. Fundamentals of Mathematical Statistics by Gupta and Kapoor (Sultan Chand).
3. Probability and Statistics for engineers and scientists by Ronald E. Walpole and Raymond H Mayers.
4. Mathematical Statistics by John Freund (Prentice Hall India Pvt. Ltd.)

COURSE-VII: OPERATIONAL RESEARCH

Course Outcome:

- Identify and develop operational research models from the verbal description of the real system.
- Understand the mathematical tools that are needed to solve optimization problems.
- Use mathematical software to solve the proposed models.

COURSE CONTENT:

UNIT I:

Definition of the term Operation Research – Nature , Management Application , Modeling , Principles of modeling , features , Different Phases , scope , Advantages and Limitations of O.R. General method for solving O.R models and Role o O.R in decision making. Some important definitions – solutions to LPP, feasible solution, basic solutions, Basic feasible solution, Optimum basic feasible solution, unbounded solution. Assumptions in LPP, Limitations of LPP, Applications of LPP and advantages of LPP.

UNIT-2

Standard Linear Programming – Formulation of a Linear Programming Solving L.P.P. by Graphical Method Problem.And Simplex Method.

Artificial Variable Technique – two phase method and Big M method,

Duality – Meaning, definitions of primal problem , General rules for converting any primal problem into its dual . Characteristics of Dual problem, Advantages of Duality, Dual formulation procedure and Problems to obtain the dual of LPP.Fundamental Duality theorems, Primal and Dual correspondence.

UNIT 3:

Transportation Problems – Method of finding initial basic feasible solution to Transportation problem- North West Corner, Least Cost Method and Vogel’s Method.

Method of finding initial basic feasible solution to Assignment Problem using Hungarian Method.

UNIT-4

Sequencing Problems – Definitions, terminology and notations, Principle assumptions, Processing ‘n’ jobs through two machines

Travelling Salesman (Routing) Problems - Formulations of TSP as an assignment problem

Reference Books:

1. “Operation Research”, by -S.D.Sharma KedarnathRamnath Publishers 16th edition 2010.
2. Operation Research by - J.K Sharma, 5th Edition, MacMillan Publishers, 2013
3. Operation Research,by - S.K. Kumar, First Edition, Khataria and Sons Publishers

COURSE-VIII: WEB PROGRAMMING

Course Outcome:

- Apply a structured approach to identifying needs, interests, and functionality of a website, design dynamic websites that meet specified needs and interests.
- Write well-structured, easily maintained, standards-compliant, accessible HTML code.
- Write well-structured, easily maintained, standards-compliant CSS code to present HTML pages in different ways.
- Use JavaScript to add dynamic content to pages, select appropriate HTML, CSS, and JavaScript code from public repositories of open-source and free scripts that enhances the experience of site visitors, modify existing HTML, CSS, and JavaScript code to extend and alter its functionality, and to correct errors and cases of poor practice.
- Write well-structured, easily maintained JavaScript code following accepted good practice.

COURSE CONTENT:

UNIT –I

Fundamentals of Web: Internet, WWW, Web Browsers, and Web Servers; URLs; MIME; HTTP; Security; the Web Programmers Toolbox. HTML: Origins and evolution of HTML; Basic syntax; Standard HTML document structure; Basic text markup, Hypertext Links; Lists; Tables; Forms; Frames.

UNIT –II

Cascading Style Sheets (CSS): Introduction; Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; The Box model; Background images; The and tags;

UNIT –III

JavaScript: Overview of JavaScript; Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errors in scripts; Examples.

UNIT –IV

CGI Programming: The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies.

Reference Books:

1. **Programming the World Wide Web** – Robert W. Sebesta, 4th Edition, Pearson Education, 2008.
2. **Internet & World Wide Web How to H program** – M. Deitel, P.J. Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004.
3. **Web Programming Building Internet Applications** – Chris Bates, 3rd Edition, Wiley India, 2006.
4. **The Web Warrior Guide to Web Programming** – XueBai et al, Thomson, 2003.

COURSE-IX: DOT NET WITH C#

Course Outcome:

- Understand the .Net frame work and the features of C# programming language to design and implement web-based applications as per the requirement.

COURSE CONTENT:

Unit-1

Introduction: An overview of the .NET framework. CLR, FCL, ASP.NET to support Internet development and ADO.NET to support database applications. Languages supported by .NET, introduction to Visual Studio .NET.

Unit-2

Introduction to C#: Program structure, Basic IO, data types, operators and expressions, relational and logical operations, control structures. Writing methods, Recursion and overloading arrays and data representation. Class definitions. Properties, indexers, and access Arrays control. Inheritance and polymorphism, delegates. Exception handling.

Unit-3

ADO.NET: Introduction to SQL. ADO.NET after Native Drivers, ODBC Drivers, DAO/RDO and ADO. Database using VS.NET Establishing Connection with Database.

Unit- 4

ASP.NET: Web forms in ASP.NET, States, Validation, Login; ASP.NET Administrative tasks ASP.NET Data controls, Ajax Extensions, LINQ, Working with XML data, Web Services.

References:

1. Pro C# with .NET 3.0 by Andrew Troelsen.
2. Microsoft ASP.NET by G.Andrew Duthie.
3. Building ASP.NET WebPages with Microsoft web Matrix. By Steve Lydford

COURSE X: PATTERN RECOGNITION

Course Outcome

- Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
- Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
- Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
- Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
- Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

COURSE CONTENT

UNIT-1:

Introduction: Machine perception, pattern recognition system, design cycle, learning and adaptation Bayesian Decision Theory- Introduction, Bayesian decision theory – Continuous features, classifiers, discriminant functions and decision surfaces, normal density, Base decision theory – Discrete features. missing and noisy features.

UNIT-2:

Maximum likelihood and Bayesian parameter estimation: Introduction, Maximum-likelihood estimation, Bayesian estimation, Bayesian parameter estimation. Non-parametric techniques: Introduction, density estimation, Density Estimation, Parzen windows-probabilistic neural networks, K nearest neighbor estimation, the nearest neighbor rule, metrics and nearest neighbor classification, fuzzy classification.

UNIT-3:

Linear discriminant functions: Introduction, Linear discriminant functions, generalized linear discriminant functions, minimizing the perceptron criterion function, relaxation procedures, non-separable behavior, minimum square error procedures, Support Vector Machines.

UNIT-4:

Unsupervised learning and clustering: Mixture densities and identifiability, Maximum likelihood estimates, application to normal mixtures, unsupervised Bayesian learning, data description and clustering, criterion functions for clustering, hierarchical and divisive clustering, partitional clustering, component analysis.

REFERENCES:

1. Richard O Duda, Peter E Hart and David G Stork- Pattern classification. John Wiley and sons.inc 2nd ED 2001

2. Christopher M Bishop- Pattern Recognition and Machine Learning, 2006, Springer.
3. Earl Gose, Richard Johnsonbaugh, Steve Jost- Pattern recognition and image analysis, Prentice Hall PTR

COURSE XI: ARTIFICIAL INTELLIGENCE

Course Outcome

- Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.
- Explain how Artificial Intelligence enables capabilities that are beyond conventional technology, for example, chess-playing computers, self-driving cars, robotic vacuum cleaners.
- Use classical Artificial Intelligence techniques, such as search algorithms, minimax algorithm, neural networks, tracking, robot localization.
- Ability to apply Artificial Intelligence techniques for problem solving.
- Explain the limitations of current Artificial Intelligence techniques.

COURSE CONTENT

UNIT 1:

Introduction-origin of AI, AI solution to problems, characteristics of AI problems; State space search - blind searches, heuristic searches; Search in game tree

UNIT 2:

Predicate logic - Backward reasoning, Resolution; Other reasoning methods - Probabilistic, Fuzzy, Non monotonic

UNIT 3:

Knowledge representation - Overview of Semantic nets, Frames, Conceptual dependency, Scripts; Planning - Goal stack, Non linear, Hierarchical

UNIT 4:

Expert systems; Learning - Rote, By Advice, By Analogy, Macro.

References:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivashankar Nair, Tata McGraw Hill
2. Artificial Intelligence, Patrick Henry Winston, AWL
3. Artificial Intelligence and Expert Systems, Dan W. Patterson, PHI
4. Artificial Intelligence, Nils J Nilson, Elsevier, Morgan Kaufmann

COURSE XII: DATA MINING AND DATA WAREHOUSING

Course Outcome

- Acquire the knowledge of data preprocessing and data quality; modeling and design of data warehouses and algorithms for data mining.
- Be able to design data warehouses and apply acquired knowledge for understanding data and select suitable methods for data analysis.

COURSE CONTENT

UNIT-1

Introduction to data mining and Data Warehousing, Modeling: Data Cube and OLAP, Data Warehouse Implementation, Data Mining – types of data, types of patterns, Data cleaning, Data integration:

UNIT-2

Data Reduction, Wavelet Transforms, Attribute Subset Selection, Histogram, Clustering, Sampling, Data Cube Aggregation Data Transformation: Strategies Overview, Data Transformation by Normalization.

UNIT-3

Mining Frequent Patterns, Associations & Correlations: pattern evaluation methods.
Classification, Decision tree Induction, Attribute Selection Measures, Tree Pruning, Bayes Classification Methods.

UNIT-4

Cluster Analysis: Requirement for Cluster Analysis, clustering methods
Data Mining Applications & Trends: Mining Sequence Data; Time Series, Symbolic, Statistical Data Mining, Visual Data Mining, Data Mining Applications.

REFERENCE BOOKS:

1. Jiawei Micheline Kamber, 'Data Mining Concepts and Techniques', Morgan Kauf Mann Publishers.
2. George M. Marakas, 'Modern Data Warehousing, Mining and Visualization', Pearson Education, 2003.
3. W.H. Inmon, 'Building the Data Warehouse', Wiley dreamtech, 3rd Edition.
4. Mastering Data Mining – Michael J.A. Berry & Gordon S. Linoff (Wiley Pub.).
5. Data Warehousing (Pearson Ed.) – Sam Anahory & Dennis Murray.

COURSE-XIII: COMMUNICATION SKILLS AND PROFESSIONAL MANAGEMENT

Course Outcome

- Communicate, interact and present his ideas to the other professionals.
- Understand and aware of importance, role and contents of soft skills through instructions, knowledge acquisition, demonstration and practice.
- Have right attitudinal and behavioral aspects, and build the same through activities.
- Possess right professional and social ethical values.

COURSE CONTENT

UNIT – I

Importance of communication, its basic model, formal and informal communications, barriers to communication, feedback and its effectiveness, conflict communication.

UNIT – II

Oral communication – influencing factors, self confidence, role of trust, motivational factors, style, importance of listening, role of visual arts, informative and persuasive communication.

UNIT – III

Written communication – writing style, important of writing skills, book review and disadvantages over oral communication. Letter writing – formal and informal letters, official and demi-official letters, business and commercial letters, personal correspondence. Technical report writing and effective meeting.

UNIT – IV

Support by word processing systems, LOTUS, Graphics software for Professional Management.

References

1. Effective Communication made simple – Rupa & Co.
2. Communication for results – C Hamilton & Parker
3. Instrument of Communication – P Meredith
4. Basic Management skills for all – E H McGrath
5. Managerial Communication – P M Timm
6. Thesis and Assignment writing - Anderson

COURSE-XIV: COMPUTATIONAL MATHEMATICS

Course Outcome

- Demonstrate basic mathematical understanding and computational skills in calculus, linear algebra, and differential equations, and advanced calculus.
- Explain and criticize mathematical reasoning through speaking and writing in a precise and articulate manner.

COURSE CONTENT

UNIT-1:

Algebraic Structures: - Sets – functions – operators- Group – homomorphism of groups - Ring – Field – Vector Space – Subspaces – direct sum - metric space – inner product space – L_p space – Banach Space - Hilbert Space.

Transforms :- Eigen values, Eigen vectors and spectrum - Diagonalizability – orthogonal diagonalization - Properties of Eigen values and Eigen vectors of Hermitian matrices

UNIT-2:

Linear independence – basis – dimension – orthonormal basis finite dimensional vector spaces – isomorphic vector spaces - Examples of finite and infinite dimensional vector spaces – $\mathbb{R}^N, \mathbb{C}^N$, signal space .

UNIT-3:

Linear Transformations :- Linear Transformations – four fundamental subspaces of linear transformation – inverse transformation - rank nullity theorem - Matrix representation of linear transformation – square matrices – unitary matrices - Inverse of a square matrix

UNIT-4:

Change of basis – coordinate transformation - system of linear equations – existence and uniqueness of solutions- projection – least square solution – pseudo inverse.

References

1. J.F. Simmons, Topology and Modern Analysis , McGraw Hill
2. Frazier, Michael W. An Introduction to Wavelets Through Linear Algebra, Springer Publications.
3. Hoffman Kenneth and Kunze Ray, Linear Algebra, Prentice Hall of India.
4. Linear Algebra and Its Applications by Gilbert Strang 4th Edition, Nelson Engineering

COURSE-XV: COMPILER CONSTRUCTION

Course Outcome

- Express the grammar of a programming language. Build lexical and syntax analyzers and use them in the construction of scanners and parsers.
- Perform the operations of semantic analysis and build a code generator.
- Use different compiler optimization schemes in addition to efficient register allocation and garbage collection.
- Design and program a complete working compiler for a given language.

COURSE CONTENT

UNIT-1:

Introduction: language processing system, the phases of a compiler- Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Symbol-Table Management, The Grouping of Phases into Passes, Compiler-Construction Tools, The Evolution of Programming Languages, The Science of Building a Compiler, Modeling in Compiler Design.

UNIT-2:

Lexical analysis: tokens, patterns, and lexemes, lexical errors, recognition of tokens, transition diagrams, nondeterministic finite automata, transition tables, deterministic finite automata, conversion of an NFA to a DFA, construction of an NFA from a regular expression, computing nullable, firstpos, and lastpos, computing followups, converting a regular expression directly to a DFA,

UNIT-3:

Syntax analysis: context-free grammars, parse trees and derivations, ambiguity, eliminating ambiguity, elimination of left recursion, top-down parsing, recursive-descent parsing, first and follow, LL(l) grammars, predictive parsing, bottom-up parsing, reductions, handle pruning, shift-reduce parsing, LR(0), constructing SLR-parsing tables, canonical LR(l) parsing, LALR parsing.

UNIT-4:

Syntax-directed definition and translation: syntax - directed definitions, evaluating an SDD, dependency graphs, S-attributed definitions, L-attributed definitions. Intermediate-code generation, Three-address code representation, Code generation and optimization: Issues in the design of a Target code generator, input to the code generator, the target program.

Reference books:

1. Monica S Lam, Alfred W Aho, Ravi Sethi, Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, Pearson, 2008, 2nd edition.
2. Andrew W Apple, Modern Compiler Implementation in C, Cambridge University Press, 2004
3. Kenneth C Loudon, Compiler Construction Principles, Thomson Education.

COURSE-XVI: SIMULATION AND MODELING

Course Outcome

- Understand the fundamental elements of discrete-event simulation including statistical models, random processes, random variates, and inputs to simulation.
- Analyze a real world problem and apply modeling methodologies to develop a discrete-event simulation model.

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- Recognize the cost/benefits of computer simulation, the generation of meaningful results, decision making, and risks
- Interpret and contrast discrete-event techniques for implementing a solution to a simulation problem.
- Compare and evaluate alternative system designs using sampling and regression.

