MASTER OF SCIENCE IN COMPUTER SCIENCE

SCHEME OF TEACHING AND EXAMINATIONS

FIRST SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Th	Ses	Pr	Total	Th	Ses	Pr	Total
Paper I	Principles of Programming Languages	3	2	-	4	100	50		150	40	30		70
Paper II	Advanced Operating System	3	2	-	4	100	50		150	40	30		70
Paper III	Data Structure through algorithms using 'C'	3	2	-	4	100	50		150	40	30		70
Paper IV	Programming in Java	3	2	-	4	100	50		150	40	30		70
Paper V	Computer System Architecture	3	2	-	4	100	50		150	40	30		70
Practical I	Programming Lab Based on Paper-III			3x2	3		25	100	125		15	50	65
Practical II	Programming Lab Based on Paper-IV			3x2	3		25	100	125		15	50	65
TOTAL		15	10	12	26	500	300	200	**1000**	200	180	100	480

07/02/23

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7/2/2023

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9/02/23

FIRST SEMESTER: M.Sc. (CS)

Paper I: Principles of Programming Languages

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- Student will understand the basic terminology used in computer programming
- Student will be able to design programs involving decision structures, loops and functions.
- Student will understand the dynamics of memory by the use of pointers.
- Student will understand different data structures and create/update basic data files.
- Skills - At the end of the course, a student will be able to:
  a) Analyse a simple programming problem specification.
  b) Design a high-level (programming language independent) solution to the problem using functional abstraction and general imperative programming language constructs. Write, compile, execute and debug a program which maps the high-level design onto concrete programming constructs.

Syllabus

UNIT – I: Introduction

Introduction to programming language, Classifications of programming languages, Role of programming language, characteristics of good language, Syntactic element of a language, Programming language paradigm.

UNIT-II: Overview of Problem Solving

Introduction to Computer based Problem Solving, Programming Concepts with Flowcharting and algorithms, Algorithm types, Developing and debugging flowcharts for Programming Problem, Programming Environment {Assemblers, compilers, interpreters, linkers, and loaders}

UNIT –III: Data Types and Binding

Names, Binding, Type Checking, and Scope, Properties of type, Elementary data type (Numeric data type, Enumeration, Boolean, Character), Composite Data type (Character String type, Pointer, Files and I/O), Derived data type(Vector and arrays, Union, Set, List, Records), Abstract data type, Control Statements (Branching, Looping, switch, break, continue, goto statements).

UNIT-IV: Procedures and Object Oriented Programming

Fundamental of sub programs, Subprogram Control, Scope Rules, Parameter passing method, Storage Management, Design Principles, Control Flow for imperative Programming, Execution steps for procedural programming, Desirable and Undesirable characteristics of procedural programming, Application of Procedure Programming, programming Design Principles for Object Oriented Programming, Application of Object Oriented programming.

UNIT-V: Functional and Logic Programming

Introduction of functional programming, Fundamental of functional programming languages, LISP Basics, Application of functional programming, Introduction of logic programming, brief introduction to predicate calculus, Origin of Prolog, Application of logic programming.

RECOMMENDED BOOKS

1. Concept of Programming Languages: Robert W. Sebesta
2. Principles of Programming Languages: Seema V. Kedar& Sanjay Thakare
3. Programming and Problem Solving: Seema V. Kedar
4. Programming Language Concepts: Ghezzi
5. Programming Language Design and Implementation: T. W. Pratt

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FIRST SEMESTER: M.Sc. (CS)

Paper II: Advanced Operating Systems

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- Student will come to know the basics of how does operating system work.
- They will inculcate knowledge of basic functions of operating system like memory management, disk scheduling etc.
- They develop critical thinking to manage processes also learn to manage hardware and software both.
- Students develop internal knowledge of system handling.

Syllabus

UNIT-I

Introduction

What is operating system, basic concept, terminology, batch processing, spooling, multiprogramming, time sharing, real time systems, protection, multiprocessor system, operating system as resource manager, process view point, memory management, process management, device management and information management, other views of operating system, historical, functional job control language and supervisor service control.

UNIT-II

Process Management- Introduction

Process State Transition Diagram, Process Scheduling, Types of scheduler, Pre-Emptive And Non-Emptive, CPU Scheduling(FIFO,SJF, SRTF, Round Robin), Multilevel Feedback Queue, Threads and Multithreading, Process Synchronization: Race Condition And Critical Section Problem, Solution for Critical Section Problem, Synchronization Hardware(Test & Set, swap). Inter process Communication, Synchronization Tool, Semaphore, Bounded Buffer Problem, Reader Writer Problem, Dining Philospher Problem.

UNIT-III

Advanced Memory Management

Virtual address space, description of user process and kernal, virtual memory architecture of Pentium group of processor. Translation Look aside Buffers, implementation of file mapping, shared memory through virtual memory virtual swap space.

UNIT - IV

Advanced Device Management Feature

Device driver framework classifying devices and driver, invoking driver code, devices switch table and driver entry points, dynamic loading and unloading of device drivers, Disk Algorithm(SCAN, CSCAN,LOOK,CLOOK,SRTF,FIFO)

UNIT V

Advanced File Management Features & Deadlock

Virtual file systems and v-node architecture, distributed file system, network file system, and remote procedure call, Deadlock-Introduction, Deadlock Prevention, Deadlock Avoidance(Bankers Algorithm), Deadlock Detection & Recovery, System Call() & Fork(), TLB, Memory Management, Paging, Segmentation, Page Replacement Policy(FIFO,OPTIMAL,LRU), Thrashing.

RECOMMENDED BOOKS

1. Principles of Operating System - Peterson.
2. Operating System - Mandinick& Donovan.
3. Advanced concepts in operating systems – SinghalMukesh, TMH

FIRST SEMESTER: M.Sc. (CS)

Paper III: Data Structure through algorithms using 'C'

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- Design the appropriate data structures and algorithms for solving real world problems.
- It enables them to gain knowledge in practical applications of data structures.
- Choose efficient data structures and apply them to solve problems. They analyze the efficiency of programs based on time complexity.
- There is number of technique such as Searching, Sorting, Tree and Graph so that student gain the reasoning ability to implement these concept in development of live commercial applications

Syllabus

UNIT – I : Introduction and Preliminaries -

Introduction, Basic terminology, Elementary data organization, Data structure, Data structure operation, Algorithms : complexity , time-space Tradeoff.. Mathematical Notation and functions, Algorithmic Notation, Control Structures, Complexity of Algorithms, Sub algorithms, Variables, Data Type.

UNIT - II : String Processing, Arrays, Records And Pointers –

Basic Terminology, Storing String, Character Data Type, String Operations, Word Processing, Pattern Matching Algorithms. Linear Array, Representation of linear Array in Memory, Traversing Linear Arrays, Inserting And Deleting, Sorting; Bubble Sort, Searching; Liner Search, Binary Search, Multidimensional Array, Pointers; Pointer Array, Records; Record Structures, Representation of Records in Memory; Parallel Arrays, Matrices, Sparse Matrices.

UNIT - III : Linked Lists, Stacks, Queues, Recursion -

Linked list, Representation of linked lists in memory, Traversing a linked list, Searching a linked list, Memory Allocation; Garbage Collection, Insertion into a linked List, Deletion from a Linked List, Header Linked List, Two- Way Linked Lists. Stacks, Array Representation of Stack, Arithmetic Expressions; Polish Notation, Quick sort, an application of Stacks, Recursion, Tower of Hanoi, Implementation of Recursive Procedures by Stacks, Queues, Dequeues, Priority Queues.

UNIT - IV : Trees & Graphs -

Binary Trees, Representing Binary Trees in Memory, Traversing binary tree, Traversal Algorithms using stacks, header nodes; threads, Binary Search Tree, Searching and Inserting in Binary Search Tree, Deleting in Binary Search tree, Heap; Heap sort, Path Lengths; Huffmans Algorithms, General Tree. Graph Theory Terminology, Sequential Representation of Graph; Adjacency Matrix, Path Matrix, Linked Representation of Graph.

UNIT - V : Sorting And Searching –

Sorting, Insertion Sort, Selection Sort, Merging, Merge Sort, Radix Sort, Searching and data modification, hashing.

BOOKS RECOMMENDED:

1. Data Structures with C - Seymour Lipschutz (Schaum's Series), TMC Publication
2. Data Structures through C -YashwantKanetkar, BPB Publication
3. Data Structure using C -A.K. Sharma, Pearson Eduction
4. Data Structure & Program Design - Robert L. Kruse, 3rd Ed., Prentice Hall.
5. Data Structures using C -Tenenbaum, Pearson Education

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FIRST SEMESTER: M.Sc. (CS)

Paper IV: Programming in Java

Max Marks: 100 **Min Marks: 40**

Course Outcomes

Understand fundamentals structure and model of Java programming language.

- Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Understand the basic principles of creating Java applications with graphical user interface (GUI).
- Student will be able to write a computer program to solve specified problems as well as make Business and research applications.

Syllabus

UNIT-I

Introduction: History and features of Java, Difference between C, C++ & JAVA. JAVA and Internet, WWW, Web Browsers, java supports system, Java Environment. JDK, JVM, Byte code **Java Programming Basics:** Structure of Java program, JAVA tokens and Statements, Constants & Variables, Data types, Operators, Command line arguments. Java Statements & Arrays: if and switch statement. while, do-while and , for. Introduction to arrays, types of arrays, new operator, Strings. String class & its methods, Vectors. Classes & Objects: Specifying classes, Methods and fields, creating objects. Passing objects to methods, returning objects, static fields & methods.Constructors, Garbage collection, Overloading methods & constructors, this keyword.

UNIT-II

Inheritances: Specifying sub class, types of inheritance, visibility control: public, private, protected, package. super keyword, Overriding methods, Dynamic method dispatch, Abstract methods and classes, final methods & classes,

Packages & Interfaces : Introduction to packages, naming conventions, package statement, creating packages, import statement, accessing package, use of CLASSPATH, adding class to package, hiding classes. Interface, implementing interfaces, multiple interfaces.

Multithreading: Creation threads, Extending Thread class, implements Runnable interface, stopping and blocking thread, Thread life cycle, thread priorities & Thread synchronization, using Thread methods.

UNIT-III:

Exception Handling: Managing errors, types of errors, exceptions, syntax of exception handling code. try, catch, throw, throws and finally statements, multiple catch & nested try statements.

Java Input output: Java I/O package, Byte/Character Stream, Buffered reader / writer, File reader / writer, File Sequential / Random. Reading numeric, character & strings data from keyboard.

Applet programming: Applet Vs. Application, Creating applets, life cycle, local & remote applets. <APPLET> tag & its attributes, adding applet to HTML file, Running applet.

UNIT-IV:

Abstract Windows Toolkit (AWT): Components and Graphics, Containers, Frames and Panels, Layout Managers, Border layout, Flow layout, Grid layout, Card layout, AWT components. Event delegation Model, Event source and handler, Event categories, Listeners, Interfaces, Controls such as text box, radio buttons, checkboxes, lists, choice, command buttons, text area etc.

JDBC: Java database connectivity, Types of JDBC drivers, Writing JDBC applications, Types of statement objects(Statement, PreparedStatement and CallableStatement), Types of resultset, Inserting and updating , records, JDBC and AWT,

UNIT-V:

Networking with Java : Networking basics, Sockets, port., Internet addressing, java.net – networking classes and interfaces, Implementing TCP/IP based Server and Client

Servlets: Introduction Servlet API Overview, Writing and running Simple Servlet, Servlet Life cycle, Generic Servlet, HTTPServlet, ServletConfig, ServletContest, Writing Servlet to handle Get and Post methods.

RECOMMENDED BOOKS

1. Core Java: An Integrated Approach -Dr. R. NageswaraRao
2. Core JavaTM2, Vol.1&2, 7edition - Horstman Cay, Cornell Gary, Pearson Education.
3. Programming with JAVA, A Primer -E. Balguruswamy (TMH)
4. Java Database Programming -MaithewSiple, TMH Publication
5. Java 2 from scratch by Steven Haines the -PHI

REFERENCE BOOKS

1. Herbert Schildt, The Complete Reference, seventh edition, [TMH]
2. Steven Holzner, JAVA 2 Programming Black Book, Wiley India.
3. Ivor Horton, Beginning Java 2, JDK 5 Ed, Wiley India.

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FIRST SEMESTER: M.Sc. (CS)

Paper V: Computer System Architecture

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- Students develop an intuitive knowledge of circuitry design of electronic components.
- Students learn to apply Boolean mathematics basics to develop architecture of digital devices.
- They be able to understand the overall internal architecture of computer in detail.
- Understand the general concepts in digital logic design, including logic elements and their use in combinational and sequential logic circuit design.

Syllabus

UNIT - I : Representation of Information

Number system, Integer & Floating point representation Character code (ASCII, EBCDIC), Error Detect and Correct code, Basic Building Blocks, Boolean Algebra, MAP Simplification, Combination Blocks, Gates, Multiplexers, Decoders, etc Sequential building block, flip-flop, registers, counters, ALU, RAM etc.

UNIT - II : Register transfer language and micro operations

Concepts of bus, data movement along registers, a language to represent conditional data transfer, data movement from its memory, arithmetic and logical operations along with register transfer timing in register transfer

UNIT - III : Basic Computer Organization and Design

Instruction code, Computer Instructions, Timing and Control, Execution of Instruction, Input and Output Interrupt, Design of Computer.

UNIT - IV : Computer Software

Programming Language, Assembly Language, Assembler, Program Loops, Input /Output Programming, System Software. Central Processor Organization: - Processor Bus Organization, Arithmetic Logic Unit, Stack Organization, Instruction Formats, Addressing modes, Data transfer and Manipulation, Program Control, Microprocessor Organization, Parallel Processing,.

UNIT - V : Input –Output & Memory Organization

Input –Output Organization : Peripheral Devices, Input/Output Interface, Asynchronous Data Transfer, Direct Memory Access (DMA), Priority Interrupt, Input-Output Processor, Multiprocessor System Organization, and Data Communication Processor.
Memory Organization : Auxiliary Memory, Micro Computer Memory, Memory Hierarchy, Associative
Memory, Virtual Memory, Cache Memory, Memory Management Hardware.

BOOKS RECOMMENDED:

1. Computer System Architecture - M. Morris Mano (PHI).
2. Digital Computer Electronics - Malvino.
3. Digital Computers and Logic Design - M.Morris Mano (PHI).
4. Structured Computer Organization - Andrew M. Tanenbanm (PHI).

REFERENCE BOOKS

1. The Elements of Computing System -Noam Nisan
2. Computer Organisation and Design -David Patterson
3. Computer Architecture: A Quantitative Approach -John L. Hennessy

MASTER OF SCIENCE IN COMPUTER SCIENCE

SCHEME OF TEACHING AND EXAMINATIONS

SECOND SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Th	Ses	Pr	Total	Th	Ses	Pr	Total
Paper I	Advanced RDBMS (PL/SQL)	3	2	-	4	100	50		150	40	30		70
Paper II	Advanced Computer Networks	3	2	-	4	100	50		150	40	30		70
Paper III	Web Development using Open Source Scripting Language	3	2	-	4	100	50		150	40	30		70
Paper IV	Formal Automata Theory	3	2	-	4	100	50		150	40	30		70
Paper V	Elective: i. Digital Signal Processing ii. Soft Computing iii. Artificial Intelligence and Expert System iv. Advanced Computer System Architecture	3	2	-	4	100	50		150	40	30		70
Practical I	Practical Based on Paper-I			3x2	3		25	100	125		15	50	65
Practical II	Practical Based on Paper-III			3x2	3		25	100	125		15	50	65
TOTAL		15	10	12	26	500	300	200	**1000**	200	180	100	480

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SECOND SEMESTER: M.Sc.(CS)

Paper I : Advance RDBMS (SQL Programming with Oracle)

Max Marks : 100 **Min Marks : 40**

Course Outcomes

- Students will be able to design a database based on the given requirements.
- Students will be able to make Database oriented application with knowledge of subject provided to them.
- Students get the knowledge about Standard Query Language statements, PL/SQL, Query processing and optimization.
- Students are expected to apply normalization techniques on given database.
  RDBMS are the basic building blocks of data warehousing, mining, Big Data Analytics, cloud computing etc.

Syllabus

UNIT - I : Overview of Database Management -
Advantages of DBMS, Codd rules ,Type of Data Models, Schema and Instances, DBMS Architecture and Data Independence , different kinds of DBMS users, importance of data dictionary, types of database languages.
ER MODEL: - Basic concept, Design issues, Mapping constraints, Keys, ER diagram, weak & strong entity sets, specialization & generalization, aggregation, inheritance, design of ER schema, Reduction of ER schema to tables , Case studies of ER-Modeling

UNIT - II : Relational Algebra & Relational Database Design –
Relation Algebra :- The structure, relation algebra with extended operations, Modification of database , Aggregate function, Null values, Derived relations, views, modification of database,.
Relational Algebra: select, project, cross product different types of joins (inner join, outer joins, self join); set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using , Nested subqueries , stand alone and embedded query languages.
Relational Database Design :
Normalization ,Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). Boyce Codd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Concepts of De-normalization

UNIT - III : SQL
Introduction database query language ,SQL& its environment , Sql Structure , Data Type. Introduction to SQL constructs (SELECT...FROM, WHERE... GROUP BY... HAVING... ORDERBY....), INSERT, DELETE, UPDATE, DROP, aggregate functions , VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, references, Triggers. Transaction control commands –commit ,Rollback ,Savepoint Embedded SQL and Application Programming Interfaces.

