UNIVERSITY OF LUCKNOW

FACULTY OF ENGINEERING AND TECHNOLOGY

POs, PSOs, & COs

MASTER OF COMPUTER APPLICATION

(TWO YEAR PROGRAMME)

TOTAL CREDITS: 96 (CBCS)

(Effective from the session 2020-21)

INTRODUCTION

MCA programme is to prepare post graduates for productive careers in software industry, corporate sector, Govt. organizations and academia. The programme's thrust is on giving the students a thorough and sound background in theoretical and skill-oriented courses relevant to the latest computer software development. The programme emphasizes the application of software technology to solve mathematical, computing, communications/networking and commercial problems.

This Programme has been designed for total duration of four semesters with Choice Based Credit System (CBCS).

PROGRAM OUTCOMES (POs)

PO-1. To produce knowledgeable and skilled human resources which are employable in IT industry.

PO-2. To impart knowledge required for planning, designing and building complex Application Software Systems as well as provide support to automated systems or applications.

PO-3. To produce entrepreneurs who can develop customized solutions for small to large enterprises.

PO-4. To develop competent and professionally motivated personnel, equipped with objective, critical thinking, right moral and ethical values that foster the scientific temper with a sense of social responsibility.

PO-5. To train students to become globally competent and employable.

PROGRAM SPECIFIC OUTCOMES (PSOs)

After completing the program students will be capable of:

PSO-1. Understanding to apply knowledge of computing and technological advances appropriate to the programme.

PSO-2. Analyzing, identifying and defining problems for logical modeling and its solutions.

PSO-3. Understanding a sense of professional, ethical, legal, security and social issues and responsibilities.

PSO-4. Analyzing the local and global impact of business solutions on individuals, organizations, and society.

COURSE COVERAGE

CREDIT STRUCTURE:

TYPE OF SESSION	CREDIT
Each Lecture	1
Each Tutorial	1
Each 2 hours Laboratory/ Project per week	1
Each 3 hours Laboratory/ Project per week	2

BREAK UP OF 96 CREDIT POINTS:

Course Category	Year I		Year II		Total
SEMESTER ➔	I	II	III	IV	
Humanities, Social Sciences & Management	05				**05**
Applied Sciences	04				**04**
Core	15	24	14		**53**
Electives			08	12	**20**
Projects/Seminars/ Training			02	12	**14**
TOTAL	**24**	**24**	**24**	**24**	**96**

COMPUTATION OF SGPA AND CGPA

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA(S_i) = \sum(C_i \times G_i)/\sum C_i$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \sum(C_i \times S_i)/\sum C_i$$

where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

ELIGIBILITY FOR PROMOTION

SEMESTER	CRITERIA FOR PROMOTION
ODD	No restriction
EVEN	Student has to secure at least 24 credits in immediately preceding two semesters including theory and practical credits.

Note:- Student will pass only if semester grade point average (SGPA) is at least 5.0

STUDY AND EVALUATION SCHEME
MASTER OF COMPUTER APPLICATION

SEMESTER-I CREDIT = 24

(Effective from the session 2020-21)

YEAR: FIRST, SEMESTER-I

Sl. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam ESE		
			L	T	P	CT	TA	Total			
1.	**MCA-101**	Fundamental of Computers and Emerging Technologies	3	1	0	20	10	30	70	100	4
2.	**MCA-102**	Computer Programming in C	3	1	0	20	10	30	70	100	4
3.	**MCA-103**	Discrete Mathematics and its Applications	3	1	0	20	10	30	70	100	4
4.	**MCA-104**	Computer Organization and Architecture	3	1	0	20	10	30	70	100	4
5.	**MCA-105**	Principles of Communication and Management	3	1	0	20	10	30	70	100	4
Practical											
6.	**MCA-106P**	Computer Programming in C Lab	0	0	3	10	10	20	30	50	2
7.	**MCA-107P**	Computer Organization and Architecture Lab	0	0	2	10	10	20	30	50	1
8.	**MCA-108P**	Professional Communication Lab	0	0	2	10	10	20	30	50	1
9.	**MCA-GP**	General Proficiency	-	-	-	-	-	-	-	50	-
		Total	**15**	**05**	**07**					**700**	**24**