UNIT 1:

Definition, use and misuse, application of simulation; Models and examples; Hand simulation of continuous and discrete systems; Probability distributions-overview

UNIT 2:

Pseudo random number generation; Tests on generated random numbers-frequency, uniformity, runs, gap

UNIT 3:

Random number generation of variety of distributions; Problems of simulation using such generators

UNIT-4:

Overview and simple problems using any simulation language; Analysis of outputs; Verification and validation of models

References:

1. Discrete System Simulation, Jerry Banks, John S Carson II, Barry L Nelson, David M Nicol, Pearson Education Asia
2. System Simulation, Geoffrey Gordon, Prentice Hall India
3. System Simulation with Digital Computers, N. Deo, PHI

COURSE-XVII: FUZZY SETS AND THEORY

Course Outcome

- Acquire necessary knowledge of important parts of fuzzy set theory, which will enable them to create effective mathematical models of technical phenomena and processes with uncertain information, and carry them out on PC by means of adequate implementations.
- Be able to distinguish between the crisp set and fuzzy set concepts through the learned differences between the crisp set characteristic function and the fuzzy set membership function.
- Be able to draw a parallelism between crisp set operations and fuzzy set operations through the use of characteristic and membership functions respectively.
- Become aware of the use of fuzzy inference systems in the design of intelligent or humanistic systems.

COURSE CONTENT

UNIT-1

Introduction, classical sets and fuzzy sets, operations on classical and fuzzy sets.

UNIT-2

Classical relations and fuzzy relations, operations on classical and fuzzy relations.

UNIT-3

Properties of Membership Functions, Fuzzification, and Defuzzification, Development of Membership Functions,

UNIT-4

Fuzzy Classification and Pattern Recognition, fuzzy arithmetic, fuzzy system design.

Reference Books

1. Fuzzy Logic with Engineering Applications: Timothy J Ross, Second Edition, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, England.
2. Fuzzy Sets and Fuzzy Logic-Theory and Applications: George J. Klir and Bo Yuan, Prentice Hall, New Jersey.

COURSE- XVIII: MACHINE LEARNING TOPICS AT A GLANCE

Course Outcome

- Gain knowledge about basic concepts of Machine Learning.
- Identify machine learning techniques suitable for a given problem.
- Solve the problems using various machine learning techniques
- Design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.

COURSE CONTENT

UNIT-1

Introduction, Machine learning definition, importance of machine learning, machine learning framework, types of machine learning, relation to other fields, examples of machine learning applications, designing a learning system, issues in machine learning.

UNIT-2

Introduction to Supervised Learning, Decision tree based classifier, Bayesian theory based classifier, Neural network based classifier, Nearest neighbour classifier, Support vector classifier, performance evaluation.

UNIT-3

Introduction to Unsupervised Learning, Clustering methods, Criteria functions for clustering, Similarity measures, Component analysis, Low dimensional analysis and multidimensional scaling.

UNIT-4

Additional topics, Reinforcement learning, Genetic algorithms, Analytical learning, Ensemble of classifiers, Design and analysis of machine learning experiments.

Reference Books

1. Machine Learning: a Probabilistic Perspective by Kevin Patrick Murphy, MIT Press, March 2014.
2. Introduction to Machine Learning by Alex Smola and S.V.N. Vishwanathan, Cambridge University Press.

3. Understanding Machine Learning: From Theory to Algorithms by Shai Shalev-Shwartz and Shai Ben-David
4. Published 2014 by Cambridge University Press.

COURSE –XIX: ACCOUNTANCY AND FINANCIAL MANAGEMENT

Course Outcome:

- Demonstrate a critical understanding and the ability to use and interpret financial and non-financial information in management planning and decision making, in operational control, and performance evaluation.
- Recognise and apply the appropriate techniques and tools used by managers in complex domains of decision making.
- Demonstrate a critical understanding of nature of the information provided by the accounting system of a company and systematically evaluate the characteristics of this information that make it most useful for decision making.
- Demonstrate a comprehensive understanding of the key role of financial management in making sound financial decisions such as fund raising and investing.
- Critically assess and evaluate the principle concepts and techniques used in the area of accounting and financial management.

COURSE CONTENT:

UNIT –I

Fundamentals of accounting: Meaning of the book keeping, Objectives and Benefits, Accounting concept and conventions, journal, ledger, trial balance, and subsidiary books.

Sole trading accounts: Preparation of trading accounts, profit and loss account and balance sheet, problems on balance sheets.

UNIT –II

Ratio analysis: Meaning uses, kinds of ratios a) Liquidity ratios b) profitability ratios c) turnover ratios Simple problems on ratio analysis.

Fund Flow statement: Meaning uses, limitations, preparation of Statement of changes in working capital Statement of fund flow operations Fund flow statement.

costing: Nature and importance of cost clarification and preparation of cost sheet.

UNIT –III

Budget and Budgetary control: Meaning of budget and budgeting, importance, limitations of budgetary control, Types of budget: Master budget and functional budget.

Standard Costing: Meaning of standard cost and standard costing uses, merits and demerits of, standard costing variance analysis, problems on material cost variance, material price variance, material usage (quantity) variance, material mix and yield variances.

UNIT –IV

Marginal Costing: Meaning of marginal cost and marginal costing, basic concepts: contributions, P/V ratios, margin of safety, angle of incidence, problems on marginal costing, break – even analysis with charts.

Capital Budgeting: Meaning, kinds of capital budgeting (theory), problems on Payback period method, Accounting Rate of return method, Net present value (NPV) method, Internal rate of return method, Profitability index.

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Reference books:

1. Management Accountancy: Sarkar.N.
2. Financial management: I.M.Pandey.
3. Accountancy: B.S.Raman
4. Management Accounting – Tools and techniques: N Vinayakam and Sinha
5. Principals of accounting, PHL: Levy and Samat

COURSE –XX: SYSTEM ANALYSIS AND DESIGN**Course Outcome:**

- Understand the business needs in order to set requirements for the construction of information systems.
- Acquire the knowledge of development process that takes into consideration user functionality and the construction of applicable models.

COURSE CONTENT:**UNIT-I**

System Concept: Definition, Characteristics, Elements of system, Physical and abstract system, open and closed system, man-made information systems. System Development Life Cycle: Various phases of system development, Considerations for system planning and control for system success.

System Planning: Base for planning a system, Dimensions of Planning. Initial Investigation: Determining users requirements and analysis, fact finding process and techniques.

Feasibility study: Determination of feasibility study, Technical, Operational & Economic Feasibilities, System performance constraints, and identification of system objectives, feasibility report.

UNIT –II

Cost/Benefit Analysis: Data analysis, cost and benefit analysis of a new system. Categories determination and system proposal.

Tools of structured Analysis: Logical and Physical models, context, diagram, data dictionary, data diagram, form driven methodology, IPO and HIPO charts, Gantt charts, system model, pseudo codes, Flow charts- system flow chart, run flow charts etc., decision tree, decision tables, data validation,

UNIT –III

Input/ Output and Form Design: Input and output form design methodologies, menu, screen design, layout consideration. Management standards – Systems analysis standards, Programming standards, Operating standards. Documentation standards – User Manual, system development manual, programming manual, programming specifications, operator manual. System testing & quality: System testing and quality assurance, steps in system implementation and software maintenance.

UNIT –IV

System security: Data Security, Disaster/ recovery and ethics in system development. threat and risk analysis. System audit. Organization of EDP: Introduction. Job Responsibilities & duties of EDP Personnel- EDP manager, System Analyst, Programmers, Operators etc. Essential features in EDP Organization. Selection of Data Processing Resources: purchase, lease, rent-advantages and disadvantages.

References Books:

1. Awad, Elias M: "System Analysis and Design" Second Edition. Galgotia Publication Pvt.Ltd.
2. System Analysis & Design by V K Jain, Dreamtech Press

3. Modern System Analysis & Design by A Hoffer, F George, S Valaciah Low Priced Edn. Pearson Education.
4. Information Technology & Computer Applications, by V.K.Kapoor, Sultan Chand & Sons, New Delhi.

COURSE –XXI: SYSTEM SOFTWARE AND OPERATING SYSTEM

Course Outcome:

- Understand the importance of operating system and utility softwares such as loaders, linkers, assemblers and compilers in computing environment and the various services provided by an operating system.
- Understand the importance of concepts such as memory management techniques, CPU scheduling, Disk scheduling and Input-output scheduling in the computing environment.
- Understand and address the issues such as thrashing, fragmentation, deadlocks and related.