UNIT - IV : PL/SQL
Introduction to PL/SQL variables – literals – data types – advantages of PL/SQL; Control statements : if ; iterative control – loop, while, for , goto ; exit when; Cursors : Types – implicit, explicit – parameterized cursors – cursor attributes; Exceptions: Types – internal , user-defined , handling exceptions – raise statement.
PL/SQL tables and records: Declaring PL/SQL tables - referring PL/SQL tables, inserting and fetching rows using PL/SQL table, deleting rows; records - declaration of records - deleting records; Sub programs: Functions - procedures – input-output parameters; purity functions - packages - package specification - advantages of packages - private and public items - cursors in packages.

UNIT - V : Data Organization & Object oriented database -
Data Organization - Fixed length & variable length records, Indexing Techniques: - indexed files -B-tree, B+-tree, and Hashing Techniques.
Introduction- OODBMS, Basic Architecture, Object-Oriented basic concepts, Transactions and Concurrency control, Properties of Transaction, Serializable (Conflict+View),Transaction State, Problem with Concurrent Execution Schedule-Type; OQL, UML Diagram Introduction to distributed database .

RECOMMENDED BOOKS

1. Database System Concept -H. Korth and A. Silberschatz, TMH
2. Data Base Management System - Ivan Bayross
3. Data Base Management System - James Matin
4. Database Management System - Leon & Leon, Vikas Publication

REFERENCE BOOKS

1. Database Management System -R. Ramakrishanan
2. Database Management System -A. K. Majumdar&P.Bhattacharya, TMH
3. An Introduction to database systems - Bipin Desai, Galgotia Publication.

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SECOND SEMESTER: M.Sc. (CS)

Paper II: Advanced Computer Networks

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- To give the students a basic understanding of computer network.
- To give the students the basic concepts of bandwidth, data communication etc.
- To make the students more employable.
- To open up new areas in the field of research and development in the area of computer networking.

Syllabus

UNIT – I

Introduction to Computer Networking : The Concept of Networking, Data Communication, Required network elements, The role of Standards Organization. Line Configuration, Various Topologies, Transmission Mode, Categories of Networks- LAN, MAN, WAN. The benefits of a Computer Networks.

The OSI and TCP/IP Reference Model : The Concept of Layered Architecture, Design Issues for the Layers. Interfaces and services, Detailed Functions of the Layers.Comparison between OSI and TCP/IP Reference model.

UNIT - II

Transmission of Digital Data : Shannon's and Nyquist theorems for maximum data rate of a channel. Transmission media- Co-axial, UTP, Fiber optic and wireless. Analog and digital data ransmissionparallel and serial transmission. DTE-DCE interface using RS-232C.Study of modems- 56k and Cable Modem. Modem standards.

Multiplexing and Switching : The Concept of Multiplexing- FDM, TDM, WDM. The Concept of Switching- Circuiting, Message switching, Packet switching.

UNIT - III

Data Link Layer and Routing Algorithms : Line Discipline, Flow Control- stop and wait, sliding window, Go back N, Error Control- ARQ stop and wait, sliding window ARQ. HDLC, SLIP, PPP. Multiple access protocols- ALOHA, Slotted ALOHA, CSMA/CD. IEEE standards for LAN's and MAN's. The IP protocol, and its header. IP address classes and subnet mask.

The concept of ICMP, ARP, RARP, RSVP, CIDR and Ipv6. : Routing algorithms- shorted path first, Distance Vector, Link State. Congestion Control-The leaky bucket and Token bucket Algorithms.

UNIT - IV

Transport Layer: The Concept of client and Server in terms of Socket addressing in Transport layer. Two way and three-way handshaking.TCP header.Network Performance Issues.The Concept of Domain Name System, Various Resource Records.Architecture and services of E-mail (RFC-822 and MIME).The Concept of World Wide Web- server side and client side.

ATM: The concept of ATM, ATM Adoption layers- AAL1, AAL2, AAL3/4, AAL5, Comparison of AAL protocols. Cell formats for UNI and NNI. Service Categories, Quality of service, Congestion Control in ATM.

UNIT - V

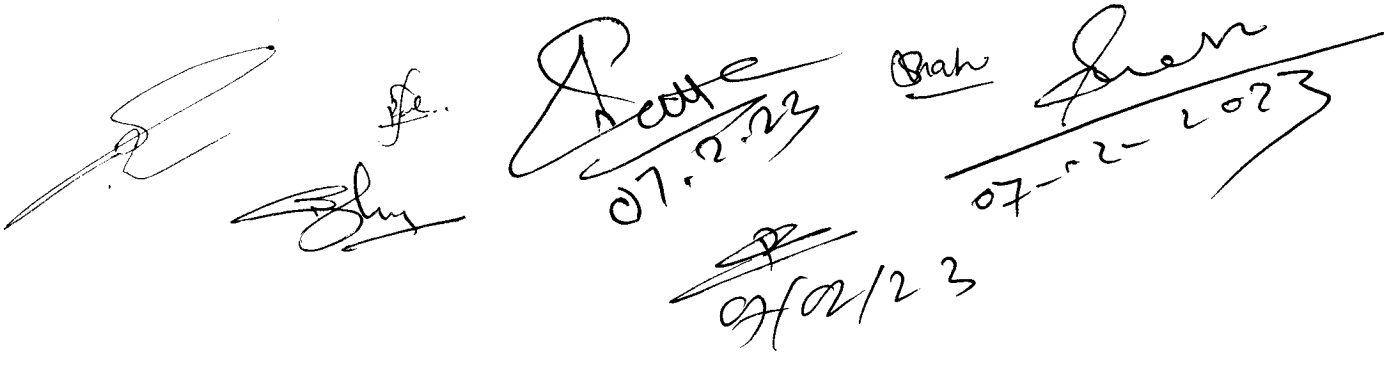
Comparative study of Networking Technologies: X.25, Frame Relay, ATM, SONET, SMDS, ISDN. **Network Security:** The importance of Security in Networking, traditional cryptography, Data Encryption tandards, RSA Algorithm.

BOOKS RECOMMENDED

1. Computer Networks -A S Tanenbaum
2. Data Communication and Networking -Forouzan
3. Computer Network and System Approach -Larry L. Pererson

REFERENCE BOOKS

1. Computer Network: A Top Down Approach Featuring the Internet -James F. Kurose
2. Computer and Communication Networks - Nader F. Mir



SECOND SEMESTER: M.Sc. (CS)

Paper III: Web Development Using Open Source Scripting Language

Max Marks: 100 **Min Marks : 40**

Course Outcomes

At the end of course, Student will come to know about

- Development of static and dynamic WebPages.
- Use of CSS for setting the style for webpage.
- Concept of web hosting and creation of website using PHP .
- Design and development of professional websites.

Syllabus

UNIT-I: Webpage Designing

HTML: Introduction to HTML, historical context and justification for HTML, Basic structure of an HTML document ,Elements of HTML, HTML Tag and Attributes, Working with Text , Lists, Tables and Frames , Hyperlinks, Images and Multimedia, Working with Forms and Controls. Static V/S Dynamic Websites, Introduction to DHTML

CSS : Concept of CSS , Creating Style Sheet , ways of Implementing CSS, CSS Properties , Selector, CSS Id and Class, CSS Styling -Background, Text Format, Controlling Fonts, Working with block elements and objects , Working with Lists and Tables , Box Model(Introduction, Border properties, Padding Properties, Margin properties)

UNIT-II: Event Handling and Validation

Java Script : What is JavaScript, Comparison between Java, JavaScript & VB Script, The Document Object Model (DOM), Introduction to Objects and Methods, The hierarchy of JavaScript Objects, window Object , document Object, Outputting Text with JavaScript, JavaScript HTML events and event listeners,**JavaScript Validation :**JavaScript Form Validation, Validate Numeric Input, Automatic HTML Form Validation, Data Validation, HTML Constraint Validation

UNIT III – Introduction to PHP

PHP: Evaluation of PHP, Basic Syntax, Defining Variable and Constant, Data type , Operator and Expression , Global Variables ,Conditional Statement & Looping Statement: If - Else, Switch, While, for , for each loopFunction: Function, Call by value and Call by reference, Recursive function, inbuilt Functions,String: Creating and accessing String, Searching & Replacing String, Formatting String, String Library FunctionArrays:Types of Arrays, Enumerated Arrays, Associative array, Iteration Multi-dimensional array, Array function and SPL.

UNIT IV – Advanced PHP

Handling HTML Form Data, Hidden field, Dealing with Multi-value Field, File uploaded form, Redirecting a form after submission, PHP File include, PHP file require, difference between include and require, Session Management , Cookies, PHP FTP, PHP HTTP.