Abbreviations:

CT - Class Test TA - Teacher's Assessment

ESE - End Semester Examination

STUDY AND EVALUATION SCHEME
MASTER OF COMPUTER APPLICATION

SEMESTER-II CREDIT = 24

(Effective from the session 2020-21)

YEAR: FIRST, SEMESTER-II

Sl. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam ESE		
			L	T	P	CT	TA	Total			
1.	**MCA-201**	Automata Theory and Formal Languages	3	1	0	20	10	30	70	100	4
2.	**MCA-202**	Object Oriented programming in JAVA	3	1	0	20	10	30	70	100	4
3.	**MCA-203**	Operating System	3	1	0	20	10	30	70	100	4
4.	**MCA-204**	Database Management System	3	1	0	20	10	30	70	100	4
5.	**MCA-205**	Data Structure and Algorithm using C Language	3	1	0	20	10	30	70	100	4
6.	**MCA-206**	Cyber Law and Ethics*	3	0	0	20	10	30	70	100*	0
Practical											
7.	**MCA-207P**	JAVA Lab	0	0	3	10	10	20	30	50	2
8.	**MCA-208P**	DBMS Lab	0	0	2	10	10	20	30	50	1
9.	**MCA-209P**	Data Structure and Algorithm using C Language Lab	0	0	2	10	10	20	30	50	1
10.	**MCA-GP**	General Proficiency	-	-	-	-	-	-	-	50	-
		Total	**18**	**05**	**07**					**700**	**24**

***Qualifying Non-credit Course**

Abbreviations:

CT - Class Test TA - Teacher's Assessment

ESE - End Semester Examination

Note: - The Summer Internship Project (6 Weeks) conducted during summer break after II semester and will be assessed during III semester. The course will be carried out at some industrial unit or under the guidance of a faculty member.

STUDY AND EVALUATION SCHEME
MASTER OF COMPUTER APPLICATION

SEMESTER-III CREDIT = 24
(Effective from the session 2021-22)

YEAR: SECOND, SEMESTER-III

Sl. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam ESE		
			L	T	P	CT	TA	Total			
1.	**MCA-301**	Computer Network	3	1	0	20	10	30	70	100	4
2.	**MCA-302**	Design and Analysis of Algorithm	3	1	0	20	10	30	70	100	4
3.	**MCA-303**	Software Engineering Concept	3	1	0	20	10	30	70	100	4
4.	**MCA-304X**	Any one from the list (Elective-I)	3	1	0	20	10	30	70	100	4
5.	**MCA-305X**	Any one from the list (Elective-II)	3	1	0	20	10	30	70	100	4
Practical											
6.	**MCA-306P**	Computer Network Lab	0	0	2	10	10	20	30	50	1
7.	**MCA-307P**	Software Engineering Lab	0	0	2	10	10	20	30	50	1
8.	**MCA-308P**	Summer Internship Project *	0	0	3	10	10	20	30	50	2
9.	**MCA-GP**	General Proficiency	-	-	-	-	-	-	-	50	-
		Total	**15**	**05**	**07**					**700**	**24**

Abbreviations:

CT - Class Test TA - Teacher's Assessment

ESE - End Semester Examination

Elective-I

MCA-3041 Artificial Intelligence (MOOCs**)
MCA-3042 Data Warehousing and Data Mining
MCA-3043 Compiler Design
MCA-3044 Advanced Database Management System
MCA-3045 Cloud Computing (MOOCs**)

Elective-II

MCA-3051 Distributed System (MOOCs**)
MCA-3052 Web Technology
MCA-3053 Management Information System
MCA-3054 Client Server Computing
MCA-3055 Simulation and Modeling

*** The Summer Internship Project (6 Weeks) conducted during summer break after II semester and will be assessed during III semester. The course will be carried out at some industrial unit or under the guidance of a faculty member.**

****Note:**

1. MOOCs is acceptable only if the course duration is of at least 08 weeks.
2. The certification exam is necessary for successful credit transfer.