COURSE CONTENT:

UNIT –I

System software and machine architecture – Hypothetical Machine architecture, Assembler - Elements of assembly language, concepts of One pass and two pass assemblers. Loader and Linker - Loader and linker functions, General loading scheme, Macro processor - Basic macro processor functions

UNIT –II

Operating system :Introduction - Functions, types, Operating system services, System calls and system programs.

Process Management :Process Concept, process state diagram, process Control block , Process Scheduling- Multithreading Models, Threading Issues, Scheduling policies

UNIT –III

Process Synchronization, critical section problem, Bakery Algorithm, Semaphores-Meaning, Types of Semaphores, Synchronization problems- Bounded Buffer Problem, Readers-Writers problem and Dining Philosophers problem.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance and recovery

UNIT –IV

Memory Management: Memory management functions, Memory management techniques, Virtual memory management - Segmentation, Demand paging, File management – concepts, Directory structures, file allocation and access methods

Reference Books:

1. D. M. Dhamdhere, "Systems Programming and Operating Systems", Second Revised Edition, Tata McGraw-Hill, 1999.
2. John J. Donovan "Systems Programming", Tata McGraw-Hill Edition, 1972.
3. Operating System Concepts – 5th edition by Abraham Silberschartz and Peter Galvin, McGraw Hill, 2000
4. Operating Systems : Internals and Design Principles, William Stallings, PHI

COURSE –XXII: COMPUTER ARCHITECTURE

Course Outcome:

- Understand the organization of basic computer, its design and the design of control unit.
- Demonstrate the working of central processing unit and RISC and CISC Architecture.
- Describe the operations and language of the register transfer, micro operations and input-output organization.
- Understand the organization of memory and memory management hardware.
- Elaborate advanced concepts of computer architecture, Parallel Processing, interprocessor communication and synchronization.

COURSE CONTENT:

UNIT –I

Basis Computer Architecture, Functional Organization, Register Organization, Arithmetic and Logic Unit, Central Processing unit, Instruction Formats, Addressing Modes. Data Transfer and Manipulation, interrupts RISC/CISC architecture.

UNIT –II

Register transfer and macro-operations, Register Transfer Languages (RTL). Arithmetic, Logic and Shift Macro-operations, Sequencing, Micro-program sequences.

Memory & Storage: Processor Vs. Memory speed: Cache memory. Associative memory, Virtual memory and Memory management

UNIT –III

Input / Output organization: Peripheral devices, I/O Asynchronous Data Transfer: Strobe Control, Data Transfer Schemes (Programmed, Initiated, DW, Transfer), I/O Processor.

UNIT –IV

Pipelining and Vector Processor : Review of Pipelining, Examples of some pipeline in modern processors

Vector processors- Use and effectiveness, memory to memory vector architectures, vector register architecture,

SISD, MISD, MIMD, Single instruction multiple data stream (SIMD) architectures. Array processors, comparison with vector processors, example of array processors such as MMX Technology.

References Books:

1. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
2. Hamacher and Zaki, "Computer Organisation", Tata McGraw Hill
3. Hwang and Briggs, "Computer Architecture & Parallel Processing", TMH

COURSE –XXIII: INFORMATION SYSTEMS MANAGEMENT

Course Outcome:

- Define an information system from both a technical and business perspective and distinguish between computer literacy and information systems literacy.

- Assess the relationship between organizations, information systems and business processes, including the processes for customer relationship management and supply chain management.

COURSE CONTENT:

UNIT –I

Fundamentals of information systems: information systems in business, fundamentals of information systems solving business problems with information systems.

Introduction to e-business: e-commerce frame work, media convergence, consumer applications, organization applications.

UNIT –II

Information systems for business operations: business information systems, transaction processing systems, management information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

UNIT –III

Issues in managing information technology: managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with it, security and ethical challenges in managing it, social challenges of information technology.

UNIT –IV

Electronic data interchange (EDI): EDI concepts, applications in business – components of international trade, customs financial EDI, electronic fund transfer, manufacturing using EDI, digital signatures and EDI.

References Books:

1. Management information systems- managing information technology in the internet worked enterprise- jams. AO'brien - TMH publishing company limited, 2002.
2. Management information systems – Laudon and LaudonPublishers .
3. Management information systems- S Sadogopan, PHI
4. Information systems for modern management – G.R. Murdick PHI, 2nd edition.

COURSE-XXIV: PROBABILITY AND STATISTICS

Course Outcome:

- Learn basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
- Learn how to derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions, how to calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.
- Learn how to use discrete time Markov chains and methods of finding the equilibrium probability distributions, how to calculate probabilities of absorption and expected hitting times for discrete time Markov chains with absorbing states and how to translate real-world problems into probability models.

COURSE CONTENT:

UNIT –I

Probability: The concept of probability, the axioms and theorems, conditional probability, Independent Event's, Bayes Theorem. Random Variables and Probability Distributions: Random variables, discrete probability distributions and Distribution functions: Bernoulli, Binomial, Hyper Geometric, Geometric, Poisson, Uniform.

UNIT –II

Continuous Probability distribution and Distributions functions: Exponential, Normal, Uniform, Concepts of Chi squared, T, joint Distributions, Independent random variables, Functions of random Variables.

UNIT –III

Mathematical Expectation: Definition, Functions of Random variables. The variance and Standard Deviation, Moments, Moment Generating Functions, Covariance, Correlation Coefficient. Sampling Theory & Estimation: Population and sample, Sampling with and without replacement, the sample mean, sampling distribution of means, proportions, differences and sums. The sample variance, the sample distribution of variances, Point estimates, Interval estimates. Variance analysis.

UNIT –IV

Tests of Hypotheses and Significance: Statistical Decisions, Statistical hypotheses, Null Hypotheses, Tests of hypotheses and significance, Type I and Type II errors, level of significance, Tests involving the Normal distribution, One-Tailed and Two-tailed, Special tests of Significance for large and small samples, The Chi-square test for goodness of fit. Introduction to regression and curve fitting.

References Books:

1. Juscir S Trivedi, "Probability and Statistics with Reliability, Queuing and Computer Applications", Prentics Hall of India, 2000.
2. Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes, McGraw Hill, 4th Edition.
3. Richard A Johnson, Probability and Statistics for Engineers Prentice Hall, India 2002.

COURSE –XXV: MOBILE COMMUNICATION

Course Outcome:

- Understand and apply the concepts of telecommunication switching, traffic and networks in communication.
- Analyze the telecommunication traffic. Analyze radio channel and cellular capacity.
- Understand and apply concepts of GSM and CDMA system.

COURSE CONTENT:

UNIT –I

Introduction, History of wireless communication, A simplified reference model, Signals, Antennas , Signal propagation, Multiplexing, modulation, spread spectrum, cellular system.

UNIT –II

Medium access control, Motivation for specialized MAC,SDMA,FDMA,TDMA,CDMA, Comparison SDMA/FDMA/TDMA/CDMA, Telecommunication systems, GSM, DECT, TETRA, UMTS and IMT-2000

UNIT –III

Satellite systems : History, Applications, basics, GEO, LEO, MEO, Routing ,Localization ,handover. Broadcast Systems :Overview, Cyclical repetition of data, Digital audio broadcasting, digital video broadcasting, convergence of broadcasting and mobile communication.

UNIT –IV

Wireless LAN, Infra-red v/s radio transmission, Ad-hoc networking, IEEE 802.11, Hiperlan, Bluetooth, Mobile Network layer , Mobile IP, Dynamic host configuration protocol, Mobile ad-hoc networks

References Books:

1. Mobile Communications by Jochen Schiller,, 2nd Edition, Pearson Education
2. Introduction To Digital Mobile Communication by Yoshihiko Akaiwa, Wiley India Pvt Ltd(2011)
3. Mobile Cellular Communication by Rao, Pearson Education (2012)

COURSE –XXVI: COMMERCE AND E-GOVERNANCE

Course Outcome:

- Understand the fundamentals of E-commerce, types and applications.
- Evaluate the role of the major types of information systems in a business environment and their relationship to each other.
- Assess the impact of internet and internet technology in a business electronic commerce and electronic business.
- Learn strategies for e-commerce, e-governance, wireless application protocol technology and electronic payment system.

