Program Outcomes, Course Outcomes and Program Specific Outcomes for

MCA

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1. Program Outcomes

These outcomes describe what students are expected to know and be able to do by the time of graduation. They relate to the skills, knowledge, and behaviours that students acquire in their course through the program. The Master of Computer Application program enables students to attain, by the time of graduation:

PO-A. Demonstrate the aptitude of Computer Programming and Computer based problem solving skills.

PO-B. Display the knowledge of appropriate theory, practices and tools for the specification, design, implementation

PO-C. Ability to learn and acquire knowledge through online courses available at different MOOC Providers.

PO-D. Ability to link knowledge of Computer Science with other two chosen auxiliary disciplines of study.

PO-E. Display ethical code of conduct in usage of Internet and Cyber systems.

PO-F. Ability to pursue higher studies of specialization and to take up technical employ ment.

PO-G. Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate .

PO-H. Ability to operate, manage, deploy, configure computer network, hardware, software operation of an organization.

PO-I .Ability to present result using different presentation tools.

PO-J. Ability to appreciate emerging technologies and tools.

PO-K. Apploy standard Software Engineering practices and strategies in real -time software project development

PO-L. Design and develop computer programs/computer -based systems in the areas related to algorithms, networking, web design, cloud computing, IoT and data analytics.

PO-M. Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems

PO-N. The ability to apploy the knowledge and understanding noted above to the analysis of a given information handling problem.

PO-O. The ability to work independently on a substantial software project and as an effective team member.

2. Course Outcomes

2.1 MCA First Semesters

Paper Code	Title	Hour & Credit		Full Mark	
		L-T-P H/W	Total Credits	Internal	External
MCA-101B	Mathematical Foundation of Computer Science	3-1-0	4	25	75
MCA-102B	Computer Programming and problem solving in C	3-1-0	4	25	75
MCA-103B	Computer Organization & Architecture	3-1-0	4	25	75
MCA-104B	UNIX & Shell Programming	3-1-0	4	25	75
MCA-105B	Fundamentals of Web Technologies	3-1-0	4	25	75
MCA-106B	Programming Lab I	0-1-6	4	25	75
Semester Total				**600**	

Subject : Mathematical Foundation of Computer Science

Subject Code : MCA-101B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the notation of mathematical thinking, mathematical proofs, and algorithmic thinking and be able to apply them in problem solving.
2. Understanding the basics of combinatorics, and be able to apply the methods from these subjects in problem solving.
3. Be able to use effectively algebraic techniques to analyse basic discrete structures and algorithms.
4. Understand basic properties of graphs and related discrete structures, and be able to relate these to practical examples.

Unit **L+T Hour**

Unit -I :Set Theory:- **6+2=8 Hours**

Sets and Subsets, set operations and the laws of Set theory, counting and Venn diagrams, cardinality-countable and uncountable sets.

Unit -II :Relations and Functions :- **7+2=9 Hours**

Cartesian products and relations. Computer representation of relations -diagraphs, Hasse diagrams, zero-one matrices . Partial orders, equivalence relation and partitions. Functions-injective, surjective, bijective. The Pigeon-hole principle, composition of functions and inverse functions.

Unit -III :Fundamentals of Logic :- 7+2=9 Hours

Basic connectives and Truth tables, Logic equivalence- The laws of logic, Logical implication-Rules of inference, Predicate Calculus; Predicate and Quantifiers. Definitions and Proofs of Theorems.

Unit -IV :Properties of integers:- 6+2=8 Hours

Mathematical Induction, Well ordering principle-Mathematical induction, Recursive definitions.

Unit -V :Algebraic Structures, Codding theory and Rings :- 8+2=10 Hours

Groups, Subgroups, Monoids, Submonoids, Normal subgroups, Homomorphisms, Isomorphism and Cyclic groups.

Elements of coding theory, the Hamming metric, the parity check and generator matrices.

Unit -VI : Lattices and Boolean Algebra :- 7+3=10 Hours

Lattice and its properties, Axiomatic definition of Boolean Algebra as algebraic structure ; Duality ; Basic results; Boolean Algebra of truth values; Applications (switching circuits, decision tables).

Unit-VII 7+3=10 Hours

Matrices and system of linear equations, operation of matrices; Solution of system of linear equations using matrix method. Eigen values, eigen vectors, diagonalisation of matrices.

Text Book

1. Ralph P Grimaldi, “Discrete & Combinatorial Mathematics,” 5th Edition, Pearson Education, 2004.

Reference Books

1. Alan Doerr, Kenneth Levasseur : “Applied Discrete Structures for Computer Science”, Galgotia Publications Pvt. Ltd.
2. Kenneth H Rosen, “Discrete Mathematics & its Applications," 7th edition, McGraw-Hill, 2010

Subject : Computer Programming and problem solving in C

Subject Code : MCA-102B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Makes students gain a broad perspective about the uses of computers in engineering industry.
2. Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
3. Develops the ability to analyze a problem, develop an algorithm to solve it.
4. Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.
5. Introduces the more advanced features of the C language

Unit **L+T Hour**

Unit -I: Overview :- **7+2=9 Hours**

Algorithms, Flow Charts, Variables, Data types, Constants, Declarations, Operators, Precedence, Associativity, Order of evaluation, Type conversion, Storage classes, Programming Examples

Unit -II :Input and output statements:- **7+2=9 Hours**

scanf, getchar, gets, printf, putchar, puts; Control Statements – if, else-if, switch, Control Structures – while, for, do-while, break and continue, goto, Programming Examples

Unit -III :Arrays:- **7+2=9 Hours**

Single dimension, Two dimensional, Multi dimensional Arrays, Strings, Programming Examples

Unit -IV :Functions:- **7+3=10 Hours**

Categories of functions, Pointers, Pointer arithmetic, Call by value, Pointer Expression, Pointer as function arguments, , recursion, Passing arrays to functions, passing strings to functions, Call by reference, Functions returning pointers, Pointers to functions, Programming Examples

Unit -V :Structures and Unions:- **7+2=9 Hours**

defining, declaring, initialization, accessing, comparing, operations on individual members; array of structures, structures within structures, structures and functions, pointers and structures, bit fields, Programming Examples

Unit -VI:Files:- **6+3=9 Hours**

defining, opening, closing, input and output operations, error handling, random access; Command line arguments;

Unit -VII:Dynamic Memory Allocation:- **7+2=9 Hours**

definition, malloc, calloc, realloc, free, dynamic arrays

Preprocessor – definition, macro substitution, file inclusion, compiler control directives, Programming Examples

Text Books

1. Programming in ANSI C, Balaguruswamy, Tata McGraw-Hill, 6th Edn.
2. The C Programming Language, Brian W Kernighan, Dennis M Rtchie, PHI, 2nd Edn.

Reference Books

1. Programming with C, Byron Gottfried, Tata McGraw-Hill edition
2. Simplifying C, Harshal Arolkar, Sonal Jain, Wiley Publications
3. Head First C, David Griffiths, & Dawn Griffiths, O'Riley.
4. C Programming, Dr. Vishal M Lichade, Dreamtech press. 2nd Edn.

Subject : Computer Organization & Architecture

Subject Code : MCA-103B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Familiar with baisc logic gates -- AND, OR & NOT, XOR, XNOR; Independently or work in team to build simple logic circuits using basic gates.
2. Be able to design and analyze combinational logic circuits.
3. Be able to design and analyze sequential logic circuits.
4. Understanding of modern computer systems, semiconductor memory organization.

Unit **L+T Hour**

Unit-I :Number System:- **7+3=10 Hours**

Binary, Octal and Hexadecimal. Positive and negative numbers; Fixed point and floating point quantities.

Arithmetic operations: Addition, subtraction etc.

Character Code: ASCII, EBCDIC and Unicode.

Redundant coding for error detection and correction: Concept of Hamming distance, parity codes, Hamming codes, block codes, Cyclic redundancy codes.

Unit-II :Boolean Algebra:- **7+2=9 Hours**

Boolean variables and functions-canonical and standard forms, truth table, minimisation of boolean function.

Unit-III: Karnaugh map:- **7+2=9 Hours**

Simplification of Boolean function using Karnaugh map – octet, quad, pair mappings; with two, three, and four variable functions; using don't care functions.

Unit-IV :Combinational logic circuits:- **7+2=9 Hours**

AND, OR, NOT, NAND, NOR, X-OR gates and tri-state buffer; implementation of Boolean functions using logic gates; Multiplexers, decoders, encoders, simple arithmetic and logic circuits.

Unit-V: Sequential Circuits:- **7+2=9 Hours**

filp-flops, triggering of flip-flops, registers, shift registers and counters (asynchronous and synchronous).

Unit-VI :Semiconductor memory:- **7+2=9 Hours**

RAM, ROM; magnetic core and surface memory- disk, drum, tape; Solid state disk, Flash memory; Access time and cost considerations; concepts of volatility, random access, serial access, direct access, online and backup storage.

Unit-VII : CPU Block Diagram:- **6+3=9 Hours**

Simple functional block diagram of a CPU with its relevant units. Generations of digital computers.

Reference Books:

1. Mano, M.M.: "Digital Logic and Computer Design", Pearson, 2004.
2. Rajaraman, V., Radhakrishan: " An Introduction to Digital Computer Design," 4th edition, PHI(EEE).
3. Mano, M.M.: "Computer System Architecture," 3rd edition, Pearson.
4. Hamacher, Vranesic, Zaky, "Computer Organization", 5th Tata McGraw-Hill.
5. Albert Paul Malvino & Jerald Brown: "Digital Computer Electronics," 3rd edition, McGraw-Hill.

Subject : UNIX & Shell Programming

Subject Code : MCA-104B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe the architecture and features of UNIX Operating System and distinguish it from other Operating System
2. Demonstrate UNIX commands for file handling and process control
3. Write Regular expressions for pattern matching and apply them to various filters for a specific task
4. Analyze a given problem and apply requisite facets of SHELL programming in order to devise a SHELL script to solve the problem

Unit **L+T Hour**

Unit-I: Introduction to UNIX :- **7+3=10 Hours**

Introduction, History, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, stty, uname, passwd, echo, tput, bc, script, spell and ispell, UNIX File System: The file, what's in a filename? The parent-child relationship, pwd, the Home directory, absolute pathnames, using absolute pathnames for a command, cd, mkdir, rmdir, Relative pathnames, The UNIX file system.

Unit -II :Introduction to the Shell:- **7+2=9 Hours**

Introduction to Shell Scripting, Shell Scripts, read, Command Line Arguments, Exit Status of a Command, The Logical Operators && and ||, exit, if, and case conditions, expr, sleep and wait, while, until, for, $, @, redirection. The here document, set, trap, Sample Validation and Data Entry Scripts.

Unit –III: Basic File Attributes:- **6+3=9 Hours**

Is – l, the –d option, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, user masks, changing ownership and group, File Attributes, More file attributes: hard link, symbolic link, umask, find

Unit -IV :Simple Filters:- **7+2=9 Hours**

Pr, head, tail, cut, paste, sort, uniq, tr commands, Filters using Regular Expression : grep & sedgrep, Regular Expression, egrep, fgrep, sed instruction, Line Addressing, Inserting and Changing Text, Context addressing, writing selected lines to a file, the –f option, Substitution, Prosperities of Regular Expressions Context addressing, writing selected lines to a file, the –f option, Substitution, Properties of Regular Expressions

Unit –V : Awk-Advanced Filters:- 7+2=9 Hours

Simple awk Filtering, Splitting a Line into Fields, printf, the Logical and Relational Operators, Number Processing, Variables, The –f option, BEGIN and END positional Parameters, get line, Built-in variables, Arrays, Functions, Interface with the Shell, Control Flow, Advanced Shell Programming, The sh command, export, cd, the Command, expr, Conditional Parameter Substitution, Merging Streams, Shell Functions, eval, Exec Statement

Unit -VI :The Process:- 7+2=9 Hours

Process basics, PS, internal and external commands, running jobs in background, nice, at and batch, cron, time commands, cpio, tar, Customizing the Environment : System Variables, profile, sty, PWD, Aliases, Command History, On-line Command Editing

Unit -VII :System Administration :- 7+2=9 Hours

Essential System Administration root, administrator's privileges, startup & shutdown, managing disk space, Maintaining security, partition and file systems, fdisk, mkfs, mounting and unmounting file systems, fsck, init, sync.