STUDY AND EVALUATION SCHEME
MASTER OF COMPUTER APPLICATION

SEMESTER-IV CREDIT = 24
(Effective from the session 2021-22)

YEAR: SECOND, SEMESTER-IV

Sl. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam ESE		
			L	T	P	CT	TA	Total			
1.	MCA-401X	Any one from the list (Elective-III)	3	1	0	20	10	30	70	100	4
2.	MCA-402X	Any one from the list (Elective-IV)	3	1	0	20	10	30	70	100	4
3.	MCA-403X	Any one from the list (Elective-V)	3	1	0	20	10	30	70	100	4
Practical											
4.	MCA-404P	Major project	0	0	18	-	-	100	250	350	12
5.	MCA-GP	General Proficiency	-	-	-	-	-	-	-	50	-
		Total	**09**	**03**	**18**					**700**	**24**

Abbreviations:

CT - Class Test TA - Teacher's Assessment

ESE - End Semester Examination

Elective-III

MCA-4011 Soft Computing (MOOCs*)
MCA-4012 Cryptography and Network Security (MOOCs*)
MCA-4013 Software Project Management
MCA-4014 Data Analytics
MCA-4015 Big Data (MOOCs*)

Elective-IV

MCA-4021 Machine Learning (MOOCs*)
MCA-4022 Internet of Things (MOOCs*)
MCA-4023 Pattern Recognition
MCA-4024 Digital Image Processing
MCA-4025 System Analysis and Design

Elective-V

MCA-4031 Mobile Computing (MOOCs*)
MCA-4032 Computer graphics and Animation
MCA-4033 Software Testing and Quality Assurance
MCA-4034 Mobile Application Development
MCA-4035 Semantic Web

***Note:**

1. MOOCs is acceptable only if the course duration is of at least 08 weeks.
2. The certification exam is necessary for successful credit transfer.

MCA-101

FUNDAMENTAL OF COMPUTERS AND EMERGING TECHNOLOGIES

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Learn about basic of computer system and its component.
- **CO-2.** Understand the concept of operating system, its function and services.
- **CO-3.** Understand recent trends in computer science and engineering like computer vision, quantum computing, big data etc.
- **CO-4.** Learn basic concept about cyber security, artificial intelligence and other trending technologies.

Unit-I **(08)**

Basics of Computer: Computer system concept, block diagram of computer; characteristics of computer, classification of computers, generation of computers, input/ output devices, and memory hierarchy. **Operating system:** Definition, purpose, function, services and types. Introduction to DOS, Windows, Linux and Android.

Unit-II **(08)**

Information Technology Basics: Introduction Need for Information Storage and Processing Information Technology Components, Role of Information Technology Information Technology and the Internet. Internet and its Tools. Internet Evolution, Basic Internet Terminology, Data over Internet, Modes of Data Transmission, Types of Networks, Types of Topologies, Protocols used in the Internet, Getting Connected to Internet Applications, Internet Application and Computer Ethics.

Unit-III **(08)**

Computer vision: Introduction, uses, future perspective.
Deep Learning: Introduction, uses, future perspective.
Natural Language Generation: Introduction, uses and future perspective.

Unit-IV **(08)**

Emerging Trends in Information Technology: Edge computing: Introduction, advantages, uses, future of the technology.
Quantum computing: Introduction, advantages, uses, future of the technology.

Unit-V **(08)**

Trending Technologies: Big data analytics, artificial intelligence and robotics, computer assisted education, bioinformatics, cyber security, IoT, and 5G.

Text Books:

1. A. Goal," Computer Fundamentals", Pearson Education.
2. Dennis Curtin," Information Technology The Breaking Wave", Tata McGraw Hill.
3. M. Bader and A. Bode, "Parallel Computing: Accelerating Computational Science and Engineering (CSE) (Advances in Parallel Computing)", IOS Press.