COURSE CONTENT:

UNIT –I:

Introduction: Electronic commerce environment and opportunities: Background, The electronic commerce environment, Electronic market place technologies. Modes of electronic commerce: Overview, Electronic data interchange (EDI), Migration to open EDI, E-commerce with WWW/Internet, Commerce Net advocacy, Web commerce going forward. Approaches to safe E-commerce: Overview, Secure Transport Protocols, Secure Transactions, Secure electronic payment protocol (SEPP), Secure electronic Transaction (SET), Certificates for authentication, Security on web commerce & Enterprise network.

Payments and Security: Electronic cash and Electronic payment Schemes: Internet monetary payment and Security requirements, payment and purchase order process, On-line electronic cash. Master card/Visa secured electronic transaction: Introduction, Business Requirements, Concepts, Payment processing.

UNIT –II:

Consumer-oriented e-commerce: Introduction, Traditional retailing and e-retailing, benefits of e-retailing, Key success factors, Models of e-retailing, features of e-retailing, developing a consumer-oriented e-commerce system, The PASS model. Business-oriented e-commerce: Features of B2B e-commerce, Business models, Integration. Web advertising and web publishing: Traditional versus internet advertising, Internet techniques and strategies, Business models for advertising and their Revenues streams, pricing models and measurement of the effectiveness of Advertisements, web

publishing- Goals and criteria, web side development Methodologies, logic design of the user interface.

UNIT –III:

E-Governance – An introduction, scope, Types of E- Governance- Public, Corporate, Urban, Public-Private Partnership. Models & issues for effective E-Governance.E-Democracy, role of E-Governance, E-Republic, E-Business.The stages of E-Government development, E-Govt Privacy, Security & Accessibility. Mobile security issues for E-Govt. ICT & E-Governance – Role of ICT(Information & Communication Technology). ICT infrastructure, Implementation of ICT policy.CRM(Customer Relationship Model)- Defining CRM in the public-service area. Standards in E-Governance, India Portal-Mission mode project, India development Gateway (InDG).

UNIT –IV:

E-Government in India- Introduction, Core policies, selection criteria, core infrastructure, support infrastructure, HRD/ Training- Technical assistance, awareness & assessment. National E-Governance Strategy, Implementation approach, governance structure. Draft policy Guidelines on website development-infrastructure, Applicability, Aims & Objectives, Content structure, website features, Administration, maintenance/updating, website promotion, technical aspects, security & secrecy of information, infrastructure & Training.

Refernces Books:

1. Ravi Kalakota, Andrew B. Frontiers of Electronic Commerce, Addison Wesley 1996.
2. Daniel Minoli, Emma Minoli: web commerce Technology Handbook. Tata McGraw Hill 1999.
3. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Cheng: E-Commerce Fundamentals and applications, John Wiley & Sons, 2002.
4. E-Governance by - V.M. RAO
5. E-Governance by - PANKAJ SHARMA.

COURSE-XXVII: LINUX PROGRAMMING

Course Outcome:

- Identify and use UNIX/Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.
- Effectively use the UNIX/Linux system to accomplish typical personal, office, technical, and software development tasks.
- Monitor system performance and network activities.
- Effectively use software development tools including libraries, preprocessors, compilers, linkers, and make files. Comprehend technical documentation, prepare simple readable user documentation and adhere to style guidelines.
- Collaborate in teams on system tasks.

COURSE CONTENT:

UNIT-I:

Introduction, Features of Linux, Linux Utilities-File handling utilities, File permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities, sed – scripts, operation, addresses, commands, applications, awk – execution, fields and records, scripts, operation, patterns, actions, functions, using system commands in awk.

UNIT-II:

Working with the Bourne shell(bash): Introduction, shell responsibilities, pipes and input Redirection, output redirection, running a shell script, the shell as a programming language control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

UNIT-III:

Files: File Concept, File System Structure, Inodes, File Attributes, File types, Library functions, the standard I/O and formatted I/O in C, stream errors, kernel support for files, System calls, File structure related system calls(File APIs), file and record locking, file and directory management – Directory file APIs, Symbolic links & hard links. Process concept.

UNIT -IV:

Multithreaded Programming: Differences between threads and processes, Thread structure and uses, Creating Threads, Thread Attributes, Thread Synchronization with semaphores and with Mutexes, Example programs. Sockets: Introduction to Sockets, example-client/server programs.

REFERENCE BOOKS:

1. Unix System Programming using C++, T.Chan, PHI.(UNIT III to UNIT VIII)
2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.
3. Beginning Linux Programming, 4th Edition, N.Matthew, R.Stones, Wrox, Wiley India Edition.
4. Advanced Programming in the Unix environment, 2nd Edition, W.R.Stevens, Pearson Education.
5. Unix Network Programming ,W.R.Stevens,PHI.

COURSE –XXVIII: INFORMATION RETRIEVAL

Course Outcome:

- Understand the concept of information retrieval; deal with storage and retrieval process of text and multimedia data.
- Able to evaluate the performance of any information retrieval system.
- Understand concept of multimedia and distributed information retrieval.

COURSE CONTENT:

UNIT –I :

Introduction, architecture of retrieval system, retrieval vs search, inductive and deductive way of retrieval, introduction to multimedia retrieval systems, validity measures- accuracy, precision, recall, f-measure, r-norm. sequencing with grouping, correct index.

UNIT –II :

Review of the Relational Model, A Historical Progression, Information Retrieval as a Relational Application, Semi Structured Search using a Relational Schema, Data Normalization

UNIT –III :

Data Clustering: Data, Features, Feature Space, Data Reduction, Proximity Indices and Similarity/Dissimilarity measures, Fuzzy Measures, Symbolic Measures, Clustering Strategies- Agglomerative Clustering, Divisive Clustering, Partitional Clustering, Cluster Validity, Applications of Data Clustering. Reduction through transformations.

UNIT –IV :

Text retrieval system: building up a corpus of text documents- preprocessing, feature extraction, different similarity and dissimilarity measures, searching a document based on query, approximations, dimensionality reduction through term selection, term elimination and combination of both, Hashing and indexing for quick retrieval, insertion and deletion of document from the corpus.

REFERENCE:

1. David A. Grossman, Ophir Frieder- Information Retrieval: Algorithms and Heuristics, Second Edition, The Information Retrieval Series, Vol. 15, Springer-2004.
2. Anil K Jain, R. C. Dubes: Algorithms for Clustering Data
3. Research Papers

COURSE-XXIX: DIGITAL IMAGE PROCESSING

Course Outcome:

- Develop and implement algorithms for digital image processing.
- Apply image processing algorithms for practical object recognition applications.

COURSE CONTENT:

UNIT –I

Introduction to digital image processing, Stages, Application areas, components, electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, relationships between pixels, Enhancement in spatial domain: Intensity transformation functions.

UNIT –II

Spatial filtering, Frequency domain enhancement: Discrete Fourier transform (DFT) properties of the 2D discrete Fourier transform, filtering in the frequency domain, Introduction to Color image processing.

UNIT –III

Segmentation – Intensity based – point, line and edge. Region based – Boundaries, region growing, Thresholding, splitting and merging, segmentation by morphological watersheds, the use of motion in segmentation.

UNIT –IV

Morphological operations: Preliminaries, opening and closing, the hit-or-miss transformation, some basic morphological algorithms, gray-scale images. Image representation

Some applications: Document image processing, Biometrics, robot vision, medical applications.

Reference Books:

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, 3-rd ed. Prentice Hall, Pearson publication.
2. Anil K Jain, Digital Image Processing, PHI Publication
3. Milan Sonka, Image Processing, Analysis, and Machine Vision, 3rd Edition, CL Engineering(2013)

COURSE-XXX: GRAPH THEORY

Course Outcome:

- Write precise and accurate mathematical definitions of objects in graph theory.
- Use mathematical definitions to identify and construct examples and to distinguish examples from non-examples.
- Validate and critically assess a mathematical proof.
- Use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory.
- Reason from definitions to construct mathematical proofs.
- Write about graph theory in a coherent and technically accurate manner.