Exception Handling - PHP Exception and Error, Difference Between fatal error and warning, Try, catch, throw

UNIT V:Database Connectivity and Website Hosting

Database Connectivity with MySQL: Introduction to RDBMS, Connection PHP with MySql Database , Performing basic database operation(DML) (Insert, Delete, Update, Select) with PHP, Setting query parameter ,Executing query in PHP

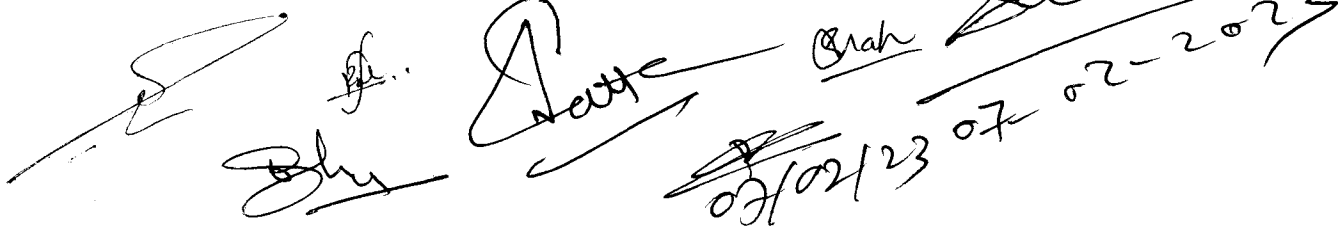
Website Hosting - Website Hosting Basics, Domain Name Registration, Configuring DNS, Website uploading and publishing, Web page performance, Search engines, Monitoring and Security

BOOKS RECOMMENDED

1. Head First PHP & MySQL - Lynn Beighley&Michael Morrison
2. Learning PHP, MySQL & JavaScript with j Query, CSS - Robin Nixon
3. HTML5 Black Book, Covers CSS3, Java Script, XML, XHTML, AJAX, PHP and jQuery -DT Editorial Services

REFERENCE BOOKS

1) PHP: The Complete Reference - Steven Holzner
2) Mastering HTML, CSS &Javascript Web Publishing - Laura Lemay &Rafe Colburn



SECOND SEMESTER: M.Sc. (CS)

Paper IV: Formal Automata Theory

Max Marks: 100 **Min Marks : 40**

Course Outcomes

At the end of this course students will:

- Be able to construct finite state machines and the equivalent regular expressions. Be able to prove the equivalence of languages described by finite state machines and regular expressions.
- Be able to construct pushdown automata and the equivalent context free grammars.
- Be able to prove the equivalence of languages described by pushdown automata and context free grammars.
- Be able to construct Turing machines and Post machines.

Syllabus

UNIT I: Fundamentals and Finite Automata

Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non deterministic finite automaton, transition diagrams and Language recognizers.

NFA with Î transitions - Significance, acceptance of languages. Conversions and Equivalence : Equivalence between NFA with and without Î transitions, NFA to DFA conversion, minimisation of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Melay machines.

UNIT II: Regular Languages and Grammar Formalism

Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma of regular sets, closure properties of regular sets (proofs not required).

Regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, derivation trees, sentential forms. Right most and leftmost derivation of strings.

UNIT III: Context Free Grammars and Push Down Automata

Ambiguity in context free grammars.Minimisation of Context Free Grammars.Chomsky normal form, Greiback normal form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL (proofs omitted).

Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA, interconversion. (Proofs not required). Introduction to DCFL and DPDA.

UNIT IV: Turing Machine

Turing Machine, definition, model, design of TM, Computable functions, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines (proofs not required). linear bounded automata and context sensitive language.

UNIT V: Computability Theory

Chomsky hierarchy of languages, linear bounded automata and context sensitive language, LR(0) grammar, decidability of, problems, Universal Turing Machine, decidability of posts. Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems.

RECOMMENDED BOOKS

1. Hopcropft and Ullman: Introduction to automata theory, Languages & Computation, Narosha Publication house.
2. Mishra &Chandrashekharan: Theory of Computer Science, Automata Lanauages& computation, 2nd Ed PHI, New Delhi.
3. Introduction to Theory of Computation –Sipser 2nd edition Thomson

REFERENCES BOOKS

1. Introduction to Forml languages Automata Theory and Computation -Kamala Krithivasan Rama R.
2. Introduction to Computer Theory -Daniel I.A. Cohen, John Wiley.
3. Theory of Computation: A Problem - Solving Approach- Kavi Mahesh, Wiley India Pvt. Ltd.
4. Elements of Theory of Computation - Lewis H.P. &Papadimition C.H. Pearson /PHI.

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SECOND SEMESTER: M.Sc.(CS)

Paper V: Elective 1. Digital Signal Processing

Max Marks : 100 **Min Marks : 40**

Course Outcomes

Upon successful completion of this course the students will have developed following skills/abilities:

- Interpret, represent and process discrete/digitalsignalsand sytems.Thorough understanding of frequency domain analysis of discrete time signals
- Ability todesign & analyze DSP systems like FIR and IIR Filter etc.
- Practicalimplementation issues such as computational complexity, hardware resource
- limitations as well as cost of DSP systemsor DSP Processors.Understanding of spectral analysis of the signals

Syllabus

UNIT I: Signals and Systems

Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem– Discrete time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution (linear and circular) - Correlation.

UNIT II: Frequency Transformations

Introduction to DFT – Properties of DFT– Filtering methods based on DFT – FFT Algorithms Decimation –in time Algorithms, Decimation – in – frequency Algorithms – Use of FFT in Linear Filtering – DCT.

UNIT III: IIR Filter Design

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (HPF, BPF, BRF) filter design using frequency translation

UNIT IV: FIR Filter Design

Structures of FIR – Linear phase FIR filter – Filter design using windowing techniques, Frequencysampling techniques – Finite word length effects in digital Filters

UNIT V: Applications

Multirate Signal processing – Speech compression – Adaptive filter – Musical sound processing –Image enhancement.

RECOMMENDED BOOKS

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles,Algorithms & Applications", Fourth edition, Pearson education / Prentice Hall, 2007.
2. Emmanuel C..Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Second edition,PearsonEducation / Prentice Hall, 2002.

REFERENCE BOOKS

1. Alan V.Oppenheim, Ronald W. Schafer & Hohn. R.Back, "Discrete Time Signal Processing", Pearson Education, 2nd edition, 2005.
2. Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2001

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SECOND SEMESTER: M.Sc.(CS)
Paper V: Elective 2. Soft Computing

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- Students will be able to understand Artificial Neural Network concept with the help of Biological Neural Network.
- Students will be able to implement algorithms to train ANN by using learning algorithms.
- Students will be able to test fuzzy set operations and binary relations.

Syllabus

UNIT - I : Introduction to Soft computing and Fuzzy Logic System

Introduction of soft computing, Soft computing vs. hard computing, various types of soft computing techniques, Importance of soft computing, Applications of soft computing.

Fuzzy Sets Operation Of Fuzzy Sets, Properties Of Fuzzy Sets, Fuzzy Relations, Fuzzy Arithmetic, Membership Functions, Fuzzy To Crisp Conversion. Fuzzy Logic, Fuzzy Rule Based Systems, Fuzzy Decision Making, Fuzzy Database, Fuzzy Intelligent System.

UNIT - II : Introduction to Artificial Neural Networks

Introduction to Artificial Neural Network, Artificial Neuron, Classification of Artificial Neural Network, Architecture of a Artificial Neural Network, Activation Function, Training an Artificial Neural Network, Application of Artificial Neural Network.

UNIT - III : Perceptron and Associative Memories

Amari General Learning Rule, HEBB Learning Rule, ADLINE, Perceptron Layer Network, Associative memory: Auto associative Memory, Bi-directional memory, Back-propagation Network: Architecture, Training Algorithm Application of Back-propagation algorithm

UNIT - IV : Machine Learning

Regression And Classification, Decision Tree, SPRINT, Gini Index, Entropy, Pruning, C4.5, Active Learning - Feature Selection, Clustering, Models And Methods, Neural Networks, Markov Chain/Processes, Hidden Markov Models (HMM).

UNIT - V : Soft Computing Tools

Introduction to MATLAB, Features, Matrix Operations, Curve Plotting, Toolbox Introduction, Introduction to Simulink.

RECOMMENDED BOOKS

1. Fuzzy systems and Fuzzy Logic - Klir and Uuna, PHI Publications.
2. Introduction to Artificial Neural Networks - S. N. Sivanandam and M. Paulraj, Vikas publication.
3. Neural Network Design - Hagan & Demuth, Vikas Pub. Comp.
4. Fundamentals of Artificial Neural Networks -M.A.Hassaoun.
5. Fuzzy sets, uncertainty and information -George J. Kir, & TA Folger.