Reference Books:

1. Somani, A.K., Ramakrishna, S., Chaudhary, A., Choudhary, C., Agarwal. “Emerging Technologies in Computer Engineering: Microservices in Big Data Analytics”, Springer publications.
2. Saroj Kaushik, ”Artificial Intelligence”, CENGAGE Learning.

MCA-102

COMPUTER PROGRAMMING IN C

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

CO-1. Understand the importance of algorithm and flowcharts in programming.

CO-2. Understand the basic concepts of writing a program in C language: write, compile, and run programs in C language.

CO-3. Understand role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language

CO-4. Write programs that involves decisions and iterations.

CO-5. Understand how to use functions, arrays, pointers, preprocessor directives along with fare confidence in file handling.

CO-6. Understand about dynamic memory allocation.

Unit-I **(08)**

C Language Fundamentals: Basics of algorithm, flowchart, character set, keywords, identifiers, variables: declaration and initialization of variables, scope of variables, constant, types of constant, data type and sizes, types of operators: unary and binary operators, bit wise operators, and type conversion.

Unit-II **(10)**

Decision Control Statements: if, if-else, nested if else, else if ladder, switch statement, break, continue statement. **Loops**: for, while, do-while, nesting of loops. structure of c program, compilation and execution of c program. Errors, and types of errors.

Unit-III **(08)**

String: Declaration, initialization, and string functions. **Arrays:** Array notation and representation, manipulating array elements, multi-dimensional arrays. Structure, union, and enumerated data types.

Unit-IV **(08)**

Pointers: Introduction, declaration, arithmetic, standard c pre-processors, defining and calling macros.

Functions: Declaration and definition, function call, types of function, parameter passing, call by value, call by reference, recursive functions, and storage classes.

Unit-V **(06)**

Dynamic memory allocation: malloc(), calloc(), sizeof(), free(), realloc().

File management: Opening & closing a file, text file & binary file, and functions for file handling.

Text Books:

1. Kernighan Brain W. and Ritchie Dennis M., "The C programming", Pearson Education.
2. E Balaguruswami, "Computer Concepts and Programming in C", McGraw Hill.
3. Reema Thareja, "Computer Fundamentals and Programming in C", Oxford Publication.

Reference Books:

1. Vikas Gupta, "Computer Concepts and Programming in C", Wiley India Publication.
2. Behrouz A. Forouzan, Richard F. Gilberg, Thomson, "Computer Science- A Structured Programming Approach Using C", Cengage Learning.
3. Jeri R. Hanly, Elliot B. Koffman, "Problem Solving and Program Design in C", Pearson Addison-Wesley.

MCA-103
DISCRETE MATHEMATICS AND ITS APPLICATIONS

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Interpret and analysis the mathematical procedure/rules in physical or other term to see what it practically means and applies.(Relations, Lattice and Fuzzy sets)
- **CO-2.** Combinatory (mathematical induction, Propositional calculus and permutation-combinations and recurrence relations)
- **CO-3.** Construct a conversion of automata and design a grammar.

Unit-I **(09)**

Propositional Logic: Proposition, logical connectives, truth tables, well-formed formula, tautology, contradiction, algebra of proposition, normal forms, modus ponens, modus tollens, and validity. **Predicate Logic:** First order predicate, well-formed formula of predicate, quantifiers, inference theory of predicate logic. **Notion of Proof:** Proof by implication, converse, inverse, contra-positive, negation and contradiction, direct proof, proof by using truth table, and proof by counter example.

Unit-II **(08)**

Algebraic Structures: Binary composition and its properties, definition of algebraic structure, semi group, monoid, group, abelain group, properties of groups, permutation group, sub group, cyclic group, integers modulo N, and application of algebraic structures in computer science.

Unit-III **(08)**

Graphs: Definition, representation and types of graph, degree of a vertex, connectivity, planar graphs, Euler's formula for connected plannar graphs, Kuratowski's Theorem (Statement only) and its use. Multigraphs, Euler and Hamiltonian paths, Euler's Theorem on the existence of Eulerian paths and circuits, isomorphism and homeomorphism of graphs, graph coloring, chromatic number, chromatic polynomial and its application.