Text Book:

1. Unix Concepts and applications, 4th edition, Sumitabha Das, Tata McGraw Hill,

Reference Book:

1. "Unix Shell Programming", Yashwant Kanetkar,
2. "Beginning Shell Scripting", Eric Foster -Johnson, John C Welch, Micah Anderson, Wrox publication.
3. "Introduction to UNIX" by M G Venkatesh Murthy.
4. Your UNIX-The Ultimate Guide, Sumitabha Das, Tata McGraw Hill,

Subject : Fundamentals of Web Technologies

Subject Code : MCA-105B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Students are able to develop a dynamic webpage by the use of java script and DHTML.
2. Students will be able to write a well formed / valid XML document. ·
3. Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table. ·
4. Students will be able to write a server side java application called Servlet to catch form data sent from client, process it and store it on database. ·
5. Students will be able to write a server side java application called JSP to catch form data sent from client and store it on database.

Unit **L+T Hour**

Unit - I :Fundamentals:- 6 +3=9 hours

Internet, WWW, Web browsers and Web servers, URLs, MIME, HTTP, Security, Cyber laws.
Web Foundations: Evolution of the Web, Peek into the History of the Web, Internet Applications, Networks, TCP/IP, Higher Level Protocols, Important Components of the Web, Web search Engines, Application Servers.

Unit -II :Introduction to XHTM:- 7+2=9 hours

Basic Syntax, Standard structure, Elements, Attributes, Images, Hypertext Links, Lists, Tables, Forms, Frames, Iframes, Symbols

Unit - III :Cascading Style sheets:- 7+2=9 hours

Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.

Unit -IV :The Basics of JavaScript:- 7+2=9 hours

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

Unit -V :JavaScript and HTML Documents:- 7+2=9 hours

The JavaScript execution environment, The Document Object Model (DOM), Elements access in JavaScript, Events and Event handling, Handling events from body elements, handling Event from Text Box and password elements, the DOM2 event model, the navigator object, DOM tree traversal and modification.

Unit -VI :Dynamic Documents with JavaScript:- 7+3=10 hours

Introduction, Positioning Elements, Moving Elements, Elements visibility, changing colors and fonts, dynamic content, stacking Elements, locating the mouse cursor, reacting to a mouse click, slow movement of elements, dragging and dropping Elements.

Unit -VII: Introduction to XM:- 7+2=9 hours

Introduction, Syntax, Document structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, displaying XML documents with CSS, XSLT style sheets, XML processors, Web services.,

TEXT BOOK

1. Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education (VTU 4th Edn.).
2. M. Srinivasan: Web Technology Theory and Practice, Pearson Education,

REFERENCES

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education.

Chris Bates: Web Programming Building Internet Applications, Wiley India.Internet Technology and Web Design, Instructional Software Research and Development (ISRD) Group, Tata McGraw Hill.

2.2 MCA Second Semester

Paper Code	Title	Hour & Credit		Full Mark	
		L-T-P H/W	Total Credit	Internal	External
MCA-201B	Probability and Statistics	3-1-0	4	25	75
MCA-202B	Data Structures using C	3-1-0	4	25	75
MCA-203B	Database Systems	3-1-0	4	25	75
MCA-204B	Formal Language and Automata Theory	3-1-0	4	25	75
MCA-205B	Object Oriented Programming in JAVA	3-1-0	4	25	75
MCA-206B	Programming Lab II MCA[202,203,205]B	0-1-6	4	25	75
Semester Total				**600**	

Subject: Probability and Statistics

Subject Code: MCA-201B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Solve problems by thinking logically, making conjectures, and constructing valid mathematical arguments
2. Make valid inferences from numerical, graphical and symbolic information
3. Apply mathematical reasoning to both abstract and applied problems, and to both scientific andnon-scientific problems.

Unit **L+T Hour**

PART A

UNIT-1.: Probability 6+2=8 Hours.

Sample space, Events, Probability of an Event, Rules of Probability, Counting Sample Points, Additive Rules, Conditional Probability, Independent events and Product Rules, Bayes' Rule.

UNIT-2: 6+2=8 Hours.

Random Variables, Probability Density and Probability Distributions

Discrete, Continuous and Mixed Random Variables, Function of a Random Variable, Probability Mass, Probability Density and Distribution Functions, Mathematical Expectations, Moments, Probability and Moment Generating Function, Median and Quartiles, Markov Inequality, Chebyshev's Inequality Problems.

UNIT-3: Special Distributions 6+2=8 Hours.

Discrete Uniform, Binomial, Geometric, Negative Binomial, Hyper-Geometric, Poisson, Continuous Uniform, Exponential, Gamma, Beta, Normal, Inverse Gaussian, Double Exponential Distributions.

UNIT-4: Joint Distributions 6+2=8 Hours.

Joint, Marginal and Conditional Distributions, Product Moments, Independence of Random Variables, Bivariate Normal Distribution Problems.

PART B

UNIT-5: Sampling Distributions 6+2=8 Hours.

Random Sampling and Sampling Distributions, The Central Limit Theorem, Distributions of the Sample Mean and the Sample Variance for a Normal population, Chi-Square, t and F distributions, problems.

UNIT-6: Sample Estimation Problems 6+2=8 Hours.

Statistical Inference, Classical Methods of Estimation, Single Sample: Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Tolerance Limits, Single Sample: Estimating the Variance.

UNIT-7: Regression and Correlation 6+2=8 Hours.

Linear and Non-linear Regression, Least Square Method of Curve Fitting, Coefficient of Determination, Confidence Intervals in Linear Regression, Correlation Analysis, Principal Component Analysis, Factor Analysis, Analysis of Variance.

UNIT-8: Testing of Hypothesis 6+2=8 Hours.

Statistical Hypotheses: General Concepts, Testing a Statistical Hypothesis, the Use of P-Values for Decision Making in Testing Hypotheses.

References:

1. JOHN E. FREUND'S; Mathematical Statistics with Applications, PEARSON.
2. AFFI. A.A.; Statistical Analysis: A Computer Oriented Approach, Academic Press Inc., 1779.
3. MORRIS, C.; ROLPH, J. Introduction to Data Analysis and Statistical Inference, Prentice Hall, 1981.
4. SCALZO, F.: Elementary Computer Assisted Statistics, Van Nostrand Reinherd Co. Ltd., 1978.
5. DRAPER, N.A.; SMITH, H: Applied Regression Analysis, John Wiley & sons, Inc.
6. ANDERSON, T.W.: An Introduction to Multivariate Statistical Analysis, John Wiley & sons, Inc.

Subject : Data Structures using C

Subject Code : MCA-202B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the concept of Dynamic memory management, data types, algorithms, Big O notation
2. Understand basic data structures such as arrays, linked lists, stacks and queues.
3. Describe the hash function and concepts of collision and its resolution methods
4. Solve problem involving graphs, trees and heaps
5. Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data

Unit **L+T Hour**

PART A

UNIT - 1 :BASIC CONCEPTS:- **6+2=8 Hours**

Pointers and Dynamic Memory Allocation, Algorithm Specification, Data Abstraction, Performance Analysis, Performance Measurement.

UNIT - 2 :ARRAYS and STRUCTURES:- **6+2=8 Hours**

Arrays, Dynamically Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays.

UNIT - 3 :STACKS AND QUEUES:- **7+1=8 Hours**

Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues.

UNIT - 4 :LINKED LISTS:- **6+2=8 Hours**

Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists.

PART - B

UNIT - 5 : TREES – 1:- **6+2=8 Hours**

Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Heaps, Binary Search Trees.

UNIT - 6 :HASHING:- **5+3=8 Hours**

Introduction, Static hashing: Hashing Tables, hashing functions, Overflow handling, Dynamic Hashing: motivation for Dynamic hashing, Dynamic hashing using directories, Directoryless Dynamic hashing.

UNIT - 7 **6+2=8 Hours**

MULTIWAY SEARCH TREES: M-way Search Trees, B-Trees, B+ Trees. Insertion deletion in B-Tree, B+ Trees.

UNIT - 8 :EFFICIENT BINARY SEARCH TREES:- 6+2=8 Hours

Optimal Binary Search Trees, AVL Trees, Red-Black Trees, Splay Trees.

Text Book:

1. Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2 Edition, University Press, 2007 (Chapters 1, 2.1 to 2.6, 3, 4, 5.1 to 5.3, 5.5 to 5.7, 8.1 to 8.3, 10, 11)

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2 Edition, Pearson Education, 2003.

Subject : Database Systems

Subject Code : MCA-203B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models.
2. Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing.
3. Learn and apply Structured query language (SQL) for database definition and database manipulation.
4. Demonstrate an understanding of normalization theory and apply such knowledge to thenormalization of a database.
5. Understand various transaction processing, concurrency control mechanisms and database protection mechanisms.

Unit **L+T Hour**

PART A

UNIT – 1 Introduction: - **5+3=8 Hours**

Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

UNIT – 2 Entity-Relationship Model:- **6 +2=8Hours**

Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

UNIT – 3 Relational Model and Relational Algebra :- **7+1=8 Hours**

Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

UNIT – 4 SQL – 1:- **6+2=8 Hours**

SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries.

PART - B

UNIT – 5 SQL – 2: - **6+2=8 Hours**

Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures.

UNIT – 6 Database Design – 1:- **5+3=8 Hours**

Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form

UNIT – 7 Database Design -2: - **6+2=8 Hours**

Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms.

UNIT – 8 Transaction Management:- **7+1=8 Hours**

The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock-Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; Introduction to ARIES; The log; Other recovery-related structures; The write-ahead log protocol; Checkpointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

(Chapters 1, 2, 3 except 3.8, 5, 6.1 to 6.5, 7.1, 8, 9.1, 9.2 except SQLJ, 9.4, 10)

2. Alexis Leon & Mathews Leon, Database Management Systems, Vikas Publishing House Pvt. Ltd. (Chapter 5,7,8,9,10,11,12,14,15,16,17,18,19,21,26,27,28,29,30,32)

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.

Subject : Formal Language and Automata Theory

Subject Code : MCA-204B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the basic concepts of formal languages, automata and grammar types, as well as the use of formal languages and reduction in normal forms
2. Demonstrate the relation between regular expressions, automata, languages and grammar with formal mathematical methods
3. Design push down automata, cellular automata and turing machines performing tasks of moderate complexity
4. Analyze the syntax and formal properties, parsing of various grammars such as LL(k) and LR(k)
5. Describe the rewriting systems and derivation languages

Unit **L+T Hour**

PART - A

UNIT – 1:Introduction to Finite Automata:- **6+2=8 Hours**

Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata

UNIT – 2 :Finite Automata, Regular Expressions:- **6+2=8 Hours**

An application of finite automata; Finite automata with Epsilon-transitions; Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions

UNIT – 3 :Regular Languages, Properties of Regular Languages:- **6+2=8 Hours**

Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata

UNIT – 4 :Context-Free Grammars And Languages :- **6+2=8 Hours**

Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages.

PART – B

UNIT – 5:Pushdown Automata:- **6+2=8 Hours**

Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata

UNIT – 6 : Properties of Context-Free Languages:- 6+2=8 Hours

Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs

UNIT – 7 :Introduction To Turing Machine:- 6+2=8 Hours

Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines; Extensions to the basic Turning Machines; Turing Machine and Computers.

UNIT – 8 : Undecidability:- 6+2=8 Hours

A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem; Other undecidable problems.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3th Edition, Pearson Education, 2007.(Chapters: 1.1, 1.5, 2.2 to 2.5, 3.1 to 3.3, 4, 5, 6, 7, 8.1 to 8.4, 8.6, 9.1, 9.2, 9.4.1, 9.5)

Reference Books:

1. K.L.P. Mishra: Theory of Computer Science, Automata, Languages, and Computation, 3th Edition, PHI Learning, 2009.

2. Raymond Greenlaw, H.James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Elsevier, 1998.

3. John C Martin: Introduction to Languages and Automata Theory, 3th Edition, Tata McGraw-Hill, 2007.

4. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3th Edition, Pearson Education, 2006.

5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford Higher Education.

Subject : Object Oriented Programming in JAVA

Subject Code : MCA-205B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
2. Understand dynamic memory management techniques
3. using pointers, constructors, destructors, etc
4. Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.
5. Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.
6. Demonstrate the use of various OOPs concepts with the help of program

Unit **L+T Hour**

PART A

Unit I : An Overview of Java: -- 7+2=9 Hours

Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings

Unit II : Operators: - 7+2=9 Hours

Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements.

Unit III : Object and Class 1: - 7+2=9 Hours

Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion

Unit IV : Class 2: - 7+2=9 Hours

Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

PART B

Unit V : Interface and Packages: - 8+2=10 Hours

Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables. Java API Packages, Using System Packages, Naming Conventions, Creating Packages,

Accessing a Package, Using a Package, Adding a Class to a Package, Hiding Classes, Static Import.

Unit VI : Exception Handling and I/O: - 7+2=9 Hours

Exceptions-Handling-Fundamentals, exception types, using try and catch, multiple catch clause, nested try statements – throw, throws and finally, built-in exceptions, creating own exceptions. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

Unit VII : Multithreaded Programming: - 7+2=9 Hours

Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface, Inter-thread communication. vectors, lists, maps.