REFERENCE BOOKS

1. Fuzzy sets, Decision making and Expert system -HJ Zimmerman, Kluwer, Boston.
2. Fuzzy set theory and its applications - H. J. Zimmerman, Kluwer, Boston
3. Machine Learning Algorithms -Giuseppe Bonaccorso
4. Matlab Machine Learning - Michael Paluszek

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SECOND SEMESTER: M.Sc.(CS)

Paper V: Elective 3. Artificial Intelligence and Expert System

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- Student will have ability to understand and define different AI problem and apply suitable problem solving technique.
- Student will have ability to define the heuristics and apply them for solving complex problem with understanding of different heuristic based search techniques. Also they have understanding of different knowledge structure and inference mechanism with ability to apply them in intelligent solutions of complex problem.
- Student will develop an understanding of game playing techniques
- Student will be able to understand working of Expert system.

Syllabus

UNIT – I

Introduction to AI: Foundations of AI, Philosophy and History; AI problems, AI technique; The Turing Test. **Intelligent Agents:** Agents and Environments, the Concept of Rationality, the Nature of Environments and the Structure of Agents. **Problem solving & State Space Search:** General problem solving: defining problems as State Space Search, Problem Characteristics; Production Systems & their characteristics.

UNIT – II

Exhaustive Searches: Generate and Test, Breadth First Search, Depth First Search and DFID.
Heuristic Search Techniques: Branch and Bound technique; Best first search; A* algorithm; Problem Reduction AND/OR Graphs and AO* algorithm. **Local Searches & Optimizations:** Hill climbing and its variants. **Constraint Satisfaction Problems:** Definition; Constraint Propagation and Backtracking. **Game Playing:** Mini-Max Search Procedure; Alpha-Beta Cutoffs; Additional Refinements.

UNIT – III

Knowledge Representation: Types of Knowledge; Knowledge Representation Issues; **Logic:** First order Predicate Logic; Representation of facts in FOL; Inference in FOL; Resolution Principle, Clausal Form and Unification; **Inference Mechanisms:** Forward and Backward Chaining; **Slot and Filler Structures:** Semantic Networks; Frame Systems and value inheritance; Conceptual Dependency; Scripts;

UNIT – IV

Reasoning under Uncertainty: Non-monotonic Reasoning, Probabilistic Reasoning and Uncertainty; Probability Theory; Bayes Theorem and Bayesian networks; Certainty Factor; Dempster-Shafer Theory. **Planning:** Overview; The Blocks Word; Component of a Planning System: Goal Stack Planning; Nonlinear Planning; **Natural Language Processing:** Introduction, Overview of Linguistics, Grammars and Languages: context sensitive and context free grammar; Chomsky Hierarchy, Parsing techniques: Recursive Transition Nets, Augmented Transition Nets, Semantic Analysis: Case, Logic and Semantic grammars;

UNIT – V

Expert Systems: Introduction, Characteristics, History and Applications of expert systems; Expert System Shells; Rule Based Systems Architectures, Non Production System Architectures; Knowledge Acquisition and Validation; Case Studies: MYCIN & DENDRAL. **Learning:** Rote learning; Learning by Taking Advise; Induction; Explanation based learning; Discovery; Analogy.

BOOKS RECOMMENDED:

- **Artificial Intelligence**, *Rich E., Knight K. and Nair S. B.*, McGraw Hill Education
- **Artificial Intelligence: A Modern Approach**,*Russell S. J. and Norvig P.*, Pearson Education
- **Introduction to Artificial Intelligence and Expert Systems**,*Patterson D. W.*, PHI
- **Principles Of Artificial Intelligence**, *Nilson N. J.*, Narosa Publications
- **Artificial Intelligence**, *Winston P. H.*, Pearson Education

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SECOND SEMESTER: M.Sc. (CS)

Paper V: Elective 4. Advanced Computer System Architecture

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- To make the students aware about Parallel Computing.
- To apprise the students of the concepts of Multiprocessors, Multicomputer, Pipelining etc.
- To increase the employability.
- To open up new areas in the field of research and development in the area of computer architecture.

Syllabus

UNIT I

Introduction:-Feng's and Flynn's classification schemes, multiprocessor and multicomputer, UMA, NUMA, COMA, NORMA, memory models, parallel computers and its type. Application of Parallel Computers.

UNIT II

System Interconnect Architecture-Static & dynamic, Hypercube interconnection network, multistage interconnection networks-architecture & routing, design consideration, throughput, delay, blocking and non-blocking properties. Performance Metrics and Benchmarks.

UNIT III

Principle of Pipelining-overlapped parallelism, Linear and non-Linear pipelining, reservation table, calculation of MAL. Types of instruction pipeline. Arithmetic pipeline designs example-Floating point adder, pipelined multiplier.

UNIT IV

Advance processor Technology-RISC, CISC,VLIW architectures. Hazard detection and resolution, functional organization of instruction in IBM 360/91.

UNIT V

Exploring parallelism in program- multidimensional arrays, Parallel Algorithm- Matrix addition, subtraction, multiplication-block and SIMD. Bitonic sort, sorting on linear array processors.Bernstein's condition, Iso efficiency Concept.

RECOMMENDED BOOKS

1. Computer Architecture & Parallel Processing by Kai Hwang and F.A. Briggs-McGraw Hill.
2. Advanced Computer Architecture By Kai Hwang –McGraw Hill.
3. Parallel Computer Architecture & Programming by- V Raja Raman and C. Shiarammuty-PHI

REFERENCE BOOKS

1. Parallel Computing Theory and practice by Michael J. Quinn –Tata Mc-Graw Hill

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MASTER OF SCIENCE IN COMPUTER SCIENCE

SCHEME OF TEACHING AND EXAMINATIONS

THIRD SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Th	Ses	Pr	Total	Th	Ses	Pr	Total
Paper I	.Net Technology	3	2	-	4	100	50		150	40	30		70
Paper II	Software Engineering	3	2	-	4	100	50		150	40	30		70
Paper III	Open Source Software with Case Study of Linux	3	2	-	4	100	50		150	40	30		70
Paper IV	Computer Graphics	3	2	-	4	100	50		150	40	30		70
Paper V	Elective: i. Image Processing ii. Data Mining and Data Warehousing iii. Satellite &Mobile Communication	3	2	-	4	100	50		150	40	30		70
Practical I	Practical based on Paper-I			3x2	3		25	100	125		15	50	65
Practical II	Practical Based on Paper-III			3x2	3		25	100	125		15	50	65
TOTAL		15	10	12	26	500	300	200	**1000**	200	180	100	480

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THIRD SEMESTER: M.Sc.(CS)

Paper I: .Net Technology

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- Students will understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic.
- Students will describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE).
- Students will create applications using Microsoft Windows Forms also able to create applications that use ADO. NET
- Students will be able to design web applications using ASP.NET and also able to use ASP.NET controls in web applications
- Students will be able to create database driven ASP.NET web applications and webservices.

Syllabus

UNIT – I: Inside the .NET framework:

Overview of .net framework, Managed Execution process, CLR, common language specification, JIT Compilation , MSIL, Namespaces, Assemblies, metadata, Common Type System, cross language, interoperability, Garbage collection.

UNIT – II: Programming with .NET Framework

Windows form: working with Visual Studio IDE, creating a .NET solution, MDI application, components and controls, Data types, variables, Type conversions, Operators, Control **Structures**: conditional statements, loops, arrays, types of methods, method data, Introduction to exception handling-exception statements.

UNIT – III: XML, Windows process and File Handling

Types, structures, Enumerations, classes, Interfaces, Working with files-Files and directories, streams, Readers and writers, Reading and writing XML files, XML serialization, processing Transaction, Monitoring and Managing Windows Process, retrieving information about process.

UNIT – IV: Building .NET Framework Applications

Introduction to ASP .NET, Differentiate classic ASP and ASP .NET, Web application, Web forms, Form validations – Client side, Server side, controls in web forms, Events in Web form.

UNIT – V:Advanced concepts and Database Programming

Delegates, ADO .NET Architecture, .NET data provider, dataset components, creating database applications using Window forms and web forms (Database connectivity through ADO .NET), Introduction to web services, web services for Mobile application, Remote overview.

BOOKS RECOMMENDED

- **MSDN online – by Microsoft**
- **Visual Basic .NET Complete** - BPB Publications, New Delhi.
- **The Complete Reference VB .NET**, *Jeffery R. Shapiro*, Tata Mcgraw Hill.
- **Professional VB .NET 2003**, *Bill Evjen& others*, Wiley India (P) Ltd.

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THIRD SEMESTER: M.Sc.(CS)

Paper II: Software Engineering

Max Marks: 100 **Min Marks : 40**

Course Outcomes

- The student will have a fair idea about the importance of using software engineering principles in real life projects
- The student will also be able to pick an appropriate software development model for developing systems
- The student will be able to prepare software requirement sheet for a real life project, keeping in mind the properties of an SRS document
- The student will be able to use mathematical models for calculating the size, cost and duration of real life projects
- The student will be able to test the developed system using different testing techniques.
- Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.