COURSE CONTENT:

UNIT –I

Fundamental concepts of Graph, Vertices, Edges, Degree, Isolated Vertices, Pendent Vertices, Regular graph, Fundamental theorems, Simple and general graphs, Complete and Infinite graphs, Adjacency and Incidence Matrix structures, Concept of Isomorphism, Review of graph in analysis and design of algorithms

UNIT –II

Connectivity, Dis-connectivity, Paths, Shortest paths, Circuits, Graph operations, Euler and Hamiltonian graphs, Travelling salesman problem, Weighted graphs, shortest distances, Path matrix

UNIT –III

Trees, Spanning Trees, Fundamental Circuits, Tree center, Cut-sets, Fundamental cut-sets, Connectivity and seperability, Circuit matrix, Cut set matrix

UNIT –IV

Planarity, Kuratowski's graphs, Faces, Euler formula, Duality, Dual properties, Chromaticity- vertex coloring, region coloring, Bipartite graphs

REFERENCES BOOKS

1. Graph Theory with Applications to Engineering and Computer Science by NarsinghDeo.

COURSE –XXXI: CRYPTOGRAPHY AND NETWORK SECURITY

Course Outcome:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.
- Compare and Contrast different IEEE standards and electronic mail security.

COURSE CONTENT:

UNIT –I

Introduction-computer security concepts, attacks, security services, security mechanisms; Classical encryption techniques-symmetric cipher models, substitution techniques, transposition techniques, rotor machines

UNIT –II

Symmetric ciphers-Block cipher principles; DES-Algorithm, strengths and weaknesses of DES, attacks on DES and defense, multiple encryptions; Asymmetric ciphers-Essential mathematics, public key cryptography,

UNIT –III

RSA, Diffie Hellman key exchange, random number generation, Data integrity and authentication Hash functions; MAC; Digital signatures;

UNIT –IV

Key management; Authentication, Web and system security, Web security; IP security; E mail security; System security-intruders, malicious software, firewalls

References Books:

1. Cryptography and Network Security - Principles and Practice, William Stallings, PEARSON
2. Cryptography and Network Security, AtulKahate, Tata McGraw Hill

COURSE –XXXII: DISTRIBUTED COMPUTING

Course Outcome:

- Understand the following concepts in the design and development of distributed computing systems: definition and classifications, motivations and economics of distributed computing, time and space management, mutual exclusion, deadlock detection, failure recovery, resource allocation, scheduling and load balancing, and security management and authentication.
- Acquire the knowledge to solve various problems in the design, implementation, and deployment of distributed computing systems and to design and conduct experiments on various distributed computing systems available in the industry.

COURSE CONTENT:

UNIT –I

Introduction to distributed systems (DS), Design goals, transparencies, fundamental issues, interconnection networks, Client server computing

UNIT –II

Naming and binding, Distributed co-ordination, Process synchronization, Inter-process communication

UNIT –III

Dead locks in distributed systems, Load Scheduling and balancing techniques, Agreement protocols

UNIT –IV

Distributed file system design, Distributed database system : A Case study

ReferencesBooks :



1. Andrew S Tanenbaum and Maarten van Steen : Distributed Systems: Principles and paradigms, PHI(2002)
2. T.L. Casavant and M. Singhal : Distributed Computing Systems, IEEE computing society press (1994)
3. M. Raynal and J. Howlett : Distributed algorithms and protocols, Wiley and Sons (1988)

COURSE-XXXIII: CLOUD COMPUTING

Course Outcome:

- Define Cloud Computing and memorize the different Cloud service and deployment models.
- Describe importance of virtualization along with their technologies.
- Use and Examine different cloud computing services.
- Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing.
- Design & develop backup strategies for cloud data based on features.

COURSE CONTENT:

UNIT –I

Introduction: Cloud models-Evolution of Cloud Computing –System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – On-demand Provisioning – Elasticity in Cloud – deployment models – service models-cloud service providers
Virtualization: Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization, Virtualization Structures - Tools and Mechanisms – resource sharing and resource pooling Desktop Virtualization – Server Virtualization.

UNIT –II

Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

UNIT –III

Programming Model: Parallel and Distributed Programming Paradigms – Map Reduce, Twister and Iterative Map Reduce – Hadoop Library from Apache – Mapping Applications - Programming Support.

Security in the Cloud: Security Overview – Cloud Security Challenges – Access control mechanisms – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Virtual Machine Security.

UNIT –IV

Enterprise Cloud-Based High Performance Computing (HPC): Overview of High Performance Computing (HPC) on Cloud-Enterprises HPC applications (high-performance grid computing, high-performance big data computing/analytics, high performance reasoning)-HPC Cloud vendor solutions: compute grids (Windows HPC, Hadoop, Platform Symphony ,Gridgain), data grids (Oracle coherence, IBM Object grid, Cassandra, HBase, Memcached, HPChardware (GPGPU, SSD, Infiniband, Non-blocking switches)

Setting up own Cloud: Cloud setup-How to build private cloud using open source tools-Understanding various cloud plugins-Setting up your own cloud environment-Autoprovisioning-Custom images-Integrating tools like Nagio-Integration of Public and Private cloud.

Reference Books :

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing, From
2. Parallel Processing to the Internet of Things, 2012, 1st Edition, Morgan Kaufmann Publishers.
3. Katarina Stanoevska-Slabeva, Thomas Wozniak, SantiRistol, Grid and Cloud Computing – A Business Perspective on Technology and Applications, 2010, Springer.
4. John W.Rittinghouse and James F.Ransome, Cloud Computing: Implementation, Management, and Security”, 2010, CRC Press.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, 2009, TMH.
6. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud O'Reilly, 2009.

COURSE –XXXIV: MOBILE APPLICATION DESIGN AND DEVELOPMENT

Course Outcome:

- Describe Android platform, Architecture and features.
- Design User Interface and develop activity for Android App.
- Use intent, broad cast receivers and internet services in Android App.
- Design and implement Database Application and Content providers.
- Use multimedia, camera and Location based services in Android App.
- Discuss various security issues in Android platform.

COURSE CONTENT:

UINT –I

Mobile application development: A brief history of mobile, Mobile ecosystem, Designing for context, Developing a Mobile Strategy, Mobile Information Architecture, Mobile Design, Types of mobile application

UINT –II

Technologies: HTML5-elements, form, graphics, media, CSS3-2Dtransforms, 3Dtransforms, transitions, animations, images, Javascript-forms, objects, error handling, validations, JQuery-selectors, effects, traversing, Ajax

UINT III

Android programming: Android toolkit, Java for android, components of an Android Application.

Android software development: Eclipse Concepts and Terminology, Eclipse Views and Perspectives, Eclipse and Android, Effective java for Android

Android Framework: Building a View, Fragments and Multiplatform Support, Handling and Persisting Data.

Android UID principles: Designing powerful user interfaces, handling advanced user input, designing accessible applications.

UINT –IV

Drawing, Animations and Graphics programming: Developing 2D graphics applications, working with animations developing Android 3D graphics applications, using Android NDK.

Reference Books :

1. Zigmund Mednieks, Laird Dornin, G. Blake Meike, and Masumi Nakamura, Programming Android, 2011, 1st Edition, O'Reilly Media.
2. Jonathan Stark, Building iPhone Apps with HTML, CSS and JavaScript, 2011, 1st Edition, O'Reilly Media.
3. Brian Flanagan, Mobile Design and Development, 2009, 1st Edition, O'Reilly Media.
4. Paul Deitel, Harvey Deitel, Abbey Deitel, Michael Morgana, Android for Programmers An App-Driven Approach, 2012, 2nd Edition, Deitel Developer Series, Pearson Education.