Unit-IV **(07)**

Trees: Definition, binary trees, binary tree traversal, binary search trees, spanning trees, minimal spanning trees , algorithm of Prism's, Kruskal's and Dijikistrra's algorithm .

Unit-V **(08)**

Elements of coding theory: Introduction, definitions, error detecting & correcting code, harmonic code and distance, theorems. Group (linear) codes, decoding methods. Parity check and generator matrix, definition parity check matrix decoding, and coset decoding. **Hamming's Codes:** Concept, implementation as error correcting code, single error correcting (SEC) Code and single error correcting & double error detection code (SEC- DED).

Text Books:

1. J.P. Tremblay & R. Manohar, "Discrete Mathematical Structure with Applications to Computer Science", Mc Graw Hill.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Mc Graw Hill.
3. S. K. Sarkar, "A Text Book of Discrete Mathematics", S.Chand & Company Ltd.

Reference Books

1. Liu and Mohapatra, "Elements of Discrete Mathematics", McGraw Hill.
2. Y.N. Singh, "Discrete Mathematical Structures", Wiley India, New Delhi.
3. R.P. Grimaldi, "Discrete and Combinatorial Mathematics", Addison Welsy.

MCA-104
COMPUTER ORGANIZATION AND ARCHITECTURE

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Conceptualize the basics of organizational and architectural issues of a digital computer.
- **CO-2.** Learn and perform computer arithmetic operations on integer and real numbers.
- **CO-3.** Analyze some of the design issues in terms of speed, technology, cost and performance.
- **CO-4.** Exemplified in a better way the I/O and memory organization.
- **CO-5.** Understand about parallel computing and its performance metrics & measures.
- **CO-6.** Understand about pipelining concept.
- **CO-7.** Learn and analyze categorization of memory organization and get a detailed explanation of the function of each element of a memory hierarchy.

Unit-I **(08)**

Introduction: Functional units of digital computer and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register bus and memory transfer, Processor organization, general register organization, stack organization and addressing modes. Signed adder and subtractor circuits. Multiplication: Signed operand multiplication, Booth's algorithm and array multiplier. Division and logic operations, Fixed and floating point representation, IEEE standard for floating point representation, Floating point arithmetic operation, Arithmetic & logic unit design.

Unit-II **(08)**

Control Unit: Instruction types, formats, instruction cycles and sub cycles (fetch, execute etc), micro-operations, execution of a complete instruction, Micro-programmed control: micro-programme sequencing, concept of horizontal and vertical microprogramming.

Unit-III **(08)**

Memory: Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 ½ *D* memory organization and address mapping. ROM memories, Cache memories: concept and design issues & performance, address mapping and replacement.

Unit-IV **(08)**

Input/Output: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions, Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors, Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.

Unit-V **(08)**

Architecture: Architectural Classification Schemes, Flynn's & Feng's Classification, Performance Metrics and Measures, Speedup Performance Laws. Pipelining and Memory Hierarchy: Basic and Intermediate Concepts, Linear and Nonlinear Pipeline Processors.

Text Book:

1. M. Mano, “Computer System Architecture”, PHI.
2. W. Stallings, “Computer Organization”, PHI.
3. P Pal Chaudhary, “Computer Organization and Design”, PHI.

Reference Books

1. Vravice, Zaky & Hamacher, “Computer Organization”, TMH Publication.
2. Tannenbaum, “Structured Computer Organization”, PHI.
3. John P.Hayes, “Computer Organization”, McGraw Hill.
4. David Patterson John Hennessy, “Computer Organization and Design”, Elsevier Publication.

MCA-105
PRINCIPLES OF COMMUNICATION AND MANAGEMENT

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Stimulated Critical thinking by designing and developing lucid and error free writing skills which shall help in drafting effective business correspondence.
- **CO-2.** Optimum usage of Vocabulary and Grammar; Distinguishing between levels of an organization; Upscaled understanding and analyzing the process of Effective Communication.
- **CO-3.** Developed knowledge of paraphrasing, deciphering instructions, interpreting guidelines to participate in discussion boards and meetings.
- **CO-4.** Relevant and coherent display of ideas in professional writings or oral presentations (Verbal & Non-Verbal Communication Skills) by the students.
- **CO-5.** Strong conceptual grip of Management and its functional areas (Decision-making, Problem-solving, Team-building) by demonstrating sensitivity towards ethical issues in the course of professionalism.