2.3 MCA Third Semester

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
MCA-301B	Design and Analysis of Computer Algorithms	3-1-0	4	25	75
MCA-302B	Problem Solving with Python	3-1-0	4	25	75
MCA-303B	Data Communication & Computer Networks	3-1-0	4	25	75
MCA-304B	Operating Systems	3-1-0	4	25	75
(CBCS paper)	Elective I (To opt to other Departments/Institutes)	3-1-0	4	25	75
MCA-306B	Programming Lab III (A:301, B:302,303)B	0-1-6	4	25	75
Semester Total				**600**	

CBCS papers that to be offered to the students of other Departments in III Sem.

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
CS-O3.1	IT Tools and Applications	3-1-0	4	25	75
CS-O3.2	Object Oriented Programming in C++	3-1-0	4	25	75

Subject : Design and Analysis of Computer Algorithms

Subject Code :MCA-301B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Apply design principles and concepts to algorithm design
2. Have the mathematical foundation in analysis of algorithms
3. Understand different algorithmic design strategies like DAC, dynamic programming, greedy, backtracking.
4. Analyze the efficiency of algorithms using time and space complexity theory

Unit **L+T Hour**

UNIT – 1: **6+2=8 Hours**

INTRODUCTION : Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms, Recurrence, Brute Force Approaches: Introduction, Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.

UNIT - 2: **6+2=8 Hours**

DIVIDE AND CONQUER : Divide and Conquer: General Method, Defective Chess Board, Binary Search, Merge Sort, Quick Sort, Heap sort and its performance.

UNIT - 3: **6+2=8 Hours**

THE GREEDY METHOD : The General Method, Amortized Complexity, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths.

UNIT – 4: **6+2= 8 Hours**

DYNAMIC PROGRAMMING : The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Single-Source Shortest Paths: General Weights, 0/1 Knapsack, The Traveling Salesperson problem.

UNIT – 5: **6+2=8 Hours**

DECREASE-AND-CONQUER APPROACHES, SPACE-TIME TRADEOFFS : Decrease-and-Conquer Approaches: Introduction, Insertion Sort, Depth First Search and Breadth First Search, Topological Sorting, Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching.

UNIT – 6 **6+2=8 Hours**

LIMITATIONS OF ALGORITHMIC POWER AND COPING WITH THEM : Lower-Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems, Challenges of Numerical Algorithms.

UNIT - 7 **6+2=8 Hours**

COPING WITH LIMITATIONS OF ALGORITHMIC POWER : Backtracking: n - Queens

problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem. Approximation Algorithms for NP-Hard Problems, Traveling Salesperson Problem, Knapsack Problem.

UNIT – 8 **6+2=8 Hours**

PRAM ALGORITHMS:Introduction, Computational Model, Parallel Algorithms for Prefix Computation, List Ranking, and Graph Problems.

Text Books:

1. Anany Levitin: Introduction to The Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007. (Listed topics only from the Chapters 1, 2, 3, 5, 7, 8, 10, 11).
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition Universities Press, 2007. (Listed topics only from the Chapters 3, 4, 5, 13)

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI, 2010.

Subject : Problem Solving with Python

Subject Code :MCA-302B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

1. Develop algorithmic solutions to simple computational problems.
2. Demonstrate programs using simple Python statements and expressions
3. Explain control flow and functions concept in Python for solving problems.
4. Use Python data structures –lists, tuples & dictionaries for representing compound data.
5. Explain files, exception, modules and packages in Python for solving problems.

Unit **L+T Hour**

UNIT – I ***6+2=8 Hours***

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

UNIT – II: ***8+2=10 Hours***

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

UNIT – III: ***7+3=10 Hours***

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

UNIT – IV: ***9+3=12 Hours***

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Scope of the Variables in a Function, Global and Local Variables, Lambda Expression, Anonymous Functions.

Modules: Using Python Packages - Creating modules, import statement, namespacing, Python packages, Introduction to PIP, Installing Packages via PIP.

UNIT – V: ***9+3=12 Hours***

Object-Oriented Programming in Python: Classes, self-variable, Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.

Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions

UNIT – VI: ***9+3=12 Hours***

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

Text/Reference.

1. The Fundamentals of Python: First Programs, by Kenneth A. Lambert, 2 Edition,Cengage Learning India Pvt. Ltd., 2019.
2. W3schools.com/python

Subject : Data Communication & Computer Networks
Subject Code :MCA-303B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand computer network basics, network architecture, TCP/IP and OSI reference models.
2. Identify and understand various techniques and modes of transmission.
3. Describe data link protocols, multi-channel access protocols and IEEE 802 standards for LAN
4. Describe routing and congestion in network layer with routing algorithms and classify IPV4 addressing scheme.
5. Discuss the elements and protocols of transport layer.
6. Understand network security and define various protocols such as FTP, HTTP, Telnet, DNS

Unit **L+T Hour**

PART A

UNIT I :Introduction to Computer Networks:- **5+2=7 Hours**

Networking Devices, Classification of Computer Networks, Network Protocol Stack (TCP/IP and ISO-OSI), Network Standardization and Examples of Networks.

UNIT II: Physical Layer:- **6+2=8 Hours**

Data Transmission Concepts, Analog and Digital Data Transmission, Transmission Impairments and Channel Capacity, Guided and Wireless transmission, communication media, Digital modulation techniques (FDMA,TDMA,CDMA) and mobile telephone systems (1G,2G,3G and 4G).

UNIT III :Data Link layer:- **6+2=8 Hours**

Framing, Error control, Flow Control, Error Detection and Correction Codes, Data Link Protocols and Sliding window protocols.

UNIT IV :Medium Access Sub Layer:- **6+2=8 Hours**

Multiple access protocols and Examples : Ethernet, Wireless LAN, Broadband Wireless and Bluetooth, Data Link Layer Switching.

PART B

UNIT V: Hours Network Layer:- **7+2=9 Hours**

Network Layer Design issues, Routing algorithms, Congestion Control Algorithms, Quality of Service, Internetworking and The Network Layer in the Internet.

UNIT VI: The Transport Layer:- **6+2=8 Hours**

The Transport Service, Elements of Transport Protocols, Congestion Control, The Internet Transport Protocol: UDP,The Internet Transport Protocols – TCP, Performance Issues.

UNIT VII:The application Layer:- **6+2=8 Hours**

DNS, Email, WWW, Streaming audio and Video and Content Delivery

UNIT VIII: Network Security:- **6+2=8 Hours**

Cryptography, Symmetric key, Public key Cryptography, Digital Signature.

Text Books

1. "Computer Networks" by Andrew S Tanenbaum, David J Wetheral, 5th Edition, Pearson 2012.

2. "Data and Computer Communications" by William Stallings , Above 7th edition , 2004

Reference:

1. Behrouz A. Forouzan,: Data Communication and Networking, 4 Edition Tata McGraw-Hill, 2006.

Subject: Operating Systems

Subject Code :MCA-304B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the basics of operating systems like kernel, shell, types and views of operating systems
2. Describe the various CPU scheduling algorithms and remove deadlocks.
3. Explain various memory management techniques and concept of thrashing
4. Use disk management and disk scheduling algorithms for better utilization of external memory.
5. Recognize file system interface, protection and security mechanisms.
6. Explain the various features of distributed OS like Unix, Linux, windows etc.

Unit **L+T Hour**

UNIT-1: Introduction and Operating-System Structures:- 6+2=8 Hours

Introduction: What Operating Systems Do, Computer-System Organization, Computer-System Architecture, Operating-System Operations, Resource Management, Security and Protection, Virtualization, Distributed Systems, Kernel Data Structures, Computing Environments, Free and Open-Source Operating Systems, **Operating-System Structures:** Operating-System Services, User and Operating-System Interface, System Calls, System Services, Linkers and Loaders, Why Applications Are Operating-System Specific, Operating-System Design and Implementation, Operating-System Structure, Building and Booting an Operating System, Operating-System Debugging

UNIT-2: Process Management :- 6+2=8 Hours

Processes: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication, IPC in Shared-Memory Systems, IPC in Message-Passing Systems, Examples of IPC Systems, Communication in Client – Server Systems, **Threads & Concurrency:** Overview of Threads, Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues, **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multi-Processor Scheduling, Real-Time CPU Scheduling, Operating-System Examples, Algorithm Evaluation

UNIT-3: Process Synchronization:- 6+2=8 Hours

Synchronization Tools: Background, The Critical-Section Problem, Peterson's Solution, Hardware Support for Synchronization, Mutex Locks, Semaphores, Monitors, Liveness, Evaluation **Synchronization Examples:** Classic Problems of Synchronization, Synchronization within the Kernel, POSIX Synchronization, Synchronization in Java, Alternative Approaches, **Deadlocks:** System Model, Deadlock in Multithreaded Applications, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

UNIT-4: Memory Management:- **6 +2=8 Hours**

Main Memory: Background ,Contiguous Memory Allocation ,Paging ,Structure of the Page Table ,Swapping ,Example: Intel 32- and 64-bit Architectures ,Example: ARMv8 Architecture ,**Virtual Memory :**Background **,**Demand Paging ,Copy-on-Write ,Page Replacement ,Allocation of Frames ,Thrashing ,Memory Compression ,Allocating Kernel Memory ,Other Considerations ,Operating-System Examples

UNIT-5: Storage Management: **6+2=8 Hours**

Mass-Storage Structure: Overview of Mass-Storage Structure ,HDD Scheduling ,NVM Scheduling ,Error Detection and Correction ,Storage Device Management ,Swap-Space Management ,Storage Attachment ,RAID Structure ,**I/O Systems :** Overview ,I/O Hardware ,Application I/O Interface ,Kernel I/O Subsystem ,Transforming I/O Requests to Hardware Operations ,STREAMS ,Performance

UNIT-6: File System:- **6+2=8 Hours**

File-System Interface: File Concept, Access Methods ,Directory Structure ,Protection ,Memory-Mapped Files,**File-System Implementation:** File-System Structure ,File-System Operations ,Directory Implementation ,Allocation Methods ,Free-Space Management ,Efficiency and Performance ,Recovery ,Example: The WAFL File **System,File-System Internals:** File Systems ,File-System Mounting ,Partitions and Mounting ,File Sharing ,Virtual File Systems ,Remote File Systems ,Consistency Semantics ,NFS

UNIT-7: Security And Protection:- **6+2=8 Hours**

Security :The Security Problem ,Program Threats ,System and Network Threats ,Cryptography as a Security Tool ,User Authentication ,Implementing Security Defenses ,An Example: Windows 10 ,**Protection :**Goals of Protection ,Principles of Protection ,Protection Rings ,Domain of Protection ,Access Matrix ,Implementation of the Access Matrix ,Revocation of Access Rights ,Role-Based Access Control ,Mandatory Access Control (MAC) ,Capability-Based Systems ,Other Protection Improvement Methods ,Language-Based Protection

UNIT-8: Case Studies :- **6+2=8 Hours**

The Linux System :Linux History ,Design Principles ,Kernel Modules ,Process Management ,Scheduling ,Memory Management ,File Systems ,Input and Output ,Interprocess Communication ,Network Structure ,Security,**Windows 10 :**History **,**Design Principles ,System Components **,**Terminal Services and Fast User Switching ,File System, Networking, Programmer Interface

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Concepts, 10th Edition, Wiley India, 2018.(Listed topics only from Chapters 1 to 17, 20,21)

Reference Books:

1. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, Pearson,2018
2. Andrew S.Tanenbaum, Herbert Bos, Modern Operating Systems, Fourth Edition, Pearson,2014

Department of Computer Science, Manipur University

Syllabus for elective paper offered to students of other departments under CBCS in 3rd Semester

Subject : IT Tools and Applications

Subject Code : CS-O3.1

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 I.A. Marks : 25

Exam Hours: 03

Course Outcomes:

1. Understand the Importance of IT and its acts in India.
2. Understanding the basic concept of computer fundamentals and number systems
3. Describe about the basic components of computer.
4. Understand the applications of MS Word, MS Excel and MS Power Point in documentation and other areas.
5. Understanding the concept of DBMS and its importance in record maintenance.

Unit **L+T Hour**

Unit 1: Computer Appreciation **5+1=6 Hours.**

Characteristics of Computers, Input, Output, Storage units, CPU, Computer System, Binary number system, Binary to Decimal Conversion, Decimal to Binary Conversion, ASCII Code, Unicode.

Unit 2: Computer Organization **6+1=7 Hours**

Central Processing Unit - Processor Speed, Cache, Memory, RAM, ROM, Booting, Memory- Secondary Storage Devices: Floppy and Hard Disks, Optical Disks CD-ROM, DVD, Mass Storage Devices: USB thumb drive. Managing disk Partitions, File System Input Devices - Keyboard, Mouse, joystick, Scanner, web cam, Output Devices- Monitors, Printers – Dot matrix, inkjet, laser, Multimedia- What is Multimedia, Text, Graphics, Animation, Audio, Images, Video; Multimedia Application in Education, Entertainment, Marketing. Names of common multimedia file formats, Computer Software- Relationship between Hardware and Software; System Software, Application Software, Compiler, names of some high level languages, free domain software.