COURSE –XXXV: NETWORK AND INFORMATION SECURITY

Course Outcome:

- Understand the basic terminology and concepts related to network and system level security, basics of computers and networking including Internet Protocol, routing, Domain Name Service, and network devices.
- Exposed to basic cryptography, security management, and network security techniques.
- Look at policies as a tool to effectively change an organization's culture towards a better secure environment.
- Put it all together in the form of a case study for designing and auditing a security system at conceptual level.

COURSE CONTENT:

UNIT –I

Introduction: Threats, vulnerabilities, controls, Confidentiality, integrity, availability, Attackers and attack types.

Authentication, Access Control and: Authentication, Identification Versus Authentication, Authentication Based on biometrics, Authentication Based on Tokens, Federated Identity management, Multifactor Authentication, Secure Authentication. Implementing Access Control, Procedure-Oriented Access Control, Role-Based Access Control.

UNIT –II

Cryptography: Problems Addressed by Encryption Terminology, DES: The Data Encryption Standard, AES: Advanced Encryption System, Public Key Cryptography, Trust Certificates: Trustable Identities and Public Keys, Digital Signatures.

Browser Attacks: Browser Attack Types, How Browser Attacks Succeed: Failed Identification and Authentication, Web Attacks Targeting Users False or Misleading Content, Malicious Web Content Protecting Against Malicious Web Pages, Foiling Data Attacks, Email Attacks.

UNIT –III

Cyber Security: Cyber Security Fundamentals – Attacker techniques and motivation – Malicious Code – Defence and Analysis Techniques – Memory Forensics – Honeypots – Malicious code Naming – Automated code analysis systems – Intrusion Detection System.

UNIT –IV

Replication: Self-Replicating Malicious Code, Evading Detection and Elevating Privileges, Persistent Software Techniques, Rootkits, Spyware, Virtual Machine Detection.

Cloud Security: Cloud Computing Concepts, Service Models, Deployment Models, Moving to the Cloud, Risk Analysis Cloud Provider Assessment, Switching Cloud Providers, Cloud Security Tools and Techniques Data Protection in the Cloud, Cloud Application Security, Cloud Identity Management.

Reference Books :

1. Charles P. Fleeger, Security in Computing, 2011, 5th edition, Prentice Hall, New Delhi.
2. P.W.Singer and Allan Friedman, Cyber security and cyber war what everyone needs to Know, 2014, 1st edition, Oxford university press,USA.
3. Taylor Sutton Finch Alexander, Information Security Management Principles, 2012, 2nd edition BCS Learning and development Limited, United Kingdom.

COURSE-XXXVI:INTERNET OF THINGS

Course Outcome:

- Understand the key technologies in internet of things, wireless sensor network architecture and its framework along with WSN applications,
- Understand the resource management and business models for the internet of things.

COURSE CONTENT:

UINT –I

Introduction to IoT: Definition and Characteristics, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies.

M2M and IoT: Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT.

IoT Protocols: IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, 6LoWPAN, RPL

UINT –II

Developing Internet of Things: IoT Platforms Design Methodology, Python packages of Interest for IoT, IoT Physical Devices and Endpoints

IoT and Cloud: IoT Physical Servers and Cloud Offerings, IoTTools:Chef,Puppet

UINT –III

Data Analytics for IoT: Big Data Platforms for the IoT, Hadoop Map Reduce for Batch Data Analysis, ApacheOozie Workflows for IoT Data Analysis, In-Memory Analytics using Apache Spark, Apache Storm for Real Time Data Analysis, Sustainability Data and Analytics in Cloud based M2M Systems, Fog Computing: A Platform for IoT and Analytics

UINT –IV

Domain Specific IoTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle, Virtual Reality Internet Advertising, Intelligent

Transportation Systems, Health Information System: Genomics Driven Wellness Tracking and Management System(Go-WELL)

Reference Books :

1. Arshdeep Bahga, Vijay Madiseti, Internet of Things: A Hands-on Approach, 2015, 1st Edition, Universities Press.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key applications and Protocols, 2012, Wiley Publication.
3. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, 2012, CRC Press.
4. Dieter Uckelmann; Mark Harrison; Florian Michahelles Architecting the Internet of Things, 2011, Springer.

COURSE –XXXVII: ENTERPRISE RESOURCE PLANNING

Course Outcome:

- To understand the basic structure of ERP.
- To identify implementation strategy used for ERP.
- To apply design principles for various business modules in ERP.
- To apply different emerging technologies for implementation of ERP.
- To analyze security issues in ERP.
- To acquire ERP concepts for real world applications.

COURSE CONTENT:

Introduction to Enterprise Resource Planning: Introduction, Benefits of ERP, Business Process Reengineering, Data Warehousing, Data Mining, Supply Chain Management.

Reasons for the Growth of ERP: Reasons for the Growth of ERP, Scenario and Justification of ERP in India, Evaluation of ERP, Various Modules of ERP, and Advantages of ERP.

Understanding ERP: Overview of Enterprise, Integrated Management Information, Business Modeling, ERP for Small Businesses, ERP for Make to Order Companies.

Business Process Mapping: Business Process Mapping in ERP, ERP Implementation Process, Hardware Environment for ERP Implementation.

ERP Implementation: Precautions in ERP Implementation, ERP Post Implementation Options, Guidelines for ERP Implementation, Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Hidden Cost, Vendors, Consultants, Human Resource, Re-Engineering, Configuration, Implementation, Team Training, Testing, Going Live and End User Training, Post Implementation.

ERP and Related Technologies: Business Process Re-engineering, Management Information System, Executive Information System (EIS), Decision Support Systems (DSS), Supply Chain Management.

ERP Modules: ERP Finance Module, Plant Maintenance, Quality Management, Materials Management Module.

ERP and E-commerce: Future Directives in ERP, ERP and Internet, Critical Factors Guiding Selection and Evaluation of ERP, Strategies for Successful ERP Implementation, Critical Success Factors in ERP Implementation, Failure Factors in ERP Implementation, Integrating ERP into Organization, ERP Software and Tools

Reference Books

1. **Concepts in Enterprise Resource Planning** 4th Edition by Ellen Monk and Bret Wagner
2. **Modern ERP: Select, Implement, and Use Today's Advanced Business Systems** by Marianne Bradford
3. **Enterprise Resource Planning: Concepts and Practice, Second Edition** New Title Edition, Kindle Edition By Vinod Kumar and Venkitakrishnan, N. K. Garg

COURSE-XXXVIII: PYTHON PROGRAMMING

Course Outcome:

- Acquire programming skills in core Python. Acquire Object Oriented Skills in Python.
- Develop the skill of designing Graphical user Interfaces in Python.
- Develop an ability to write database applications in Python.

COURSE CONTENT:

UNIT –I

Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

UNIT –II

Types, Operators and Expressions: Types – Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while break, continue, pass

Data Structures Lists: Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

UNIT –III

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function- Global and Local Variables. **Modules:** Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

UNIT –IV

Object-Oriented Programming OOP in Python: Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions

UNIT –V

Brief Tour of the Standard Library: Operating System Interface – String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Reference Books:

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd.
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015.
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1st Edition, Wiley India Pvt Ltd, 2016.
5. ReemaThareja, "Python Programming using problem solving approach", Oxford university press, 2017.
6. Python Programming: A Modern Approach, VamsiKurama, Pearson
7. Learning Python, Mark Lutz, Orielly
8. Introduction to Python, Kenneth A. Lambert, Cengage.

COURSE-XXXIX: SOFTWARE PROJECT MANAGEMENT

Course Outcome

- Understand the methods used to evaluate and select projects for investment of funds.
- Acquire knowledge on the principles and techniques of software project management.
- Learn organization behaviour and general management techniques used for project management.

COURSE CONTENT

UNIT I

Introduction to Software Project Management: Project Definition – Contract Management – Activities Covered By Software Project Management – Overview of Project Planning – Stepwise Project Planning.

UNIT II

Project Evaluation: Strategic Assessment–Technical Assessment–Cost Benefit Analysis–Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

UNIT III

Activity Planning: Objectives – Project Schedule – Sequencing and Scheduling Activities – Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning and Control.