Unit-I **(08)**

Technical Communication: Communication: Meaning, features, forms, types, levels; features of literary communication; barriers to communication; language as a tool of communication. Word formation, functional words, functional grammar (articles, tenses, connectors, passives and speech narration); technical sentence construction. **Technical Written Communication:** Paragraph development: Techniques (mind mapping, brainstorming and free writing), methods, unity, and coherence. **Report Writing:** Objectivity, subjectivity, tools and techniques, developing questionnaire, determining source (primary and secondary sources), referencing (IEEE etc).

Unit-II **(08)**

Proposal writing: Techniques; elements (executive summary, technical section, managerial section, financial section), problem statement and its usage. **Letter writing:** 7Cs, writing process; elements; referencing; formatting; sale letter, credit letter, purchase letter. **Developing Personality:** Five-factor model; kinesics; haptics; proxemics; cross cultural personality traits; self-confidence; pragmatism in attitude; Sigmund Freud, William James and the theory of pragmatism

Unit-III **(08)**

Introduction to Management: Definition, nature scope and significance of management, the evolution of management thought, approaches of management, manager and environment. **Planning:** Definition, nature, scope and significance of planning, objectives, steps of planning, decision making, process and techniques of decision making. **Organizing:** Definition, nature, scope and significance, approaches, forms of organization structure.

Unit-IV **(09)**

Staffing: Concept, factors affecting staffing, manpower planning, job analysis, recruitment and selection, training and development, appraisal and development of managers.

Directing: Concept and principles of directing, motivation - nature and significance, theories and techniques, leadership and leadership styles. **Controlling:** Concept, process & types of controlling, controlling and management by exception, design of effective control system and essentials of effective control system.

Unit-V **(07)**

Organizational Change & Development: Concept, forces and need for change, process of change, resistance to change, approached to planned change, meaning, process and techniques of organizational development.

Text Books:

1. Ferguson, Sherry Devereaux; Lennox-Terrion, Jenepher; Ahmed, Rukhsana; Jaya, Peruvemba, "Communication in Everyday Life: Personal and Professional Contexts", Oxford University Press.
2. Trenholm, Sarah; Jensen, Arthur, "Interpersonal Communication", Oxford University Press.
3. Koontz & O'Donnell, "Essentials of Management", Tata McGraw Hill.

Reference Books:

1. Vasishth, Neeru, "Principles of Management", Taxmann.
2. Robbins S.P, and Decenzo David A., "Fundamental of Management: Essential Concepts and Applications", Pearson Education.
3. James, William, "Pragmatism and other essays", New York: Washington Square Press.

MCA-201
AUTOMATA THEORY AND FORMAL LANGUAGES

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understanding the basic terminology of Grammar and construction of logical machine of NFA and DFA with minimization of number of states.
- **CO-2.** Learning to generate regular expressions of various languages, its relationship with FA, related theorems and limitation of finite automata.
- **CO-3.** Understanding the CFG and its simplification and various forms.
- **CO-4.** Able to write description for PDA and understand its relation with CFG
- **CO-5.** Basic ability to write simple Turing machines and fair understanding of undesirability.

Unit-I **(08)**

Introduction: Alphabets, strings and languages, automata and grammars, deterministic finite automata (DFA)- definition, simplified notation: state transition graph, transition table, language of DFA, Nondeterministic finite Automata (NFA), Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata. Finite Automata with output- Moore Machine, Mealy Machine, equivalence of Moore and Mealy Machine, and minimization of finite automata.