Unit 3: Operating System **5+3=8 Hours**

Microsoft Windows- An overview of different versions of Windows, Basic Windows elements, File management through Windows. Using essential accessories: System tools – Disk cleanup, Disk defragmenter, Entertainment, Games, Calculator, Imaging – Fax, Notepad, Paint, WordPad. Command Prompt- Directory navigation, path setting, creating and using batch files. Drives, files, directories, directory structure. Application Management: Installing, uninstalling, Running applications. Linux- An overview of Linux, Basic Linux elements: System Features, Software Features, File Structure, File handling in Linux: H/W, S/W requirements, Preliminary steps before installation, specifics on Hard drive repartitioning and booting a Linux system.

Unit 4: Information Technology and Society **5+1=6 Hours**

Internet and its applications, Web browsers, Web servers, URLs, HTTP, Security, Cyber laws,

Indian IT Act, Intellectual Property Rights – issues. Application of information Technology in Railways, Airlines, Banking, Insurance, Inventory Control, Financial systems, Hotel management, Education, Video games, Telephone exchanges, Mobile phones, Information kiosks, special effects in Movies.

Unit 5: Word Processing **7 +3=10 Hours**.

Word processing concepts: saving, closing, Opening an existing document, Selecting text, Editing text, Finding and replacing text, printing documents, Creating and Printing Merged Documents, Character and Paragraph Formatting, Page Design and Layout. Editing and Profiling Tools: Checking and correcting spellings. Handling Graphics, Creating Tables and Charts, Document Templates and Wizards.

Unit 6: Spreadsheet Package **7+3=10 Hours**.

Spreadsheet Concepts, Creating, Saving and Editing a Workbook, Inserting, Deleting Work Sheets, entering data in a cell / formula Copying and Moving from selected cells, handling operators in Formulae, Functions: Mathematical, Logical, statistical, text, financial, Date and Time functions, Using Function Wizard. Formatting a Worksheet: Formatting Cells – changing data alignment, changing date, number, character or currency format, changing font, adding borders and colors, Printing worksheets, Charts and Graphs – Creating, Previewing, Modifying Charts. Integrating word processor, spread sheets, web pages.

Unit 7: Presentation Package **6+2=8 Hours**.

Creating, Opening and Saving Presentations, Creating the Look of Your Presentation, Working in Different Views, Working with Slides, Adding and Formatting Text, Formatting Paragraphs, Checking Spelling and Correcting Typing Mistakes, Making Notes Pages and Handouts, Drawing and Working with Objects, Adding Clip Art and other pictures, Designing Slide Shows, Running and Controlling a Slide Show, Printing Presentations.

Unit 8: Data Base Operations **7+2=9 Hours**.

Data Manipulation-Concept: Database, Relational Database, Integrity. Operations: Creating, dropping, manipulating table structure. Manipulation of Data: Query, Data Entry Form, Reports.

RECOMMENDED BOOKS MAIN READING

1. P.K. Sinha and P. Sinha, " Foundations of Computing" , BPB Publication, 2008.
2. Sagman S, "MS Office for Windows XP", Pearson Education, 2007.
3. ITL Educational Society, "Introduction to IT", Pearson Education, 2009.
4. Miller M, "Absolute Beginners Guide to Computer Basics", Pearson Education, 2009.

SUPPLEMENTARY READING

1. Turban, Mclean and Wetherbe, "Information Technology and Management" John Wiely & Sons.
2. Balagurusamy E, "Fundamentals of Computers", 2009, Tata McGraw-Hill
3. Kulkarni, "IT Strategy for Business", Oxford University Press Refer: Open Office/ MS Office Environment for practice.
4. Satish Jain, "O Level IT Tools and Business System", BPB Publications, 2010
5. Pankaj Kumar, "IT Tools and Business Systems", Choice International, Edn-2017

Department of Computer Science, Manipur University

Syllabus for elective paper offered to students of other departments under CBCS in 3rd Semester

Subject : OBJECT ORIENTED PROGRAMMING IN C++

Subject Code : CS-O3.2

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand key features of the object-oriented programming language such as encapsulation (abstraction), inheritance, and polymorphism.
2. Design and implement object-oriented applications.
3. Analyze problems and implement simple C++ applications using an object-oriented software engineering approach.

Unit **L+T Hour**

PART - A

UNIT 1 :Introduction:- **6+2=8 Hours**

Overview of C++, Sample C++ programs, Different data types, operators, expressions, and statements, arrays and strings, pointers & user- defined types.

Function Components, argument passing, inline functions, function overloading, recursive functions.

UNIT 2: Classes & Objects – I:- **6+2=8 Hours**

Class Specification, Class Objects, Scope resolution operator, Access members, Defining member functions, Data hiding, Constructors, Destructors, Parameterized constructors, Static data members, Functions.

UNIT 3: Classes & Objects –II:- **6+2=8 Hours**

Friend functions, Passing objects as arguments, Returning objects, Arrays of objects, Dynamic objects, Pointers to objects, Copy constructors, Generic functions and classes, Applications.

Operator overloading using friend functions such as +, - , pre-increment, post-increment, [ ] etc., overloading <<, >>.

UNIT 4: Inheritance – I:- **6+2=8 Hours**

Base Class, Inheritance and protected members, Protected base class inheritance, Inheriting multiple base classes

PART – B

UNIT 5: Inheritance – II:- **6+2=8 Hours**

Constructors, Destructors and Inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes.

UNIT 6: Virtual functions, Polymorphism:- **6+2=8 Hours**

Virtual function, Calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, Pure virtual functions, Abstract classes, Using virtual functions, Early and late binding.

UNIT 7: I/O System Basics, File I/0:- **6+2=8 Hours**

C++ stream classes, Formatted I/O, I/O manipulators, fstream and the File classes, File operations.

UNIT 8: Exception Handling, STL:- **6+2=8 Hours**

Exception handling fundamentals, Exception handling options STL: An overview, containers, vectors, lists, maps.

Text Books:

1. Herbert Schildt: The Complete Reference C++, 4 Edition, Tata McGraw Hill, 2003.

Reference Books:

1. Balagurusamy, Object Oriented Programming with C++, 6th Edition McGraw 2013 by
2. K R Venugopal, Rajkumar Buyya, T Ravi Shankar: Mastering C++, Tata McGraw Hill, 1999.

2.4 MCA 4th Semester

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
MCA-401B	Computer Graphics	3-1-0	4	25	75
MCA-402B	Object Oriented Analysis and Design	3-1-0	4	25	75
MCA-403B	Software Engineering	3-1-0	4	25	75
MCA-404B	Elective II	3-1-0	4	25	75
MCA-405B (CBCS Paper)	Elective III (To opt from other Departments/Institutes)	3-1-0	4	25	75
MCA-406B	Programming Lab IV(A:401, B:304)B	0-1-6	4	25	75
Semester Total				**600**	

MCA IV Semester Elective – II

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	**External**
MCA-404B(E2.1)	Optimization Techniques	3-1-0	4	25	75
MCA-404B(E2.2)	Natural Language Processing	3-1-0	4	25	75
MCA-404B(E2.3)	Machine Learning	3-1-0	4	25	75
MCA-404B(E2.4)	Mobile Application Development	3-1-0	4	25	75
MCA-404B(E2.5)	Neural Networks	3-1-0	4	25	75
MCA-404B(E2.6)	Numerical Techniques	3-1-0	4	25	75

CBCS papers that to be offered to the students of other Departments in IV Sem.

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	**External**
CS-O4.1	Web Technology	3-1-0	4	25	75
CS-O4.2	Symbolic Logic & Boolean Algebra	3-1-0	4	25	75

Subject : Computer Graphics
Subject Code :MCA-401B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
2. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
3. Use of geometric transformations on graphics objects and their application in composite form.
4. Extract scene with different clipping methods and its transformation to graphics display device.
5. Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.
6. Render projected objects to naturalize the scene in 2D view and use of illumination models for this.

Unit **L+T Hour**

PART - A

UNIT – 1 :Introduction:- **6 +2=8 Hours**

Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable Pipelines; Performance CharacteristicsGraphics Programming: The Sierpinski gasket; Programming Two Dimensional Applications.

UNIT – 2 :The OpenGL:- **6 +2=8 Hours**

The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three- dimensional gasket; Plotting Implicit Functions.

UNIT – 3: Input and Interaction:- **6 +2=8 Hours**

Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking; A simple CAD program; Building Interactive Models; Animating Interactive Programs; Design of Interactive Programs; Logic Operations

UNIT – 4 :Geometric Objects and Transformations-I:- **6 +2=8 Hours**

Scalars, Points, and Vectors; Three-dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling;

PART - B

UNIT – 5 :Geometric Objects and Transformations-II:- 6 +2=8 Hours

Geometric Objects and Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to three-dimensional applications; Quaternion's.

UNIT – 6: Viewing:- 6 +2=8 Hours

Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden- surface removal; Interactive Mesh Displays; Parallel-projection matrices; Perspective-projection matrices; Projections and Shadows.

UNIT – 7 :Lighting and Shading:- 6 +2=8 Hours

Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.

UNIT – 8 :Implementation:- 6 +2=8 Hours

Basic Implementation Strategies; Four major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon Rasterization; Hidden-surface removal; Antialiasing; Display considerations.

Text Books:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education, 2008. (Chapters 1 to 7)

Reference Books:

1. Donald Hearn and Pauline Baker: Computer Graphics OpenGL Version 3th Edition, Pearson Education, 2004.

2. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3th Edition, PHI, 2909.

3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.

Subject : Object Oriented Analysis and Design
Subject Code :MCA-402B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the use of unified modeling language for object oriented analysis and design
2. Know the syntax of different UML diagrams.
3. Develop different models for a software system.
4. Apply object oriented analysis and design to build a software system
5. Apply forward and reverse engineering for a software system.

Unit **L+T Hour**

PART – A

UNIT – 1 :Introduction, Modeling Concepts, class Modeling:- 6+2=8 Hours

What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling historyModeling as Design Technique: Modeling; abstraction; The three models. Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

UNIT – 2: Advanced Class Modeling, State Modeling:- 6+2=8 Hours

Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips.State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.

UNIT – 3 :Advanced State Modeling, Interaction Modeling:- 6+2=8 Hours

Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips.Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

UNIT – 4 :Process Overview, System Conception, Domain Analysis:- 6+2=8 Hours

Process Overview: Development stages; Development life cycle.System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement.Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

PART – B

UNIT – 5 :Application Analysis, System Design:- 6+2=8 Hours

Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

UNIT – 6 : Class Design, Implementation Modeling, Legacy Systems:- 6+2=8 Hours

Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example. Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing.Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

UNIT – 7 :Design Patterns – 1:- 6+2=8 Hours

What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.

UNIT – 8 : Design Patterns – 2, Idioms:- 6+2=8 Hours

Management Patterns: Command processor; View handler.Idioms: Introduction; what can idioms provide? Idioms and style; Where to find idioms; Counted Pointer example

Text Books:

Michael Blaha, James Rumbaugh: Object-Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005. (Chapters 1 to 17, 23)

Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007. (Chapters 1, 3.5, 3.6, 4)

Reference Books:

1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2. Brahma Dathan, Sarnath Ramnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009.
3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, Wiley-Dreamtech India, 2004.
4. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2 Edition, Tata McGraw-Hill, 2002.

Subject : Software Engineering
Subject Code :MCA-403B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Plan a software engineering process life cycle, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements.
2. Able to elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project
3. Analyze and translate a specification into a design, and then realize that design practically, using an appropriate software engineering methodology.
4. Know how to develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.
5. Able to use modern engineering tools necessary for software project management, time management and software reuse.

Unit **L+T Hour**

PART – A

UNIT – 1 :Overview:- **6+2=8 Hours**

Introduction: FAQ's about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties; Systems engineering;

Organizations, people and computer systems; Legacy systems.

UNIT – 2 :Critical Systems, Software Processes:- **6+2=8 Hours**

Critical Systems: A simple safety- critical system; System dependability; Availability and reliability. Software Processes: Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering.

UNIT – 3 : Requirements:- **6+2=8 Hours**

Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document.

Requirements Engineering Processes: Feasibility studies; Requirements

UNIT – 4 : System models, Project Management::- **6+2=8 Hours**

System Models**,** Context models; Behavioral models; Data models; Object models; Structured

methods.Project Management: Management activities; Project planning; Project scheduling; Risk management

PART - B

UNIT – 5 : Software Design:- 6+2=8 Hours

Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles.