UNIT IV

Monitoring and Control: Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

Reference Books:

1. Bob Hughes, Mikecotterell, "Software Project Management", Third Edition, Tata McGraw Hill, 2004.
2. Ramesh, Gopaldaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
3. Royce, "Software Project Management", Pearson Education, 1999.
4. Jalote, "Software Project Management in Practive", Pearson Education, 2002.

COURSE-XV: DATA CLUSTERING

Course Outcome

- Acquire the knowledge of different categories of clustering and their applicability in clustering large volume of data.
- Identify the areas and the type of data where the concepts of clustering can be used for discovering the knowledge hidden in the data.
- Be able to handle various issues while implementing and validating the performance of any clustering algorithm.

COURSE CONTENT:

Definition, Algorithms, Connectivity-based clustering (hierarchical clustering), Centroid-based clustering, Distribution-based clustering, Density-based clustering, Recent developments, Evaluation and assessment, Internal evaluation, External evaluation, Cluster tendency, Applications,

References:

1. Anil K Jain and R.C. Dubes. Algorithms for Clustering Data. Prentice Hall, New Jersey 1988.
2. R. Ng and J. Han, Efficient and effective clustering method for spatial data mining.

OPEN ELECTIVE PAPER

COURSE –I: COMPUTER FUNDAMENTALS AND PROGRAMMING CONCEPTS

Course Outcome:

- Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming
- Write, compile and debug programs in C language and use different data types for writing the programs.
- Design programs connecting decision structures, loops and functions.
- Understand the dynamic behavior of memory by the use of pointers.
- Use different data structures and create / manipulate basic data files and developing applications for real world problems

COURSE CONTENT:

UNIT –I

Introduction to Computers: History, Generations of Computers, Application of computers in various fields, Classification of computers

Block diagram of a computer, Input and output devices – Keyboard, , Mouse and other input devices, Output devices – Monitor, Printer and Audio output devices, Storage devices – Primary and secondary storage – RAM, ROM and its types, Magnetic storage devices, Optical Storage devices, measuring device performance.

UNIT –II

Data and Information – Representation of different types of data, Data processing cycle, Factors affecting processing speed, Data processing types. Computer Software, Types of Software, Operating System-Introduction, Types of Operating System.

Problem solving aspects – Introduction, stages in problem solving , Introduction to algorithms and flow charts, Programming languages – Types of programming languages, Basic programming constructs - sequence, selection and iteration.

UNIT –III

Introduction to C, Features, Basic structure, Programming constructs : Constants – Types of constants, Variables – declaration of variables, Identifiers , Data types in C – int, float and char with their modifiers.

Operators and Expression: Arithmetic, Relational, logical, assignment, increment and decrement, conditional, bitwise and special operators, Expression – Arithmetic, relational and logical expressions, Evaluation of expressions, Type conversions in expressions, Operator precedence and associatively, Mathematical functions. Managing Input and Output Operations, Reading a character, writing a character, formatted input and formatted output

UNIT –IV

Decision Making and Branching

Decision making with IF statement, Simple IF statement, The IF ELSE statement, Nesting of IF ...

ELSE statements, The ELSE IF ladder, the switch statement, the ?: Operator, The GOTO statement. Decision Making and Looping

The WHILE statement, The DO statement, The FOR statement, Jumps in loops Arrays

One-dimensional arrays, Two-dimensional arrays, Initializing two-dimensional arrays., Strings in C – string handling functions, Introduction to functions in C – Advantages of functions, Defining and calling a function

Reference Books:

1. Problem Solving with C, M.T. Somashekara, PHI Learning, New Delhi, 2009
2. Programming in ANSI C 2nd Edition by E Balaguruswamy Published by Tata McGraw Hill.
3. Computer Concepts and C programming by P.B. Kotur
4. Let Us C by YashwantKanetker, BPB Publication

COURSE-II: E-TECHNOLOGY

Course Outcome:

- Be aware of various concepts of ICT and its relevance as a distinct discipline.
- Know the conceptual and functional/practical knowledge in the field of ICT, including various theories/ techniques/tools related to modern development.

COURSE CONTENT:

UNIT –I:

E-Governance – An introduction, scope, Types of E- Governance- Public, Corporate, Urban, Public-Private Partnership. Models & issues for effective E-Governance.E-Democracy, role of E-Governance, E-Republic, E-Business.The stages of E-Government development, E-Govt Privacy, Security & Accessibility. Mobile security issues for E-Govt.

ICT & E-Governance – Role of ICT(Information & Communication Technology). ICT infrastructure, Implementation of ICT policy. CRM (Customer Relationship Model)- Defining CRM in the public-service area.

UNIT –II

Standards in E-Governance, India Portal-Mission mode project, India development Gateway (InDG). E-Government in India- Introduction, Core policies, selection criteria, core infrastructure, support infrastructure, HRD/ Training- Technical assistance, awareness & assessment. National E-Governance Strategy, Implementation approach, governance structure.

Draft policy Guidelines on website development-infrastructure, Applicability, Aims & Objectives, Content structure, website features, Administration, maintenance/updating, website promotion, technical aspects, Secrecy of information

UNIT –III

Introduction to Computer Networks – Network elements, Objectives and applications of networks, Network types – LAN, WAN and MAN, intranet v/s Internet, Network topologies, Internet services – E-mail, browsing, File services, Net banking, OSI ISO reference model – Functions of different layers

UNIT –IV

Web Designing using HTML: Introduction to HTML, HTML tags, Different types of list – ordered, unordered and definition, Linking multiple web pages, Tables in HTML

References books:

1. E-Governance by V.M. RAO
2. E-Governance by PANKAJ SHARMA.
3. Computer Fundamentals by V. Rajaraman, PHI Publication
4. Beginning HTML, XHTML, CSS, And Javascript 1st Edition, Jon Duckett.
5. HTML 5 for Beginners, FiruzaAibara, Shroff publisher (2012)

COURSE –III: HIGH PERFORMANCE COMPUTING**Course Outcome:**

- Apply the tools and techniques derived from the courses and develop proper applications for solving the real-world problems.
- Apply acquired knowledge toward academic/ professional and personal development.
- Empowers every student to demonstrate their ability to excel in their academic and other careers.

COURSE CONTENT:**UNIT –I**

Introduction: The need for parallel computers, Models of computation, Analyzing parallel algorithms, Expressing parallel algorithms,

UNIT –II

The Computational Power of the PRAM model: Comparison between RAM and PRAM models, Graph coloring on PRAM, Parallel computation thesis, NC and P-complete classes

UNIT –III

Selection: Sequential algorithms, Desirable properties for parallel algorithms, An EREW algorithm for parallel selection, Merging: A network for merging, Merging on the CREW model.

UNIT –IV

Parallel Sorting Algorithms: Bubble, Quick, Odd-Even Transposition sort, Shear sort.

References:

1. Michael Quinn, Parallel Programming in C with MPI and OpenMP (preprint), McGraw-Hill.
2. R. Greenlaw, H.J. Hoover, W.L. Ruzzo, Limits to Parallel Computation: P-Completeness Theory, Oxford University Press, New York, 1995.
3. V. Kumar, A. Grama, A. Gupta, G. Karypis, Introduction to Parallel Computing, The Benjamin/Cummings Publishing Company, Redwood City, California, 1994.
4. T. Cormen, C. Leiserson, R. Rivest, Introduction to Algorithms, The MIT Press, Cambridge, 1992.
5. S. G. Akl, The Design and Analysis of Parallel Algorithms, Prentice Hall, 1989.
6. M. J. Quinn, Parallel Computing, McGraw Hill, 1994.
7. F.T. Leighton, Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes, Morgan Kaufmann Publishers, San Mateo, California, 1992.
8. D.P. Bovet, P. Crescenzi, Introduction to The Theory of Complexity, Prentice Hall, N.Y., 1994.
9. Al Geist, et al., PVM: Parallel Virtual Machine - a User's Guide and Tutorial for Networked Parallel Computing, The MIT Press, Cambridge, 1994.