

SCHEME OF TEACHING AND EXAMINATIONS 2019-2020
MASTER OF SCIENCE IN COMPUTER SCIENCE

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	Advance 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

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FIRST SEMESTER : M.Sc.(CS)
Paper I : Principles of Programming Languages

Max Marks : 100

Min Marks : 40

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 : Advance Operating Systems

Max Marks : 100

Min Marks : 40

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

Advanced Processor Management Features

Multi- threaded operating system architecture micro-kernels operating system architecture multiple operating system- subsystem and environments, client-server architecture, protected mode software architecture ,visual machine- JAVA virtual machine and virtual 8086 mode, hard and soft real time operating system, pre-emptive and non-pre-emptive multitasking and scheduling inter process communication shared memory semaphore message queues, signals sessions management, multiprocessor and distributed process synchronization, symmetric multiprocessing systems.

UNIT-III

Advanced Memory Management

Virtual address space, description of user process and kernel, virtual memory architecture of Pentium group of processor. Translation Lookaside 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

UNIT V

Advanced File Management Features

Virtual file systems and v-node architecture, distributed file system, network file system, remote procedure call

RECOMMENDED BOOKS

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

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FIRST SEMESTER : M.Sc.(CS)
Paper III : Data Structure through algorithms using 'C'

Max Marks : 100

Min Marks : 40

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:

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| 1. Data Structures with C | - Seymour Lipschutz (Schaum's Series), TMC Publication |
| 2. Data Structures through C | -Yashwant Kanetkar, 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

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,

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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, ServletContext, Writing Servlet to handle Get and Post methods.

RECOMMENDED BOOKS

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| 1. Core Java: An Integrated Approach | -Dr. R. Nageswara Rao |
| 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 | -Maithew Siple, 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

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,.

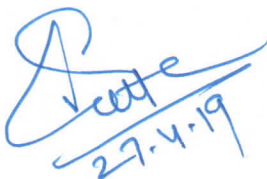
UNIT - V : Input –Output & Memory Organization

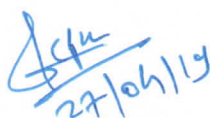
Input –Output Organization : Peripheral Devices, Input/Output Interface, Asynchronous Data Transfer, Direct Memory Access (DMA), Priority Interrupt, Input-Output Processor, Multiprocessor System Organization, and Data Communication Processor.

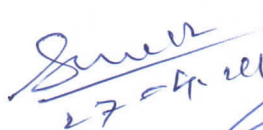
Memory Organization : Auxiliary Memory, Micro Computer Memory, Memory Hierarchy, Associative Memory, Virtual Memory, Cache Memory, Memory Management Hardware.

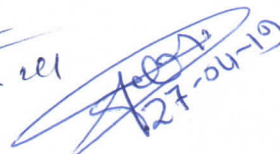
BOOKS RECOMMENDED:

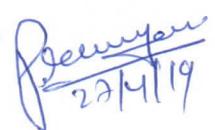
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|---------------------------------------|------------------------------|
| 1. Computer System Architecture | - M. Morris Mano (PHI). |
| 2. Digital Computer Electronics | - Malvino. |
| 3. Digital Computers and Logic Design | - M.Morris Mano (PHI).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

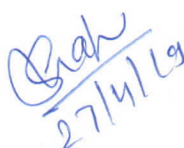

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REFERENCE BOOKS

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

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SCHEME OF TEACHING AND EXAMINATIONS 2019-2020
MASTER OF SCIENCE IN COMPUTER SCIENCE

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

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 Denormalization

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.

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UNIT - V : Data Organization & Object oriented database -

Data Organization - Fixed length records, variable length records, Organization of records in files, Indexing: - indexed files -B-tree, B+-tree, and Hashing Techniques.

Object-Oriented Databases: Overview of Object-Oriented concepts, Object identity, Object structure, and type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Type extents and queries,

Complex objects; Database schema design for OODBMS; OQL,

Persistent programming languages; OODBMS architecture and storage issues; Transactions and Concurrency control, Example of ODBMS,UML Diagram.

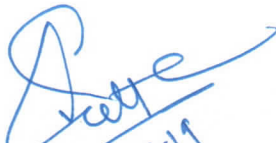
Introduction to distributed database .

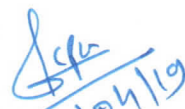
RECOMMENDED BOOKS

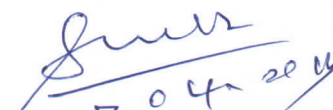
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| 1. Database System Concept | -H. Korth and A. Silberschatz, TMH |
| 2. Data Base Management System | - Ivan Bayross |
| 3. Data Base Management System | - James Matin |
| 4. Database Management System | - Leon & Leon, Vikas Publication |

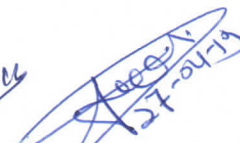
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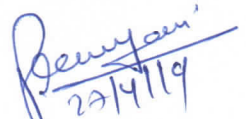
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| 1. Database Management System | -R. Ramakrishanan |
| 2. Database Management System | -A. K. Majumdar & P.Bhattacharya, TMH |
| 3 . An Introduction to database systems | - Bipin Desai, Galgotia Publication. |

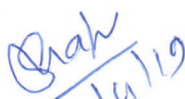

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SECOND SEMESTER : M.Sc.(CS)

Paper II : Advanced Computer Networks

Max Marks : 100

Min Marks : 40

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 transmission parallel 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- shortest 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.

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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 standards, RSA Algorithm.