Object-Oriented design: Objects and Object Classes; An Object-Oriented design process; Design evolution.

UNIT – 6 : Development:- 6+2=8 Hours

Rapid Software Development: Agile methods; Extreme programming; Rapid application development.Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution.

UNIT – 7 :Verification and Validation:- 6+2=8 Hours

Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods.

Software testing: System testing; Component testing; Test case design; Test automation.

UNIT – 8 : Management: 6+2=8 Hours -

Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model.Software Cost Estimation: Productivity; Estimation techniques; Algorithmic cost modeling, Project duration and staffing.

Text Books:

1. Ian Sommerville: Software Engineering, 8th Edition, Pearson Education, 2007.(Chapters-: 1, 2, 3, 4, 5, 6, 7, 8, 11, 14, 17, 21, 22, 23, 25, 26)

Reference Books:

1. Roger.S.Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill, 2007. 2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009.

Subject : Optimization Techniques
Subject Code :MCA-404B(E2.1)

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Cast engineering minima/maxima problems into optimization framework
2. Learn efficient computational procedures to solve optimization problems.
3. Use Matlab to implement important optimization methods.

Unit **L+T Hour**

PART - A

UNIT – 1 : Introduction, Linear Programming – 1:- **6+2=8 Hours**

Introduction: The origin, nature and impact of OR; Defining the problem and gathering data;

Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation.Introduction to Linear Programming: Prototype example; The linear programming (LP) model.

UNIT – 2: LP – 2, Simplex Method – 1: **6+2=8 Hours**

Assumptions of LP; Additional examples. The essence of the simplex method; Setting up the simplex method;

Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method

UNIT – 3: Simplex Method – 2:- **6+2=8 Hours**

Adapting to other model forms; Post optimality analysis; Computer implementationFoundation of the simplex method.

UNIT – 4: Simplex Method – 2, Duality Theory:- **6+2=8 Hours**

The revised simplex method, a fundamental insight.The essence of duality theory; Economic interpretation of duality, Primal dual relationship; Adapting to other primal forms

PART - B

UNIT – 5 : Duality Theory and Sensitivity Analysis, Other Algorithms for LP :-

6 +2=8 Hours

The role of duality in sensitive analysis; The essence of sensitivity analysis; Applying sensitivity analysis. The dual simplex method; Parametric linear programming; The upper bound technique.

UNIT – 6 :Transportation and Assignment Problems:- 6+2=8 Hours

The transportation problem; A streamlined simplex method for the transportation problem;

The assignment problem; A special algorithm for the assignment problem.

UNIT – 7: Game Theory, Decision Analysis:- 6+2=8 Hours

Game Theory:The formulation of two persons, zero sum games; Solving simple games- a prototype example;

Games with mixed strategies; Graphical solution procedure; Solving by linear programming, Extensions.

Decision Analysis: A prototype example; Decision making without experimentation; Decision making with experimentation; Decision trees.

UNIT – 8 :Metaheuristics:- 6+2=8 Hours

The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.

Text Books:

1. Frederick S. Hillier and Gerald J. Lieberman: Introduction to Operations Research: Concepts and Cases, 8th Edition, Tata McGraw Hill, 2005.(Chapters: 1, 2, 3.1 to 3.4, 4.1 to 4.8, 5, 6.1 to 6.7, 7.1 to 7.3, 8, 13, 14, 15.1 to 15.4)

Reference Books:

1. Wayne L. Winston: Operations Research Applications and Algorithms, 4th Cengage Learning, 2003.

2. Hamdy A Taha: Operations Research: An Introduction, 8th Edition, Pearson Education, 2007.

Subject : Natural Language Processing
Subject Code :MCA-404B(E2.2)

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand approaches to syntax and semantics in NLP.
2. Understand approaches to discourse, generation, dialogue and summarization within NLP.
3. Understand current methods for statistical approaches to machine translation.
4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP

Unit **L+T Hour**

Unit 1: Introduction- **6+2=8 Hours**
Human languages, models, ambiguity, processing paradigms; Phases in natural language processing, applications. Text representation in computers, encoding schemes. Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank,WordNet. Resource management with XML, Management of linguistic data with NLTK.

Unit 2:- Regular expressions:- **6+2=8 Hours**
, Finite State Automata, word recognition, lexicon. Morphology, acquisition models, Finite State Transducer.

Unit 3:- N-grams:- **6+2=8 Hours**
smoothing, entropy, Noisy channel model, Text classification- Naive Bayes, K nearest Neighbour, decision tree, Support Vector Machine(SVM).

Unit 4:-Part of Speech tagging:- **6+2=8 Hours**
Stochastic POS tagging, HMM, Transformation based tagging (TBL), Handling of unknown words, named entities, multi word expressions.

Unit 5:- Semantics and analysis:- **6+2=8 Hours**
Meaning representation, semantic analysis, lexical semantics, WordNet, Word Sense Disambiguation- Selection restriction, machine learning approaches, dictionary based approaches.
Introduction, Context Free Grammar, Constituency, Unification, probabilistic parsing, TreeBank.

Unit 6: Discourse:- **6+2=8 Hours**
Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure.

Unit 7: Information Retrieval:- **6+2=8 Hours**
Classical information retrieval models, term weighting- Boolean value, Term frequency(TF), Inverse Document Frequency(IDF), Term Frequency and Inverse Document Frequency(TF-IDF),

Dimensionality reduction improving user queries.

Unit 8: Machine Translation:– **6+2=8 Hours**

Introduction, Problems in Machine Translation, Machine Translation approaches.

***Textbook*:**

1. Daniel Jurafsky and James H Martin. *Speech and Language Processing, 2e*, Pearson Education, 2009

***Reference Books*:**

1. James A.. *Natural language Understanding 2e*, Pearson Education, 1994
2. Manning, C.D. and H. SchAtze: *Foundation of Statistical Natural Language Processing*. The MIT Press. 1999. ISBN 0-262-13360-1.
3. Bharati A., Sangal R., Chaitanya V.. *Natural language processing: a Paninian perspective*,PHI, 2000
4. Siddiqui T., Tiwary U. S.. *Natural language processing and Information retrieval*, OUP, 2008

Subject : Machine Learning
Subject Code :MCA-404B(E2.3)

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Gain knowledge about basic concepts of Machine Learning
2. Identify machine learning techniques suitable for a given problem
3. Solve the problems using various machine learning techniques
4. Apply Dimensionality reduction techniques
5. Design application using machine learning techniques.

Unit **L+T Hour**

PART-A

UNIT 1: Overview and Introduction to Bayes Decision Theory:- 6 +3=9 Hours

Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches.

UNIT 2: Linear machines:- 7+2=9 Hours

General and linear discriminants, decision regions, single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and widrow-Hoff learning algorithm; multi-Layer perceptrons: two-layers universal approximators, backpropagation learning, on-line, off-line error surface, important parameters.

UNIT 3:Learning decision trees:- 7+2=9 Hours

Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence, pruning, learning with incomplete data.

UNIT 4 :Instance-based Learning:- 7+2=9 Hours

Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability.

UNIT 5 : Machine learning concepts and limitations:- 7+3=10 Hours

Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff.

UNIT 6 :Machine learning assessment and Improvement:- 7+2=9 Hours

Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting.

UNIT 7: Support Vector Machines:- 7+2=9 Hours

Margin of a classifier, dual perceptron algorithm, learning non- linear hypotheses with perceptron kernel functions, implicit non-linear feature space, theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk,

maximal margin classifier.

Text Book

E. Alpaydin**, Introduction to Machine Learning**, Prentice Hall of India, 2006.

T. M. Mitchell, **Machine Learning**, McGraw-Hill, 1997.

Readings

1. C. M. Bishop, **Pattern Recognition and Machine Learning**, Springer, 2006.
2. R. O. Duda, P. E. Hart, and D.G. Stork, **Pattern Classification**, John Wiley and Sons, 2001.
3. Vladimir N. Vapnik, **Statistical Learning Theory**, John Wiley and Sons, 1998.
4. Shawe-Taylor J. and Cristianini N., Cambridge, **Introduction to Support Vector**
5. **Machines**, University Press, 2000.

Subject : Mobile Application Development
Subject Code :MCA-404B(E2.4)

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Install and configure Android application development tools.
2. Design and develop user Interfaces for the Android platform.
3. Save state information across important operating system events.
4. Apply Java programming concepts to Android application development.

Unit **L+T Hour**

UNIT 1 : Introduction **8+3=11 Hours**

Mobile devices vs desktop devices; ARM and intel architectures, Power Management, Screen resolution,

Touch interfaces, Application deployment (App Store, Google Play, Windows Store);

Native vs. web applications.

UNIT 2: Frameworks and Tools **8+3=11 Hours**

Development Environments (XCode, Eclipse, VS2012, Android Studio, PhoneGAP, etc.); Development Tools

(HTML5, CSS, JavaScript, JQuery); Mobile-specific enhancements (Browser-detection, Touch Mobile OS

Architectures (Android, iOS, Windows); Mobile OS (Darwin, Linux, Windows);

Runtime Environments (Objective-C, Dalvik, winRT), Mobile Agents and Peer-to-Peer Architecture.

UNIT 3 : Performance Management **8+3=11 Hours**

Memory Management, Power Management, Security, Synchronization and Replication of Mobile Data,

Getting the Model right, Storing and Retrieving Data

UNIT 4 : Developing an Application 8 Hours **8 +3=11Hours**

Building a simple “Hello World” App (Android, iOS, Windows); App-structure, built-in Controls,

file access, basic graphics; Building useful apps; Database, Network, File access; Packaging and Deployment

UNIT 5: System-level Apps **8+2=10 Hours**

Native programming (Android), Low-level programming (iOS), Low-level APIs (Windows).

UNIT 6: Advanced Topics: **8+2=10 Hours**

Power Management, Augmented Reality, Mobile Device Security ;

Wake locks and assertions, Low-level OS support, Writing power-smart applications, GPS,

Accelerometer, Camera, Mobile malware, Device protections, Rooting (Android), Jailbreaking (iOS),

Defenestration (Windows)

Text Books:

1 Jeff McWherter, Scott Gowell: Professional Mobile Application Development, John Wiley & Sons, Aug 2012

2 Reto Meier: Professional Android 4 Application Development, Wrox Publications, 2012

3 HTML5, CSS3 and Jquery with Adobe Dreamweaver CS 5.5 Learn by Video, David Powers, Richard,

Trade paperback, Peachpit Press, 2011

References:

1. Valentino Lee, Heather Schnerider, Robbie Schell: Mobile Applications: Architecture, Design and Development, Prentice Hall, 2004

2. Rajkamal: Mobile Computing, Oxford University Press, 2007.

3. Wallace B McClure, Nathan Blevins, John J. Croft IV, Jonathan Dick, Chris Hardy : Professional Android Programming with Mono for Android and .NET/C#, Wiley-India.

4. Reto Meier : Professional Android 4 Application Development, Wiley-India

Subject : Neural Networks
Subject Code :MCA-404B(E2.5)

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Know the main provisions neuro mathematics;
2. Know the main types of neural networks;
3. Know and apply the methods of training neural networks;
4. Know the application of artificial neural networks;
5. To be able to formalize the problem, to solve it by using a neural network.

Unit **L+T Hour**

PART – A

UNIT – 1: Introduction:- **6+2=8 Hours**

What is a Neural Network?, Human Brain, Models of Neuron, Neural Networks viewed as directed graphs, Feedback, Network Architectures, Knowledge representation, Artificial Intelligence and Neural Networks.

UNIT – 2 :Learning Processes – 1:- **6+2=8 Hours**

Introduction, Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzamann learning, Credit Assignment problem, Learning with a Teacher, Learning without a Teacher, Learning tasks, Memory, Adaptation.

UNIT – 3 :Learning Processes – 2, **Single Layer Perceptrons:-** **6+2=8 Hours**

Statistical nature of the learning process, Statistical learning theory, Approximately correct model of learning. Single Layer Perceptrons: Introduction, Adaptive filtering problem, Unconstrained optimization techniques, Linear least-squares filters**,** Least- mean square algorithm, Learning curves, Learning rate annealing techniques, Perceptron, Perceptron convergence theorem,

Relation between the Perceptron and Bayes classifier for a Gaussian environment.

UNIT – 4 :Multilayer Perceptrons – 1:- **6+2=8 Hours**

Introduction, Some preliminaries, Back- propagation Algorithm, Summary of back-propagation algorithm, XOR problem, Heuristics for making the back-propagation algorithm perform better, Output representation and decision rule, Computer experiment,

Feature detection, Back-propagation and differentiation.

PART - B

UNIT – 5 :Multilayer Perceptrons – 2:- 6+2=8 Hours

Hessian matrix, Generalization, approximation of functions, Cross validation, Network pruning techniques, virtues and limitations of back- propagation learning, Accelerated convergence of back propagation learning,

Supervised learning viewed as an optimization problem, Convolution networks.