Unit-II **(08)**

Regular Expression: Definition, operators of regular expression and their precedence, algebraic laws for regular expressions, Kleen's Theorem, regular expression to FA, DFA to regular expression, Arden's Theorem, non-regular languages, pumping lemma for regular languages. Application of pumping lemma, closure properties of regular languages, and decision properties of regular languages,

Unit-III **(08)**

Context Free Grammar and Languages: Definition, examples, derivation, derivation trees, ambiguity in grammar, inherent ambiguity, ambiguous to unambiguous CFG, useless symbols, simplification of CFGs, normal forms for CFGs: CNF and GNF, closure properties of CFLs, decision properties of CFLs: Emptiness, and pumping lemma for CFLs.

Unit-IV **(08)**

Push Down Automata (PDA): Description and definition, language of PDA, acceptance by final state, acceptance by empty stack, deterministic PDA, equivalence of PDA and CFG, CFG to PDA and PDA to CFG, and two stack PDA.

Unit-V **(08)**

Turing machines (TM): Basic model, definition and representation, instantaneous description, language acceptance by TM, variants of Turing machine, TM as computer of integer functions, universal TM, Church's thesis, recursive and recursively enumerable languages, and halting problem.

Text Books:

1. Hopcroft, Ullman, “Introduction to Automata Theory, Languages and Computation”, Pearson Education.
2. K.L.P. Mishra and N.Chandrasekaran, “Theory of Computer Science: Automata, Languages and Computation”, PHI Learning Private Limited, Delhi India.
3. K.Krithivasan and R.Rama, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education.

References:

1. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
2. Y.N.Singh “Mathematical Foundation of Computer Science”, New Age International.
3. Papadimitrou, C. and Lewis, C.L., “Elements of the Theory of Computation”, PHI Learning Private Limited, Delhi India.

MCA–202
OBJECT ORIENTED PROGRAMMING IN JAVA

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand the concept object modeling, dynamic modeling, functional modeling and the basics of object-oriented methodologies.
- **CO-2.** Define class, create object and excess class members.
- **CO-3.** Understand the concept of constructor and method overloading.
- **CO-4.** Understand the concept of inheritance and exception handling.
- **CO-5.** Write, compile, run, and test object-oriented Java programs.

Unit-I **(08)**

Object Modeling: Object and classes, links and associations, multiplicity, advanced link and association, generalization and inheritance, aggregation, abstract classes, multiple inheritance, meta data, and candidates keys. **Dynamic Modeling:** Events and states, state diagram operations and methods, nested state diagrams, state generalization, concurrency, relation of object and dynamic models.

Unit-II **(08)**

Functional Modeling: Functional models, data flow diagrams, specifying operations, constraints, relation of function to object and dynamics models. **Object Oriented Methodologies:** Translating object oriented design into an implementation, OMT methodologies, examples and case studies to demonstrate methodology, and comparison of methodology.

Unit-III **(08)**

Java Basic: JAVA environment, JAVA program structure, tokens, Statements, JVM, constant and variables, data types, declaration of variables, scope of variables, symbolic constants, and type casting. **Operators:** Arithmetic, relational, logical assignments, increment and decrement, conditional, bitwise, special, expressions and its evaluation. **Object and Class Concept:** Defining a class, adding variables and methods to classes, creating objects, accessing class members, constructors, methods overloading, static members, and nesting of methods.

Unit -IV **(08)**

Inheritance: Extending a class, overriding methods, final variables and methods, final classes, finalize methods, abstract methods and classes, and visibility control. **Arrays:** One dimensional and two dimensional, strings, vectors, and wrapper classes.

Unit -V **(08)**

Interface: Defining interface, extending interface, implementing interface, and accessing interface variable. **Exception Handling:** Concepts of exceptions, types of exception, try and catch keyword, nested try and catch.

Text Books:

1. James Rumbaughet. al, “Object Oriented Modeling and Design”, PHI.
2. Mark Priestley “Practical Object-Oriented Design with UML”, TMH.
3. E. Balagurusamy, “Programming in Java”, TMH Publications.

Reference Books:

1. Peter Norton, “Peter Norton Guide to Java Programming”, Techmedia Publications.
2. Naughton, Schildt, “The Complete Reference JAVA 2”, TMH.
3. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Pearson Education.