Syllabus

UNIT – ISoftware Engineering Fundamentals:

Introduction to Software Engineering; Software Engineering Principles(Layers); Software Process – Process Framework, Umbrella Activities, Process Adaptation; Software Crisis; Process Models-Waterfall Model, Prototype Model, Incremental Model, Spiral Model, RAD Model; Agile Process.

UNIT – II Software Analysis and Design:

Requirement Engineering; Analysis Model-Data Flow Diagram, Data Dictionary, E-R Diagram, Decision Table; Software Requirements Specification(SRS), Structure of SRS; Pseudo code; Software Design; Design Process; Design Concepts-Abstraction, Partitioning, Modularity, Information Hiding, Refinement, Refactoring; Function Oriented Design; Object Oriented Design; Cohesion and Coupling.

UNIT – III Software Quality and Case Tools:

Software Metrics, Categories of Metrics, Function Point Metric; Software Quality; McCall's Quality Factors; Software Maturity Model-CMM,CMMI; Software Quality Assurance; ISO Standards-9000, 9001 and 9126; Software Reliability; Case Tools and its Scope; Case Objectives; Architecture of Case Tools; Case Classification.

UNIT – IV Coding and Testing:

Programming Style; Structured Programming; Coding Standard; Internal Documentation; Software Testing-Verification and Validation; Alpha and Beta Testing; Levels of Testing-Unit, Integration and System Testing; Testing Techniques- White Box, Black Box; Cyclomatic Complexity; Test Plan; Debugging-Debugging Process, Debugging Strategies(Approaches).

UNIT – V Software Maintenance and Project Management:

Risk Management – Software Risk, Risk Identification; Introduction to Software Maintenance, Categories of Maintenance; Belady and Lehman Model; Boehm Model; Project Management Concept – People, Product, Process, Project; Software Team; Software Project Planning; Software Project Estimation; Cost Estimation Model(COCOMO, COCOMO II, Putnam-SLIM, Walston and Felix); Software Reengineering.

RECOMENDED BOOKS:

1. **Software Engineering: A Practitioner's Approach**, *Roger S. Pressman*, TMH
2. **An Integrated approach to Software Engineering**, *PankajJalote*, Narosa Publications
3. **Software Engineering**, *Bharat BhushanAgarwal.*

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THIRD SEMESTER: M.Sc.(CS)

Paper III: Open Source Software with Case Study of Linux

Max Marks: 100 **Min Marks: 40**

Course Outcomes

- At the end of course, student will be able to know about open source software linux.
- Student will have to know about creation of group and user. And also about concept of shell programming, Inter process communication in Linux.
- They will be able to know about the advance system administration in open system software.

Syllabus

UNIT – I

Open Source Software: Introduction, History, Examples(Operating System GNU/Linux, Apache Web Server), Strengths and Advantages(Network effects, Lower cost, Availability, Maintainability), Challenges, System Structure, Kernel and its function. **File System :** Concept of i-node table, links, commonly used commands like who, pwd, cd, mkdir, rm, ls, mv, lp, chmod, cp, grep, sed, awk, make, etc. Getting started (login / logout), File system management, file operation, system calls, buffer cache. **Vi Editor :** command and edit mode, invoking vi, deleting and inserting line, deleting and replacing character, searching strings, yanking, running shell command, command macros, set windows, set auto indent, set number, intro to exrc file.

UNIT – II

Shell Programming: Introduction to shell feature, wild card characters, i/out redirections, standard error redirection, system and user created shell variables, profile files, pipes/tee, background processing, command line arguments, command substitution, read statement, conditional execution of commands, special shell variables $ #, #?, $* etc. Shift commands, loops and decision making- for, while and until, choice making using case...esac, decision making if ....fi, using test, string comparison, numerical comparison, logical operation, using expr.

UNIT – III

Introduction to Shell: Features, changing the login shell, cshrc, login, logout files, setting environment, variables, history and alias mechanism, command line arguments, redirection/appending safely, noclobber, noglob, ignore eof, directory stacks (pushd, popd). **Process Control:** Process management, process states and transition, regions and control of process, signals, system boot and init process, traps, setting process priorities.

UNIT – IV

Inter-process Communication: I/O Sub system, terminal drives, disk drives, messages, shared memory, semaphores, memory management, swapping, demand paging. **System Calls and Unix -C Interface :** File handling calls like - open() & close() with algorithm, read() & write() with algorithm, create(), access (), fseek(), process control system calls like kill(), exec(), fork(), wait(), signal(), exit().

UNIT – V

System Administration: Process and Scheduling, Security, Basic System Administration:- Adding a User, User Passwords, Delete of a User, Adding a Group, Deleting a Group, Super User, Startup and Shutdown. Advanced System Administration:- Managing Disk Space, Backup and Restore, Managing System Services.

BOOKS RECOMMENDED:

1. **Design of Unix Operating System;** *Maurice J. Bach*
2. **Advanced Unix,** *Stephan Pratta*
3. **Unix Concepts & Techniques,** *Sumitabha Das*
4. **The Unix Programming Environment,** *Kennighan and Pike*
5. **Unix Programmers Guide,** *P. P. Selvester*
6. **Introduction to Unix System,** *Rachell Morgan*

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THIRD SEMESTER: M.Sc.(CS)

Paper IV: Computer Graphics

Max Marks : 100 **Min Marks : 40**

Course Outcomes

Upon successful completion of this course, student will be able to

- Understand the core concepts of computer graphics, including viewing, projection, perspective, modelling and transformation in two and three dimensions.
- Apply the concepts of colour models, lighting and shading models, textures, ray tracing, hidden surface elimination, anti-aliasing, and rendering.
- Interpret the mathematical foundation of the concepts of computer graphics.

Syllabus

UNIT - I: Display Devices Refresh Cathode-Ray tubes, Random Scan and Raster Scan Display, Color CRT Monitors, Color display techniques: shadow masking and Beam penetration, Direct view storage tubes, Flat Panel display: plasma panel displays, LED & LCD devices.**Interactive Graphics**Physical Input devices, logical classification, input function, interactive picture construction techniques.

UNIT - II: Output Primitives Points and Lines, Line drawing Algorithms: DDA Algorithm and Bresenham's Line Algorithm, Antialiasing. Circle generating Algorithms: Bresenham's Circle Algorithms, Midpoint Circle Algorithm, Ellipse Generating Algorithm: Midpoint, Character generation and text display. Output command for various geometrical shapes,Filled Area Primitive: Scan line polygon fill algorithm, Boundary fill algorithm, Flood fill algorithm. Attribute of outputs primitives: line attribute, Area-fill Attribute, Text attribute, Bundled attributes, Area-Fill.

UNIT - III: Two Dimensional Transformation and ViewingTransformation: Translation, Scaling, Rotation, Reflection, Shearing. Matrix representations of Transformation and Homogenous Coordinates, Composite Transformations and Concatenation of transformation.**Two-Dimensional Viewing Coordinate system:** World/user coordinates, Device coordinate, Normalized device coordinates,Viewing pipeline: windows and viewports, Viewing transformation pipeling, Window-to-Viewport coordinate transformation, Clipping algorithm: point, line clipping algorithm: Cohen-Sutherland, Liang Barsky, Nicholl-Lee-Nicholl, Line Clipping, polygon clipping algorithm : Sutherland-Hodgman, Weiler-Atherton, text clipping.

UNIT - IV: 3-D Transformation Translation, Scaling, Rotation about standard and arbitrary axis, Other Transformation: Reflections and shears, Transformation commands.**Viewing:**Viewing Pipeline, Viewing Coordinates: transformation from world to viewing coordinates.

UNIT - V: 3-D Projection: Parallel Projection, Perspective Projection, Normalized view volume, viewport Clipping, Clipping in Homogeneous Coordinate.**Visible-Surface detection algorithms**: Back-Face removal, Depth Buffer method, Scan line method, Depth sorting method, Area subdivision and Octree method.

RECOMMENDED BOOKS:

1. **Computer Graphics**, *Hearn D. & Baker P.M.*
2. **Computer Graphics**: A Programming Approach, *Harrington S.*
3. **Procedural Elements for Computer Graphics**, *Rogers D.F.*

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THIRD SEMESTER : M.Sc.(CS)

Paper V : Elective 1. Image Processing

Max Marks : 100 **Min Marks : 40**

Course Outcomes

- Review the fundamental concepts of a digital image processing system.
- Analyze images in the frequency domain using various transforms, also evaluate the techniques for image enhancement and image restoration.
- Categorize various compression techniques and also interpret Image compression standards.
- Interpret image segmentation and representation techniques.

Syllabus

UNIT - I

Digital Image fundaments: Introduction, An image model, sampling & quantization, basic relation ships between Pixels, imaging geometry.