UNIT – 6 :Radial-Basic Function Networks – 1:- 6+2=8 Hours

Introduction, Cover's theorem on the separability of patterns, Interpolation problem,

Supervised learning as an ill- posed Hypersurface reconstruction problem, Regularization theory, Regularization networks, Generalized radial-basis function networks, XOR problem, Estimation of the regularization parameter.

UNIT – 7 :Radial-Basic Function Networks – 2, Optimization – 1:- 6+2=8 Hours

Approximation properties of RBF networks, Comparison of RBF networks and multilayer Perceptrons, Kernel regression and it's relation to RBF networks, Learning strategies, Computer experiment.

Optimization using Hopfield networks: Traveling salesperson problem, Solving simultaneous linear equations, Allocating documents to multiprocessors.

UNIT – 8: Optimization Methods – 2:- 6+2=8 Hours

Iterated gradient descent, Simulated Annealing, Random Search, Evolutionary computation- Evolutionary algorithms, Initialization, Termination criterion, Reproduction, Operators, Replacement, Schema theorem.

Text Books:

Simon Haykin: Neural Networks - A Comprehensive Foundation, 2nd Edition, Pearson Education, 1999.(Chapters 1.1-1.8, 2.1-2.15, 3.1-3.10, 4.1-4.19, 5.1-5.14)

Kishan Mehrotra, Chilkuri K. Mohan, Sanjay Ranka: Artificial Neural Networks, Penram International Publishing, 1997.(Chapters 7.1-7.5)

Reference Books:

1. B.Y egnanarayana: Artificial Neural Networks, PHI, 2001.

Subject : Numerical Techniques
Subject Code :MCA-404B(E2.6)

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.
2. Apply various interpolation methods and finite difference concepts
3. Work out numerical differentiation and integration whenever and wherever routine methods are not applicable
4. Work numerically on the ordinary differential equations using different methods through the theory of finite differences.
5. Work numerically on the partial differential equations using different methods through the theory of finite differences

Unit **L+T Hour**

PART A

UNIT I :Computer arithmetic:- **6+2=8 Hours**

Floating point numbers -Operations, Normalizations and their consequences. Iterative Methods: Zeros of a single transcendental equations and zeros of polynomials using bisections, false position, Newton-Raphson; convergence of solution.

UNIT II :Simultaneous Linear Equations:- **6+2=8 Hours**

Solutions of simultaneous linear equations, Gauss elimination method and pivoting; III-conditioned equations and refinement of solutions; Gauss-Seidal iterative method.

UNIT III **6+2=8 Hours**

Numerical Differentiation and Integration.

UNIT IV : Solution of Differential Equation:- **6+2=8 Hours**

Runge-Kutta method; predictor-corrector method; Automatic error monitoring; Stability of solutions.

PART B

UNIT V :Interpolation and Approximation:- **6+2=8 Hours**

Polynomial interpolation-Newton, Lagrange's etc.; Difference tables; Approximation of functions by Taylor series and Chebyshev's polynomials.

UNIT VI : Frequency Charts:- **6+2=8 Hours**

different frequency charts. Regression Analysis: Least square fit; polynomial and curve fittings; Linear regression and Nonlinear regression algorithms; Multiple regression algorithms.

UNIT VII :Time Series and Forecasting:- **6+2=8 Hours**

Moving averages; Smoothening of curves; Forecasting models and methods. Statistical Quality Control Methods.

UNIT VIII **6+2=8 Hours**

Factor analysis, ANOVA, Tests of significance; X^2-test and F-test, applications to medicine, psychology, agriculture.

References:

2. Numerical Methods, E. Balagurusamy, Tata McGraw Hill.
3. Computer Oriented Numerical Methods, V. Rajaraman, PHI
4. Numerical analysis, Conte and Deboor, Tata McGraw Hill

Subject : FUNDAMENTALS OF WEB TECHNOLOGIES
Subject Code : CS-O4.1

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes
1. Explain the history of the internet and related internet concepts that are vital in understanding web development.
2. Discuss the insights of internet programming and implement complete application over the web.
3. Demonstrate the important HTML tags for designing static pages and separate design from content using Cascading Style sheet.
4. Utilize the concepts of JavaScript and Java
5. Use web application development software tools i.e., Ajax, PHP and XML etc. and identify the environments currently available on the market to design web sites.

Unit **L+T Hour**

Unit - I :Fundamentals:- **7+2=9 hours**

Internet, WWW, Web browsers and Web servers, URLs, MIME, HTTP, Security, Cyber laws.
Web Foundations**:**Evolution of the Web, Peek into the History of the Web, Internet Applications, Networks, TCP/IP, Higher Level Protocols, Important Components of the Web, Web search Engines, Application Servers.

Unit -II :Introduction to XHTM:- **7+2=9 hours**

Basic Syntax, Standard structure, Elements, Attributes, Images, Hypertext Links, Lists, Tables, Forms, Frames, Iframes, Symbols

Unit - III :Cascading Style sheets:- **7+2=9 hours**

Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.

Unit -IV :The Basics of JavaScript:- **7+2=9 hours**

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

Unit -V :JavaScript and HTML Documents:- **7+3=10 hours**

The JavaScript execution environment, The Document Object Model (DOM), Elements access in JavaScript, Events and Event handling, Handling events from body elements, handling Event from Text Box and password elements, the DOM2 event model, the navigator object, DOM tree traversal and modification.

Unit -VI :Dynamic Documents with JavaScript:- **7+2=9 hours**

Introduction, Positioning Elements, Moving Elements, Elements visibility, changing colors and fonts, dynamic content, stacking Elements, locating the mouse cursor, reacting to a mouse click, slow movement of elements, dragging and dropping Elements.

Unit -VII: Introduction to XM:- 6+3=9 hours

Introduction, Syntax, Document structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, displaying XML documents with CSS, XSLT style sheets, XML processors, Web services.,

TEXT BOOK

1. Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education (VTU 4th Edn.).
2. M. Srinivasan: Web Technology Theory and Practice, Pearson Education,

REFERENCES

5. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education.
6. Chris Bates: Web Programming Building Internet Applications, Wiley India.Internet Technology and Web Design, Instructional Software Research and Development (ISRD) Group, Tata McGraw Hill.

Subject : Symbolic Logic & Boolean Algebra
Subject Code : CS-O4.2

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:
1. Understand the concept of Symbolic logic.
2. Application of symbolic logic in AI
3. Understand the Application of Boolean algebra along with symbolic logic in AI

Unit **L+T Hour**

PART A : Symbolic Logic

Unit I : Propositional logic:- **7+3=10 hours**

Atomic formulas or atoms, compound propositions using logical connectivity, well formed formulas, truth tables,

Unit II: Interpretations :- **7+2=9 hours**

Interpretations validity & inconsistency, conjunctive normal forms and disjunctive normal forms, logical consequences, Applications of propositional logic.

Unit III: First-Order Logic:- **7+3=10 hours**

Quantifiers, terms, atoms, bounded and free variables, well formed formulas, interpretations, satisfiability, unsatisfiability, validity, logical consequence in first-order logic. Prenex normal form,

Unit IV : Applications :- **7+2=9 hours**

Applications of First -order –logic, Direct proof and indirect proof.
Resolution principle and its applications.

Part B: Boolean Algebra

Unit V: Overview:- **7+2=9 hours**

Algebraic structures, lattices and its properties, axiomatic definition of Boolean Algebra as algebraic structure;

Unit VI : Duality:- **7+2=9 hours**

Basic laws, Boolean Algebra of truth values, minterm, maxterm,

Unit VII : Applications:- **6+2=8 hours**

Applications of Boolean Algebra in switching circuits and decision tables.

Text Books:

1. Chin-lian Chang & Richart Char-Tung Lee, "Symbolic logic & Mechanical theorem proving", Academic Press

2. Alan Doerr, Kernneth Levasseur," Applied Discrete structure for computer Science", Galgotia Publications Pvt. Ltd.

Reference:

1. D. Patterson, "Artificial Intelligence and Expert Systems", Pearson.
2. Kenneth H. Rosen, "Discrete Mathematics & Its Applications", Tata McGraw-Hill.

2.5 MCA 5th Semester

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
MCA-501B	Combinatorics and Graph Theory	3-1-0	4	25	75
MCA-502B	Advanced Java Programming	3-1-0	4	25	75
MCA-503B	Artificial Intelligence	3-1-0	4	25	75
MCA-504B	Elective IV	3-1-0	4	25	75
MCA-505B	Elective V	3-1-0	4	25	75
MCA-506B	System Project I	0-1-6	4	25	75
Semester Total				**600**	

MCA V Semester Elective - IV

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
MCA-504B(E4.1)	Deep Learning	3-1-0	4	25	75
MCA-504B(E4.2)	Digital Image Processing	3-1-0	4	25	75
MCA-504B(E4.3)	Mobile Ad-hoc Networks	3-1-0	4	25	75
MCA-504B(E4.4)	Cloud Computing	3-1-0	4	25	75
MCA-504B(E4.5)	Computer and Network Security	3-1-0	4	25	75

MCA V Semester Elective - V

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
MCA-505B(E5.1)	Multimedia Computing	3-1-0	4	25	75
MCA-505B(E5.2)	Advanced Web Technology	3-1-0	4	25	75
MCA-505B(E5.3)	Big Data	3-1-0	4	25	75
MCA-505B(E5.4)	Software Testing and Quality Assurance	3-1-0	4	25	75
MCA-505B(E5.5)	Text Mining and Analytics	3-1-0	4	25	75

Subject : Combinatorics and Graph Theory

Subject Code :MCA-501B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe important types of combinatorial optimization problems
2. Formulate combinatorial optimization problems as mathematical models and determine the difficulty of the problems with the help of complexity theory
3. Explain the design of and the principles behind efficient solution methods and use the methods for solving combinatorial optimization problems
4. Use available software for solving optimization problems take part of development of software for optimization problems

Unit **L+T Hour**

PART – A

UNIT - 1 :Introduction to Graph Theory:- **6+2=8 Hours**

Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits.

UNIT – 2 :Introduction to Graph Theory *contd*.:- **6+2=8 Hours**

Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials.

UNIT - 3 :Trees:- **6+2=8 Hours**

Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes.

UNIT - 4 :Optimization and Matching:- **6+2=8 Hours**

Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem, Matching Theory.

PART – B

UNIT – 5:Fundamental Principles of Counting:- **6+2=8 Hours**

The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalan Numbers.

UNIT - 6 :The Principle of Inclusion and Exclusion:- **6+2=8 Hours**

The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.

UNIT - 7 :Generating Functions:- 6+2=8 Hours

Introductory Examples, Definition and Examples – Calculation Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator.

UNIT - 8 :Recurrence Relations:- 6+2=8 Hours

First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, The Method of Generating Functions.

Text Book:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.
   (Chapter 11, Chapter 12.1 to 12.4, Chapter 13, Chapter 1, Chapter 8.1 to 8.4, Chapter 9 Chapter 10.1 to 10.4).

Reference Books:

7. D.S. Chandrasekharaiah: Graph Theory and Combinatorics, Prism, 2005.

8. Chartrand Zhang: Introduction to Graph Theory, TMH, 2006.

9. Richard A. Brualdi: Introductory Combinatorics, 4th Edition, Pearson Education, 2004.

10. Geir Agnarsson & Raymond Geenlaw: Graph Theory, Pearson Education, 2007.

Subject : Advanced JAVA Programming

Subject Code :MCA-502B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Students will design and implement programs in the Java programming language that make strong use of classes and objects.
2. Students will learn to print formatted text to the console output and read/parse console input text using a Scanner object.
3. Students will apply logical constructs for branching and loops as well as use iterator objects when appropriate.
4. Students will learn to define classes and methods.

Unit **L+T Hour**

PART - A

UNIT – 1 :Introduction to Java:- **6+2=8 Hours**

Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs.Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers.Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, The ? Operator;

Operator Precedence; Logical expression; Type casting; Strings Control Statements: Selection statements, iteration statements, Jump Statements.

UNIT – 2: Classes, Inheritance, Exceptions, Applets : - **6+2=8 Hours**

Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes. Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading.Exception handling**:** Exception handling in Java.

UNIT – 3: Multi Threaded Programming, Event Handling: - **6+2=8 Hours**

Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable;

Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer- consumer problems.

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

UNIT – 4 :Swings:- **6+2=8 Hours**

Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon;

JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.

PART – B

UNIT – 5 :Java 2 Enterprise Edition Overview, Database Access:- 6+2=8 Hours

Overview of J2EE and J2SE, The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process;

Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.

UNIT – 6 :Servlets:- 6+2=8 Hours

Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter;

The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking.