BOOKS RECOMMENDED

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

REFERENCE BOOKS

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

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SECOND SEMESTER : M.Sc.(CS)

Paper III : Web Development Using Open Source Scripting Language

Max Marks : 100

Min Marks : 40

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 loop

Function: Function, Call by value and Call by reference, Recursive function, inbuilt Functions,

String: Creating and accessing String, Searching & Replacing String, Formatting String, String Library Function

Arrays : 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

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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

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SECOND SEMESTER : M.Sc.(CS)

Paper IV : Formal Automata Theory

Max Marks : 100

Min Marks : 40

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 \hat{I} transitions - Significance, acceptance of languages. Conversions and Equivalence : Equivalence between NFA with and without \hat{I} 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. Hopcroft 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

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REFERENCES BOOKS

1. Introduction to Formal 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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Kavi

SECOND SEMESTER : M.Sc.(CS)
Paper V : Elective 1. Digital Signal Processing

Max Marks : 100

Min Marks : 40

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,
Frequency sampling 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, Pearson Education / Prentice Hall, 2002.

REFERENCE BOOKS

1. Alan V. Oppenheim, Ronald W. Schaffer & John R. Buck, “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

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

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 World; 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

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-Mc Graw Hill.
2. Advanced Computer Architecture By Kai Hwang -Mc Graw Hill.
3. Parallel Computer Architecture & Programming by- V Raja Raman and C. Shiarammuty-PHI

REFERENCE BOOKS

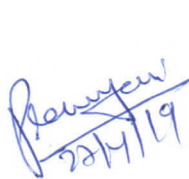
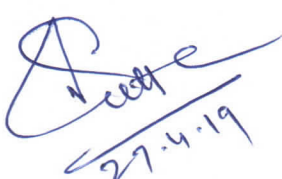
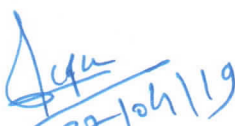
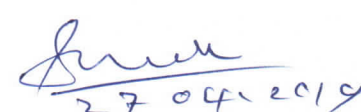
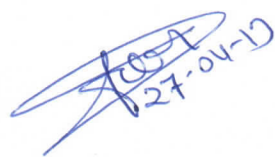
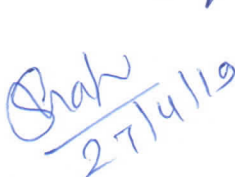
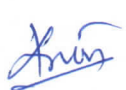
1. Parallel Computing Theory and practice by Michael J. Quinn -Tata Mc-Graw Hill

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SCHEME OF TEACHING AND EXAMINATIONS 2019-2020
MASTER OF SCIENCE IN COMPUTER SCIENCE

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

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 Eyjen & others, Wiley India (P) Ltd.

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THIRD SEMESTER : M.Sc.(CS)

Paper II : Software Engineering

Max Marks : 100

Min Marks : 40

UNIT – I Software 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**, Pankaj Jalote, Narosa Publications
3. **Software Engineering**, Bharat Bhushan Agarwal.

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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

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 iffi, 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

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 Viewing Transformation: 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

UNIT - I

Digital Image fundamentals: 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, diagonalisation 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

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 – III

Association Rule Mining, Classification and Prediction: Association Rule Mining, Market Basket Analysis, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Apriori 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 Micheline Kamber
3. **Data Mining Techniques**, Arun K Pujari,
4. **Data Mining Introductory and Advanced Topics**, Margaret H Dunham, Pearson

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THIRD SEMESTER : M.Sc.(CS)
Paper V: Elective 3. Satellite & Mobile Communication

Max Marks: 100

Min Marks: 40

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 red vs radio transmission , introduction to MAC. Technologies influence WLANs / WPANs in future.

UNIT – V: Mobile Adhoc Network

Introduction to Mobile Adhoc Network(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, Hybrid 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 Zeng, Vikas Publishing House

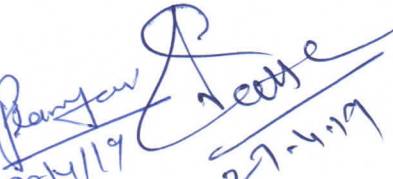
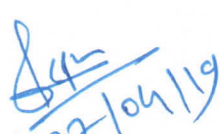
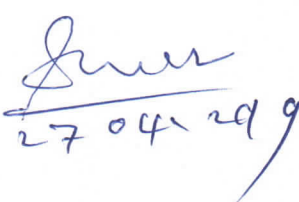

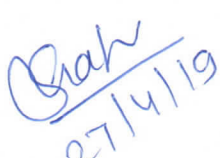

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Panyani 27/4/19
Rohit 27-4-19
Sya 27/04/19
Suri 27.04.19
A0521 27-04-19
Shah 27/4/19
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SCHEME OF TEACHING AND EXAMINATIONS 2019-2020
MASTER OF SCIENCE IN COMPUTER SCIENCE
FOURTH SEMESTER

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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FOURTH SEMESTER : M.Sc.(CS)

Paper I : Cloud Computing

Max Marks : 100

Min Marks : 40

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**, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education
2. **Cloud Computing: Black Book**, Kailash Jayaswal et al., Kogent Learning Solutions, Dreamtech Press
3. **Cloud Computing: Principles and Paradigms**, Rajkumar Buyya 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 Matherm Subra Kumaraswamy and Shahed Latif, O'Reilly Media.

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FOURTH SEMESTER : M.Sc.(CS)
Paper II : Network Security and Cryptography

Max Marks : 100

Min Marks : 40

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**: Hash Functions 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 Summary 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 of Firewall, 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**, Atul Kahate, 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

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FOURTH SEMESTER : M.Sc.(CS)

Paper III : Internet of Things

Max Marks : 100

Min Marks : 40

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:

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

P. Senthil
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G. Raghav
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