UNIT - II

Image Transforms: Properties of 2 – D Fourier transform, FFT algorithm and other separable image transforms. Walsh transforms. Hadamard, Cosine, Haar, Slant transforms, KL transforms and their properties.

UNIT - III

Image Enhancement: Background, enhancement by point processing, histogram processing, spatial filtering and enhancement in frequency domain, color image processing.

Image filtering and restoration : degradation model, diagnolisation of circulant and block circulate matrices, Algebraic approach to restoration, inverse filtering, least mean squares and interactive restoration, geometric transformations.

UNIT - IV

Image compression: Fundamentals, image compression modes, error free compression, lossy compression, image compression standards.

Image segmentation: Detection of discontinuities, edge linking and boundary detection thresholding, region – oriented segmentation, use of motion in segmentation.

UNIT - V

Representation and description: Various schemes for representation, boundary descriptors, and regional descrip
Image reconstruction from Projections, Radon Transforms; Convolution/Filter back – Project Algorithms.

Reference:

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods
2. Fundamentals of Digital Image Processing - A. K. Jain, Prentice Hall

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THIRD SEMESTER : M.Sc.(CS)

Paper V : Elective 2. Data Warehousing and Mining

Max Marks : 100 **Min Marks : 40**

Course Outcomes

After successful completion of this course students will be

- Design a data warehouse for an organization.
- Develop skills to write queries using DMQL
- Extract knowledge using data mining techniques, also adapt to new data mining tools.
- Explore recent trends in data mining such as web mining, spatial-temporal mining.

Syllabus

UNIT – I

Introduction: KDD (Knowledge Discovery from Databases),Fundamentals of data mining, Data Mining Functionalities, Major issues in Data Mining, Data Warehouse and OLAP Technology, Multidimensional Data Model, Data Warehouse Architecture, OLAP operations, Warehouse schema.

UNIT – II

Data Preprocessing & Data Mining Languages: Need of Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation, Data Mining Primitives, Data Mining Query Languages, Architectures of Data Mining Systems, Concepts Description: Characterization and Comparison, Analytical Characterization.

UNIT – II

Association Rule Mining, Classification and Prediction: Association Rule Mining, Market Basket Analysis, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Apiori algorithm, FP-Tree growth algorithm, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation.

UNIT – IV

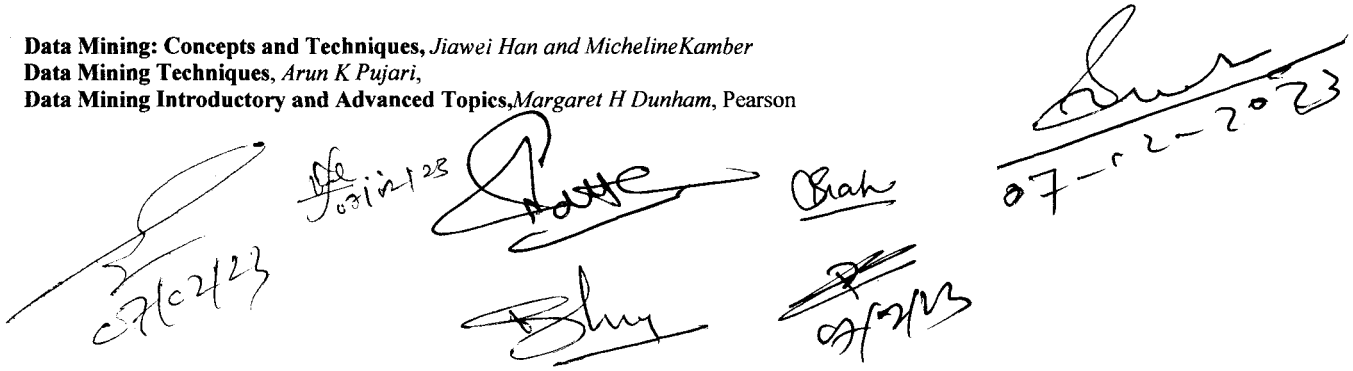
Cluster Analysis: Types of Data in Cluster Analysis, Outlier Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Heirarchical Methods, Density-Based Methods, Grid- Based Methods, Model-Based Clustering Methods.

UNIT – V

Mining Complex Types of Data: Web Mining, Text Mining, Multimedia Mining, Temporal and Spatial Data Mining, Trends in Data Mining, Data Mining Applications.

RECOMENDED BOOKS:

1. **Data Mining: Concepts and Techniques,** *Jiawei Han and MichelineKamber*
2. **Data Mining Techniques**, *Arun K Pujari*,
3. **Data Mining Introductory and Advanced Topics,***Margaret H Dunham*, Pearson



THIRD SEMESTER : M.Sc.(CS)

Paper V: Elective 3. Satellite & Mobile Communication

Max Marks: 100 **Min Marks: 40**

Course Outcomes

After completion of course student are able to:

- Understand the cellular concepts and infrastructure such as frequency reuse.
- Hand off and how interference between mobiles and base stations affects the capacity of cellular systems.
- Identify the technical aspects of wireless and mobile communications along with the knowledge about the GPS, wireless LAN, PAN, MANET and its routing protocol.
- Mobile Computing plays important role in research in wireless communication.

Syllabus

UNIT – I: Introduction.

Introduction to Mobile Communication, Short history of wireless communication, Applications, Vehicles, Emergency, Business, Replacement of wired network, Location dependent services, infotainment, Mobile and Wireless devices, A Simplified reference model, some open research topics in mobile communication.

UNIT – II: Satellite Systems

History of satellite system, Applications of satellite systems, Type of satellite systems, characteristics of satellite systems, satellite system infrastructure, satellite system architecture, Global Positioning system (GPS), Limitations of GPS. Beneficiaries of GPS, Applications of GPS

UNIT – III: Mobile Communication Systems

Introduction, Cellular System Infrastructure,, Registration, Handoff Parameters and Underlying support, Roaming Support Using System Backbone, to Mobile IP, Functions of Mobile IP, Mobile Node, Corresponding Node, Home Network, Foreign Network, Home Agent, Foreign Agent, Care-of Address, IP Packet Delivery, Agent Discovery, Agent Solicitation, Registration, Tunneling, Dynamic host configuration protocol.

UNIT – IV: Wireless LANs and PANs

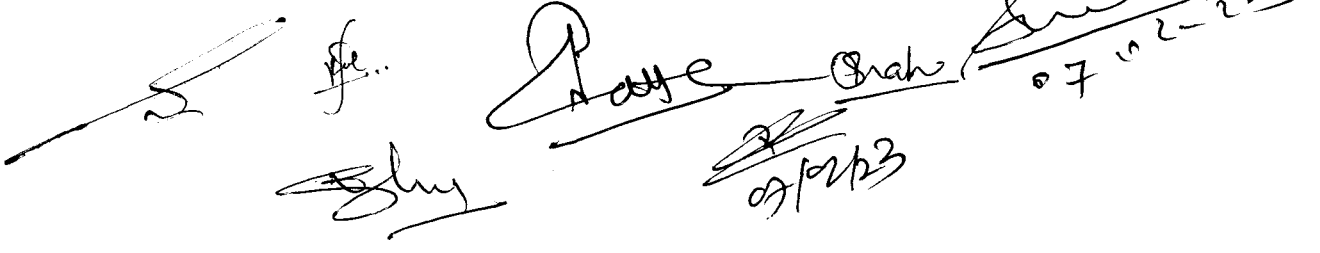
Introduction to IEEE 802.11, Ricochet, Ricochet Wireless Modem, Services Provided by Ricochet , Home RF, Home RF Technology, Hiper LAN, Blue tooth , Advantages and disadvantages of Wireless LAN, Infra redvs radio transmission , introduction to MAC. Technologies influence WLANs / WPANs in future.

UNIT – V: Mobile Adhoc Network

Introduction to Mobile AdhocNetwork(MANET), Characteristics of MANET, Applications of MANET, Routing, Need for Routing, Routing Classification, Table-Driven Routing Protocol – Destination Sequenced Distance Vector Routing Protocol, Cluster-Head Gateway Switch Routing, Wireless Routing Protocol. Source initiated On-demand Routing- Adhoc on Demand Distance Vector Routing, Dynamic Source Routing, Temporarily Ordered Routing Algorithms, Hybrib Protocol – Zone Routing Protocol.