UNIT – 7 :JSP, RMI:- 6+2=8 Hours

Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects.Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side.

UNIT – 8 :Enterprise Java Beans: - 6+2=8 Hours

Enterprise java Beans; Deployment Descriptors; Session Java Bean, Entity Java Bean; Message-Driven Bean; The JAR File.

Text Books:

Herbert Schildt: Java The Complete Reference, 7 Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 10, 11, 21, 22, 29, 30, 31)

Jim Keogh: J2EE - The Complete Reference, Tata McGraw Hill, 2007.(Chapters 5, 6, 11, 12, 15)

Reference Books:

1. Y . Daniel Liang: Introduction to JA V A Programming, 7th Edition, Pearson Education, 2007.

2. Stephanie Bodoff et al: The J2EE Tutorial, 2th Edition, Pearson Education, 2004.

Subject : Artificial Intelligence

Subject Code :MCA-503B

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
5. Demonstrate proficiency in applying scientific method to models of machine learning.
6. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Unit **L+T Hour**

PART – A

Unit-I: Introduction:- **6+2=8 Hours**

Introduction to Artificial Intelligence, various definitions of AI, AI Applications and Techniques, Turing Test and Reasoning - forward & backward chaining.

Unit-II: Intelligent Agents:- **6+2=8 Hours**

Introduction to Intelligent Agents, Rational Agent, their structure, reflex, model-based, goal-based, and utility-based agents, behavior and environment in which a particular agent operates.

Unit-III: Problem Solving by Search:- **6+2=8 Hours**

Defining the problem as a State Space Search Strategies: Breadth – first Search, Depth- first search, Depth limited search, Iterative Depending depth first search.

Heuristic Search Techniques**:** Hill Climbing, Simulated Annealing, Best First Search: OR Graphs, Heuristic Functions, A* Algorithm, AND –OR graphs, AO* Algorithm.

Unit-IV: Knowledge Acquisition and Representation:- **6+2=8 Hours**

Introduction to Knowledge Acquisition and Representation, Hypothesis, Knowledge Levels, Knowledge Classification, Knowledge Representation Schemas; Logic based, Procedural, Network and Structural Representations, Unification, Semantic Nets, Conceptual Dependencies, Semantic Networks, Frames System, Production Rules, Conceptual Graphs, Ontologies.

PART – B

Unit-V: Planning:- **6+2=8 Hours**

Basic representation for planning, Planning and Acting in the Real world, Uncertain Knowledge and Reasoning: Uncertainty- Probabilistic Reasoning- Making Simple Decisions.

Unit-VI: Reasoning with Uncertain Knowledge:- **6+2=8 Hours**

Different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modeling uncertainty such as Dempster-Shafer theory and fuzzy sets/logic.

Unit - VII: Learning:- **6+2=8 Hours**

Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory. Learning from Observations-Knowledge in Learning-Statistical Learning Methods-Reinforcement Learning.

Unit - VIII: AI Present and Future:- **6+2=8 Hours**

Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed?

Text Books:

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015.
2. Elaine Rich and Kelvin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2017.
3. DAN.W. Patterson, Introduction to A.I. and Expert Systems – PHI, 2007.
4. Michael Wooldridge, An Introduction to MultiAgent Systems, 2nd edition, John Wiley & Sons, 2009.
5. Fabio Luigi Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multi-Agent Systems with JADE, Wiley Series in Agent Technology, John Wiley & Sons, 2007.
6. W.F. Clocksin and C.S. Mellish, Programming in PROLOG, 5th edition, Springer, 2003.
7. Saroj Kaushik, Logic and Prolog Programming, New Age International Publisher, 2012.
8. Ivan Bratko, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 4th edition, 2011.

Subject : Digital Image Processing

Subject Code :MCA-504BE4.2

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques.

Unit **L+T Hour**

PART – A

UNIT – 1 :Digitized Image and its properties:- **6+2=8 Hours**

Basic concepts, Image digitization, Digital image properties

UNIT – 2 :Image Preprocessing:- **6+2=8 Hours**

Image pre-processing: Brightness and geometric transformations, local preprocessing.

UNIT – 3: Segmentation – 1:- **6+2=8 Hours**

Thresholding, Edge-based segmentation.

UNIT – 4 : Segmentation – 2:- **6+2=8 Hours**

Region based segmentation, Matching.

PART – B

UNIT – 5: Image Enhancement:- **6+2=8 Hours**

Image enhancement in the spatial domain: Background, Some basic gray level transformations, Histogram processing, Enhancement using arithmetic/ logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Image enhancement in the frequency domain: Background, Introduction to the Fourier transform and the frequency domain, Smoothing Frequency-Domain filters, Sharpening Frequency Domain filters, Homomorphic filtering.

UNIT – 6 : Image Compression:- **6+2=8 Hours**

Image compression: Fundamentals, Image compression models, Elements of information theory, Error-Free Compression, Lossy compression.

UNIT – 7: Shape representation:- 6+2=8 Hours

Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes.

UNIT – 8 :Morphology:- 6+2=8 Hours

Basic morphological concepts, Morphology principles, Binary dilation and erosion, Gray-scale dilation and erosion, Morphological segmentation and watersheds

Text Books:

Milan Sonka, Vaclav Hlavac and Roger Boyle: Image Processing, Analysis and Machine Vision, 2nd Edition, Thomoson Learning, 2001.(Chapters 2, 4.1 to 4.3, 5.1 to 5.4, 6, 11.1 to 11.4, 11.7)

Rafel C Gonzalez and Richard E Woods: Digital Image Processing, 3rd Edition, Pearson Education, 2003.(Chapters 3.1 to 3.7, 4.1 to 4.5, 8.1 to 8.5)

Reference Books:

1. Anil K Jain, "Fundamentals of Digital Image Processing", PHI, 1997, Indian Reprint 2009.

2. B.Chanda, D Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2002.

Subject : MOBILE ADHOC NETWORKS Theory
Subject Code :MCA-504BE4.3

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Have gained an understanding of the current topics in MANETs and WSNs, both from an industry and research point of views.
2. Have an understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.
3. Understand how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

Unit **L+T Hour**

PART – A

UNIT 1: Introduction:- **6+2=8 Hours**

Ad hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT 2 :MAC – 1:- **6+2=8 Hours**

MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks,

Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols with reservation mechanisms.

UNIT 3: MAC – 2:- **6+2=8 Hours**

Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT 4 :Routing – 1: **6+2=8 Hours**

Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand

PART- B

UNIT 5 :Routing – 2: - **6+2=8 Hours**

Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols.

UNIT 6: Transport Layer:- **6+2=8 Hours**

Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.

UNIT 7: Security:- **6+2=8 Hours**

Security: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.

UNIT 8 :QoS:- **6+2=8 Hours**

Quality of service in Ad hoc wireless Networks: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks,

Classification of QoS solutions, MAC layer solutions, network layer solutions.

Text Books:

Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.

Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.

C.K. Toh: Adhoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002.

Subject : CLOUD COMPUTING
Subject Code :MCA-504BE4.4

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Explain the core issues of cloud computing such as security, privacy, and interoperability.
4. Choose the appropriate technologies, algorithms, and approaches for the related issues.
5. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.
6. Provide the appropriate cloud computing solutions and recommendations according to the applications used.

Unit **L+T Hour**

PART – A

UNIT-1 :Distributed System Models and Enabling Technologies:- 6+2=8 Hours

Scalable Computing Service over the Internet: The Age of Internet Computing, scalable computing Trends and New Paradigms,

Internet of Things and Cyber-Physical Systems. System Models for Distributed and Cloud Computing: Clusters of Cooperative Computers,

Grid Computing Infrastructures, Peer-to-Peer Network Families, Cloud Computing over the Internet. Software Environments for Distributed

Systems and Clouds: Service-Oriented Architecture (SOA), Trends towards Distributed Operating Systems, Parallel and

Distributed Programming Models. Performance, Security, and Energy-Efficiency: Performance Metrics and Scalability Analysis,

Fault-T olerance and System Availability, Network Threats and Data Integrity, Energy-Efficiency in Distributed Computing.

UNIT-2 :Computer Clusters for scalable parallel computing:- 6+2=8 Hours s

Clustering for massive parallelism: Cluster Development Trends, Design Objective of Computer Clusters, Fundamental Cluster Design issues.

Virtual machines and Virtualization of clusters and Data centers: Implementation levels of virtualization: levels of virtualization Implementation,

VMM Design requirements and providers, Virtualization support at the OS level, Middleware Support for Virtualization.

UNIT-3 :Cloud Platform Architecture over Virtualized Data Centers:- **6+2=8 Hours**

Cloud computing and Service Models: Public, Private, and Hybrid Clouds, Cloud Ecosystem and Enabling Technologies,

Infrastructure-as- a- Service (IaaS), Platform- and Software-as-a- Service (Paas, SaaS).

Architectural Design of Compute and Storage Clouds: A Generic Cloud architecture Design, Layered Cloud Architectural development, Virtualization Support and Disaster Recovery, Architectural Design Challenges.

UNIT-4 :Public Cloud Platforms:- **6+2=8 Hours**

GAE, AWS, and Azure: Smart Cloud, Public Clouds and Service Offerings, Google App Engine (GAE), Amazon Web Service (A WS),

Microsoft Windows Azure. Inter-cloud Resource Management: Extended Cloud Computing Services, Resource Provisioning and Platform Deployment,

Virtual Machine Creation and Management. Cloud Security and Trust management: Cloud Security Defense Strategies,

Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques.

PART – B

UNIT-5 :Cloud Programming and Software Environments:- **6+2=8 Hours**

Features of Cloud and Grid Platforms: Cloud Capabilities and Platform Features, Traditional Features Common to Grids and Clouds,

Data Features and Databases, Programming and Runtime Support. Parallel and Distributed Programming Paradigms:

Parallel Computing and Programming Paradigms, MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache.

UNIT-6 :Programming Support of App Engine:- **6+2=8 Hours**

Programming the Google App Engine, Google File System (GFS), Bigtable, Google's NOSQL system, Chubby, Google's Distributed Lock service.

Programming on Amazon AWS and Microsoft Azure: Programming on Amazon EC2, Amazon Simple Storage Service S3,

Amazon Elastic Block Store EBS and SimpleDB, Microsoft Azure programming support.

Emerging Cloud Software Environments: Open Source Eucalyptus and Nimbus, Open Nebula, Sector/Sphere, and OpenStack,

Manjrasoft Aneka Cloud and Appliances.

UNIT-7 :Ubiquitous Clouds and the Internet of Things:- **6+2=8 Hours**

Performance of Distributed Systems and the Cloud Data-intensive Scalable Computing (DISC), Quality of Service in Cloud computing,

Benchmarking MPI, Azure, EC2, MapReduce, and Hadoop. Online social and Professional Networking: Online Social Network Characteristics,

UNIT-8 : Graph-Theoretic Analysis : **6+2=8 Hours**

Graph-Theoretic Analysis of social networks, Communities and Applications of Social Networks, Facebook: The World's Largest Content-Sharing Network, Twitter for Micro blogging, News and Alert Services.

Text Book:

1. Kai Hwang, Jack Dungaree, and Geoffrey Fox: Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, MK Publishers, 2012.
   Chapters – 1,2,3,4,5,6,9

Reference Books:

1. Michael Miller, Cloud Computing: Web-Based Applications that change the Way you work and collaborate Online, Pearson Publication, 2012.

2. Anthony T. Volte, Toby J. Volte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Fill, 2010.

3. Cloud Computing for Dummies: J. Hurwitz, ISBN 978-0-470-484-8

4. Dr. Kumar Sourabh, Cloud Computing, 2nd Edition, Wiley India.

Subject : COMPUTER & NETWORK SECURITY
Subject Code :MCA-504BE4.5

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Identify the security issues in the network and resolve it.
2. Analyse the vulnerabilities in any computing system and hence be able to design a security solution.
3. Evaluate security mechanisms using rigorous approaches by key ciphers and Hash functions.
4. Demonstrate various network security applications, IPSec, Firewall, IDS, Web Security, Email Security and Malicious software etc.,

Unit **L+T Hour**

PART – A

UNIT 1 **6+2=8 Hours**

OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, Model for Network Security.

UNIT 2 :Classical Encryption Technique:- **6+2=8 Hours**

Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

UNIT 3 :Block Ciphers, Data Encryption Standard and Advanced Encryption Standard :-

6+2=8 Hours

Block Cipher Principles, The Data Encryption Standard, Block Cipher Design Principles and Modes of operation, Evaluation Criteria for AES, AES Cipher-Encryption and Decryption, Data Structure, Encryption Round.

UNIT 4 :Public Key Cryptography and Key Management :- **6+2=8 Hours**

Principles of Public Key Cryptosystem, RSA algorithm, Key management, Diffie Hellman Key exchange

PART – B

UNIT 5: Message Authentication and Hash Function :- **6+2=8 Hours**

Authentication Requirement, Authentication Functions, Message Authentication Code, Hash Functions, Digital Signatures, Digital Signature Standard

UNIT 6: IP Security:- **6+2=8 Hours**

IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

UNIT 7 : Web Security :- **6+2=8 Hours**

Web security Considerations; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET)

UNIT 8 :System Security:- **6+2=8 Hours**

Intruders, Intrusion Detection, Firewall Design Principles- Characteristics, Types of Firewall and Firewall Configuration.

Text Books:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", 4th Pearson Education, 2009.
(Chapters: 1, 2.1-2.3, 3.1,3.2,3.5, 5.1,5.2, 6.2, 9.1,9.2, 10.1,10.2, 11.1- 11.4, 13.1, 13.3, 14.1, 4.2, 15.1, 15.2, 16.1-16.6, 17.1-17.3, 18.1, 18.2, 20.1)

Reference Book:

1. Behrouz A. Forouzan and Debdeep Mukhopadhyay: "Cryptography and Network Security", 2nd Edition TMH 2010.

2. Atul Kahate, "Cryptography and Network Security" 2nd Edition, Tata McGraw-Hill.

Subject : MULTIMEDIA COMPUTING
Subject Code :MCA-505BE5.1

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe the types of media and define multimedia system.
2. Describe the process of digitizing (quantization) of different analog signals (text, graphics, sound and video).
3. Use and apply tools for image processing, video, sound and animation.
4. Apply methodology to develop a multimedia system.
5. Apply acquired knowledge in the field of multimedia in practice and independently continue to expand knowledge in this field.

Unit **L+T Hour**

PART A

UNIT – 1 Introduction:- 6+2=8 Hours

Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases.

UNIT -2 Media and Data Streams, Audio Technology:- 6+2=8 Hours

Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values, and Presentation Dimensions; Key Properties of a Multimedia System: Discrete & Continuous Media, Independence Media, Computer Controlled Systems, Integration; Characterizing Data Streams: Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams. Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission.

UNIT – 3 Graphics and Images, Video Technology, Computer-Based Animation: -

6+2=8 Hours

Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options. Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modeling Language.

UNIT – 4 Data Compression 6+2=8 Hours

Storage Space; Coding Requirements; Source, Entropy, and Hybrid Coding; Basic Compression Techniques; JPEG: Image Preparation, Lossy Sequential DCT-based Mode, Expanded Lossy DCT-based Mode, Lossless Mode, Hierarchical Mode

PART – B

UNIT – 5 Optical Storage Media:- 6+2=8 Hours

History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CD-ROM Extended Architecture; Further CD-ROM- Based Developments; Compact Disc Recordable; Compact Disc Magneto- Optical; Compact Disc Read/Write; Digital Versatile Disc.

UNIT – 6 Content Analysis :- 6+2=8 Hours

Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.

UNIT – 7 Data and File Format Standards: - 6+2=8 Hours

Rich-Text Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI File Format; JPEG DIB File Format for Still and Motion Images; AVI Indeo File Format; MPEG Standards; TWAIN

UNIT – 8 Multimedia Application Design :- 6+2=8 Hours

Multimedia Application Classes; Types of Multimedia Systems; Virtual Reality Design; Components of Multimedia Systems; Organizing Multimedia Databases; Application Workflow Design Issues; Distributed Application Design Issues.

Text Books:

1. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Vol 1- Media Coding and Content Processing, 2nd Edition, PHI, Indian Reprint 2008. (Chapters 2, 3, 4, 5, 6, 7, 8, 9)
2. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.

   (Chapters 1, 3, 7)

Reference Books:

1. K.R Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic: Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson Education, 2002.

Subject : Advanced Web Technology

Subject Code :MCA-505BE5.2

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Students are able to develop a dynamic webpage by the use of java script and DHTML.
2. Students will be able to write a well formed / valid XML document.
3. Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.
4. Students will be able to write a server side java application called Servlet to catch form data sent from client, process it and store it on database.
5. Students will be able to write a server side java application called JSP to catch form data sent from client and store it on database.

Unit **L+T Hour**

PART-A

UNIT 1 **6+2=8 Hours**

Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples.

UNIT 2 :CGI Scripting:- **6+2=8 Hours**

What is CGI? Developing CGI Applications, Processing CGI, Introduction to CGI.pm, CGI.pm methods,

Creating HTML Pages Dynamically, Using CGI.pm – An Example, Adding Robustness, Carp, Cookies

UNIT 3 :Building Web Applications with Perl :- **6+2=8 Hours**

Uploading files, Tracking users with Hidden Data, Using Relational Databases, using lib www,

UNIT 4 :Introduction to PHP :- **6+2=8 Hours**

Origins and uses of PHP , Overview of PHP , General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files.

UNIT 5 :Building Web applications with PHP :- **6+2=8 Hours**

Tracking users, cookies, sessions, Using Databases, Handling XML.

UNIT 6:Introduction to Ruby:- **6+2=8 Hours**

Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching.

UNIT 7 :Introduction to Rails and web 2.0:- 6+2=8 Hours

Overview of Rails, Document requests, Processing forms, Rails applications with Databases, Layouts.

What is Web 2.0?, Folksonomies and Web 2.0, Software As a Service (SaaS), Data and Web 2.0, Convergence,

Iterative development, Rich User experience, Multiple Delivery Channels, Social Networking.

UNIT8: WebServices:- 6+2=8 Hours

Web Services: SOAP, RPC Style SOAP, Document style SOAP, WSDL, REST services, JSON format, What is JSON?,

Array literals, Object literals, Mixing literals, JSON 0053yntax, JSON Encoding and Decoding, JSON versus XML.

Text Books:

1. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006 (Chapter 10,11,13)

2. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008. (Chapters 8,11,13, 14, 15)3. Francis Shanahan: Mashups, Wiley India 2007(Chapters 1, 6)

Reference Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 3rd Edition, Pearson Education / PHI, 2004.2. Xue Bai et al: The Web Warrior Guide to Web Programming, Thomson, 2003.

3. Joel Murach's PHP and MySQL. Mauch's Publications, First Edition.

Subject : SOFTWARE TESTING AND QUALITY ASSURANCE
Subject Code :MCA-505BE5.4

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe fundamental concepts of software quality assurance.
2. Explore test planning and its management.
3. Understand fundamental concepts of software automation.
4. Apply Selenium automation tool for testing web based application.
5. Demonstrate the quality management, assurance, and quality standard to software system.
6. Demonstrate Software Quality Tools and analyze their effectiveness.

Unit **L+T Hour**

PART-A

UNIT 1 **6+2=8 Hours**

Humans, Errors and Testing, Software Quality; Requirements, Behavior and Correctness, Correctness Vs Reliability;

Testing and Debugging; Test Metrics; Software and Hardware Testing; Testing and Verification; Defect Management;

Execution History; Test Generation Strategies; Static Testing; Test Generation from Predicates.

UNIT 2 :Basic Principles, Test case selection and Adequacy:- **6+2=8 Hours**

Sensitivity, Redundancy, Restriction, Partition, Visibility and Feedback, Test Specification and cases, Adequacy Criteria, Comparing Criteria.

UNIT 3:A perspective on Testing, Examples:- **6+2=8 Hours**

Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Level of testing, Examples: Generalized pseudo code, The triangle problem, the Next Date function,

The commission problem, The SATM (Simple Automation Teller Machine) problem, The currency converter, Saturn windshield wiper.

UNIT 4 :Boundary value testing, Equivalence class testing, Decision table based testing:- **6+2=8 Hours**

Boundary value analysis, Robustness testing, Worst-case testing, special value testing, Examples, Random testing, Equivalence classes,

Equivalence test cases for triangle problem, NextDate function and commission problem, Guidelines and observations, Decision tables, Test cases for triangle problem.

UNIT 5:Path Testing, Data flow testing:- **6+2=8 Hours**

DD Paths, Test coverage metrics, Basis path testing, guidelines and observations, Definition Use testing, Slice based testing, Guidelines and observations.

UNIT 6: Levels of Testing, Integration Testing :- 6+2=8 Hours

Traditional view of testing levels, Alternative life cycle models, the SATM systems, separating integration and system testing, Guidelines and observations.

UNIT 7 :Fault Based Testing:- 6+2=8 Hours

Assumptions in fault-based testing, Mutation Analysis, Fault-based Adequacy Criteria; Variations on mutation Analysis;

From Test case specification to Test Cases, Scaffolding, Generic vs specific Scaffolding, Test Oracles, Self checks as oracles, Capture and Replay.

UNIT 8: Planning and Monitoring the Process, Documenting Analysis and Test:-

6+2=8 Hours

Quality and Process, Test and Analysis strategies and plans, Risk Planning, Monitoring theProcess, Improving the process,

The quality team, Organizing documents, Test strategydocument, Analysis and test plan, Test design specifications documents, Test and analysis reports.

Text Books

1. Adithya P.Mathur " Foundations of Software Testing – Fundamental Algorithms and Techniques", Pearson Education India, 2011

2. MauroPezze, Michael Young, Software testing and Analysis- Process, Principles and Techniques, Wiley India, 2012

3. Paul C Jourgensen, "Software Testing A Craftmans Approach", Aueredach publications, 3rd edition, 2011.

Reference Books

1. Kshirasagara Naik, Priyadarshi Tripathy: Software Testing and Quality Assurance, Wiley India 2012.
2. M.G.Limaye: Software Testing-Principels, Techniques and Tools – McGrawHill, 2009.
3. Brain Marick: The Craft of Software Testing, Pearson Education India, 2008.
4. Ron Patton: Software Testing, 2nd Edition, Pearson Education, India, 2013.
5. Rahul Shende, , "Software Automation Testing Tools for Beginners". Shroff publishers and distributors, 2012.

Subject : Text Mining and Analytics

Subject Code :MCA-505BE5.5

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Use basic methods for information extraction and retrieval of textual data
2. Apply text processing techniques to prepare documents for statistical modelling
3. Apply relevant machine learning models for analyzing textual data and correctly interpreting the results
4. Use machine learning models for text prediction5. evaluate the performance of machine learning models for textual data

Unit **L+T Hour**

PART-A

Unit 1: Introduction- **6+2=8 Hours**

Human languages, models, ambiguity, processing paradigms; Phases in natural language processing, applications. Text representation in computers, encoding schemes. Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank,WordNet. Resource management with XML, Management of linguistic data with NLTK.

Unit 2: Morphology and Language Modeling - **6+2=8 Hours**

Finite State Automata, word recognition, lexicon. Morphology, acquisition models, Finite State Transducer, N-grams, Smoothing, entropy, Noisy channel model.

Unit 3: Text classification- **6+2=8 Hours**

Naive Bayes, K nearest Neighbour, decision tree, Support Vector Machine(SVM).

Unit 4:-Part of Speech tagging:- **6+2=8 Hours**

Stochastic POS tagging, HMM, Transformation based tagging (TBL), Handling of unknown words, named entities, multi word expressions.

Unit 5:- Semantics analysis:- **6+2=8 Hours**

Introduction, Context Free Grammar, Constituency, Unification, probabilistic parsing, TreeBank.

Unit 6:- Semantics **6+2=8 Hours**

Meaning representation, semantic analysis, lexical semantics, WordNet, Word Sense Disambiguation- Selection restriction, machine learning approaches, dictionary based approaches.

Unit 7: Information Retrieval:- **6+2=8 Hours**

Introduction, Classical information retrieval models, term weighting- Boolean value, Term frequency(TF), Inverse Document Frequency(IDF), Term Frequency and Inverse Document Frequency(TF-IDF), Dimensionality reduction improving user queries.

Unit 8: Machine Translation:– **6+2=8 Hours**

Introduction, Problems in Machine Translation, Machine Translation approaches.

***Textbook*:**

1. Daniel Jurafsky and James H Martin. *Speech and Language Processing, 2e*, Pearson Education, 2009

***Reference Books*:**

1. James A.. *Natural language Understanding 2e*, Pearson Education, 1994
2. Manning, C.D. and H. SchAtze: *Foundation of Statistical Natural Language Processing*. The MIT Press. 1999. ISBN 0-262-13360-1.
3. Bharati A., Sangal R., Chaitanya V.. *Natural language processing: a Paninian perspective*,PHI, 2000
4. Siddiqui T., Tiwary U. S.. *Natural language processing and Information retrieval*, OUP, 2008

3. Program Specific Outcomes (PSO)

The program is designed to fulfill the following specific outcomes.

PSO1: Enable the students to apply the computing and soft skills acquired in the MCA program and developing innovative applications for the betterment of the society.

PSO2: Provide exposure to techniques that would enable the students to design, implement and evaluate IT solutions.

PSO3: To enable the students to meet the challenges of research and development in computer science and applications.