RECOMMENDED BOOKS:

1. **Mobile Communication**: *Jochen H. Schiller*, Pearson Education Publication
2. **Introduction to Wireless and Mobile Systems**: *D.P. Agrawal, Qing-An Zing*, Vikas Publishing House



MASTER OF SCIENCE IN COMPUTER SCIENCE

SCHEME OF TEACHING AND EXAMINATIONS

FOURTH SEMESTER

Subject Code	SUBJECTS	Teaching Load Per Week			Credit L+(T+P)/2	Examination Marks							
						Max. Marks				Min. Marks			
		L	T	P		Theory	Sessional	Pr	Total	Sessional Marks of Project Work	Project Viva-Voce	Pr	Total
Paper I	Cloud Computing	3	2	-	4	100	50	-	150	40	30	-	70
Paper II	Network Security and Cryptography	3	2	-	4	100	50	-	150	40	30	-	70
Paper III	Internet of Things	3	2	-	4	100	50	-	150	40	30	-	70
Paper IV	Project Based Seminar	-	-	1x2	1	-	50	-	50	-	30	-	30
Paper V	Major Project	-	-	5x2	5	-	100	200	300	-	60	100	160
TOTAL					**18**	**300**	**300**	**200**	**800**	**120**	**180**	**100**	**400**

Note:

- Major Project may be a Research Project also.
- Participating in Workshops, Conferences and Seminars or publishing Research Papers will be given weightage in the research project.

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07/02/23

09/02/23

07-02-2023

FOURTH SEMESTER: M.Sc.(CS)

Paper I: Cloud Computing

Max Marks: 100 **Min Marks : 40**

Course Outcomes

- Students will be able to perform cloud oriented analysis.
- Students will be able to model cloud candidate derived from existing business documentation.
- Students will be able to design the composition of a cloud services , also able to design application services for technology abstraction
- Student will be able to appreciate the cloud computing paradigm, recognize its various forms and able to implement some cloud computing features

Syllabus

Unit – I

Introduction: Cloud Computing: Vision, Definition, Reference Model, Characteristics, Benefits and Challenges, Historical Developments, Cloud Computing Environments, Cloud Platforms and Technologies; The Evolution of Cloud Computing: Parallel Computing vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing, Introduction of Grid Computing.

Unit – II

Virtualization: Introduction, Characteristics, Taxonomy of Virtualization, Levels of Virtualization, Structure and Mechanism of Virtualization, Virtualization and Cloud Computing, Advantages and Disadvantages, Virtualization Technology Examples: Xen, VMware, Microsoft Hyper-V.

Unit – III

Cloud Computing Architecture: Service Oriented Architecture, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Data Storage as a Service (DSaaS). Types of Clouds; Economics of the Cloud and Open Challenges; **Security and Organizational aspects**: Host Security and Data Security.

Unit – IV

Migration to the Cloud: Adoption and use of Cloud by Businesses (Small and Enterprise), Pace of Adoption, Benefits and Phases of Adoption, Cloud Service Provider's Capabilities and Liabilities, Success factors and Issues. **Migrating Applications**: Key Aspects, Migration Techniques, Phases of Migration. **Service Level Agreement (SLA)**: Aspects and Requirements, Availability and Outages, Credit Calculations, SLA Samples.

Unit – V

Industry Platforms: Amazon Web Services, Google AppEngine, Microsoft Azure; **Cloud Applications**: Scientific Applications, Business and Consumer Applications; Advanced Topics: Energy Efficiency in Clouds, Market Based Management, Federated Clouds / InterCloud, Third Party Cloud Services.

RECOMMENDED BOOKS:

1. **Mastering Cloud Computing**, *RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi*, McGraw Hill Education
2. **Cloud Computing: Black Book**, *KailashJayaswal et al.*,Kogent Learning Solutions, Dreamtech Press
3. **Cloud Computing: Principals and Paradigms**, *RajkumarBuyya et al.*, Wiley India
4. **Cloud Computing: Concepts, Technology & Architecture**, *Erl*, Pearson Education India
5. **Cloud Computing Bible**, *Barrie Sosinsky*, O'Reilly Media
6. **Cloud Computing: A Practical Approach**, *Toby Velte, Anthony Vote and Robert Elsenpeter*, McGraw Hill
7. **Cloud Application Architectures: Building Applications and Infrastructures in the Cloud**, *George Reese*, O'Reilly Media.
8. **Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance**, *Tim MathermSubraKumaraswamy and ShahedLatif*, O'Reilly Media.

07-12-2023

FOURTH SEMESTER: M.Sc.(CS)

Paper II: Network Security and Cryptography

Max Marks : 100 **Min Marks : 40**

Course Outcomes

- To give the students a basic understanding of computer network.
- To give the students the basic concepts of bandwidth, data communication , cryptography, hash function, security tools etc.
- Student will learn about different malicious software and attacks.
- To make the students more employable.
- To open up new areas in the field of research and development in the area of computer networking.

Syllabus

UNIT – I: INTRODUCTION

Computer Security Concepts, The Challenges of Computer Security, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, A model for network Security, **Symmetric Encryption Principal :** Cryptography, Crypt analysis, Feistel Cipher Structure, DES, Random and Pseudorandom Numbers, Symmetric Block Modes of Operation (ECB, CBC, CFB, CTR).

UNIT – II PUBLIC KEY CRYPTOGRAPHY

Approaches to Message Authentication, **Hash Functions**: HashFunctions Requirement, Security of Hash Functions, The SHA Secure Hash Function, **Public Key Cryptography:** Public –Key Encryption Structure, Applications for Public Key Cryptosystem, RSA, Attacks on RSA, OAEP.

UNIT – III MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION

Message Integrity: Document and Finger Printing, Message and Message Digest, Cryptographic Hash Function Criteria Random Oracle Model, Birthday Problems and Summery of solutions, **Message Authentication:** Modification Detection Code, Message Authentication Code, Introduction of HMAC & CMAC, **Digital Signature:** Comparison, Process, Services, Attacks on Digital Signature.

UNIT – IV MALICIOUS SOFTWARE

Intruders: Intruder Behavior Patterns, Intrusion Techniques, Intrusion Detection by Audit Records, Statistical Intrusion Detection, Distributed Intrusion Detection, Honeypots. Types of Malicious Software, Nature of Viruses, Virus Classification, Antivirus Approaches, Worms and its Propagation model, DDoS Attack.

UNIT – V FIREWALL & SECURITY TOOLS

Firewall: Need & Characteristics ofFirewall, Types of Firewall, Firewall Basing, Firewall Location and Configuration, Introduction to Kali Linux ,Tools Available in Kali Linux and Its Usage. WireShark Packet Analyzer and Its Features. Cyber Security Policy, Domain of Cyber Security Policies.

RECOMMENDED BOOKS:

1. **Network Security Essentials**, *William Stallings*, PEARSON
2. **Cryptography and Network Security**, *William Stallings*, PHI.
3. **Cryptography and Network Security**, *AtulKahate*, Tata McGraw Hill
4. **Cryptography and Network Security**, *B.A. FOROUZAN*, TMH
5. **Cyber Security policy Guidebook**, *Jennifer Jason Paul, Marcus Jeffery Joseph.* Wiley Publication, 2012.
6. **Network Security: The Complete Reference**, Robertra Bragg, Tata McGraw Hill.
7. **Cyber Security Essentials**, *James Graham, Richard Ryan*, CRC press

FOURTH SEMESTER: M.Sc. (CS)

Paper III: Internet of Things

Max Marks : 100 **Min Marks : 40**

Course Outcomes

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

- Explain the definition and usage of the term "Internet of Things" in different contexts and Understand the key components that make up an IoT system
- Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack
- Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis
- Understand where the IoT concept fits within the broader ICT industry and possible future trends and appreciate the role of big data, cloud computing and data analytics in a typical IoT system.

Syllabus

Unit – I: OVERVIEW

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

Unit – II: REFERENCE ARCHITECTURE

IoT Architecture – State of the Art – Introduction, State of the art, Reference Model and architecture, **IoT reference Model** – IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints** – Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

Unit – III: IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

Unit – IV TRANSPORT & SESSION LAYER PROTOCOLS:

Transport Layer : Transmission Control Protocol (TCP), Multipath Transmission Control Protocol (MPTCP), User Datagram Protocol (UDP), Datagram Congestion Control Protocol (DCCP) , Stream Control Transmission Protocol (SCTP), Transport Layer Security (TLS), Datagram Transport Layer Security (DTLS))

Session Layer : Hyper Text Transfer Protocol (HTTP), Constrained Application Protocol (CoAP), Extensible Messaging and Presence Protocol (XMPP), Advanced Message Queuing Protocol (AMQP), Message Queue Telemetry Transport (MQTT)

Unit – V SERVICE LAYER PROTOCOLS & SECURITY:

Service Layer – oneM2M, European Telecommunications Standards Institute (ETSI) M2M (Machine-to-Machine), OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, Routing Protocol for Low-Power and Lossy Networks (RPL), Application Layer

RECOMMENDED BOOKS:

From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, *Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle,* Academic Press, 2014

1. **Learning Internet of Things**, *Peter Waher*, PACKT publishing
2. **Architecting the Internet of Things**, *Bernd Scholz-Reiter, Florian Michahelles,* Springer
3. **Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications**, *Daniel Minoli,* Willy Publications
4. **Internet of Things (A Hands-onApproach)**, *Vijay Madisetti and ArshdeepBahga*, VPT, 2014.