MCA-203
OPERATING SYSTEM

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Analyze various process scheduling Algorithms and their comparisons.
- **CO-2.** Understand the difference between processes and threads.
- **CO-3.** Understand the issues and use of locks, semaphores and monitors for synchronizing multithreaded systems and implement them in multithreaded programs.
- **CO-4.** Understand deadlock concept and its algorithm.
- **CO-5.** Contrast various Memory management schemes and Page replacement policies.
- **CO-6.** Demonstration of paging Technique of Memory Management.
- **CO-7.** Understand the concept of disk scheduling and file system.

Unit-I **(08)**

Introduction: Operating system and its functions, classification of operating systems- batch, interactive, time sharing, real time system, multiprocessor systems, multiuser systems, multithreaded systems, and operating system structure- layered structure, system components, and operating system services.

Unit-II **(06)**

Process and CPU Scheduling: Process concept, process states, process state transition diagram, scheduling concepts, performance criteria, schedulers, process control block (PCB), threads and their management, scheduling algorithms, and multiprocessor scheduling.

Unit-III **(09)**

Concurrent Processes: Principle of concurrency, producer/consumer problem, mutual exclusion, critical section problem, semaphores, test and set operation; Classical problem in concurrency- dining philosopher problem, sleeping barber problem; Inter process communication models and schemes, and process generation.

Deadlock: System model, deadlock characterization, prevention, avoidance, detection, and recovery from deadlock.

Unit-IV **(08)**

Memory Management: Basic bare machine, resident monitor, multiprogramming with fixed partitions, multiprogramming with variable partitions, paging, segmentation, paged segmentation, virtual memory concepts, demand paging, performance of demand paging, page replacement algorithms, thrashing, and cache memory organization.

Unit -V **(09)**

File Management: File systems, secondary storage structure, file concept, access methods, directory implementation, efficiency and performance, and recovery.

Disk Management: Disk structure, disk scheduling, disk management, recovery, disk structure, swap-space management, and disk reliability.

I/O Management: I/O devices, and I/O subsystems, and I/O buffering.

Text Books:

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley.
2. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson Education.
3. D M Dhamdhere, "Operating Systems: A Concept based Approach", 2nd Edition, TMH.

Reference Books:

1. SibsankarHalder and Alex A Aravind, "Operating Systems", Pearson Education.
2. Harvey M Dietel, "An Introduction to Operating System", Pearson Education.
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education".

MCA–204
DATABASE MANAGEMENT SYSTEM

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand database concepts, structures and query language.
- **CO-2.** Understand the E R model and relational model.
- **CO-3.** Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
- **CO-4.** Create and manage database with all integrity constraints.
- **CO-5.** Refine the schema of database by applying normal forms.
- **CO-6.** Understand concept of transaction processing and concurrency control.

Unit-I **(10)**

Introduction: An overview of database management system, database system vs file system, database system concept and architecture, data model schema and instances, data independence, database language and interfaces, and overall database structure.

Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, and relationship of higher degree.

Unit-II **(10)**

Relational Data Model and Language: Relational data model concepts, integrity constraints, entity integrity, referential integrity, keys constraints, domain constraints, relational algebra, relational calculus, tuple calculus, and domain calculus.

Introduction to SQL Statements: Data retrieval, DDL, DML, TCL, DCL, characteristics of SQL, advantage of SQL, SQL data type and literals, types of SQL commands, SQL operators and their procedure, tables, views and indexes, queries and sub queries, aggregate functions, joins, unions, intersection, minus, cursors, and triggers.

Unit-III **(08)**

Database Design & Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, lossless join decompositions, and normalization using FD, MVD and JDs.

Unit-IV **(06)**

Transaction Processing Concept: Transaction system, testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, recovery from transaction failures, log based recovery, checkpoints, and deadlock handling.

Unit-V **(06)**

Concurrency Control Techniques: Concurrency control, locking techniques for concurrency control, time stamping protocols for concurrency control, and validation based protocol.

Text Books:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill.
2. Elmasri, Navathe, "Fundamentals of Database Systems", Addision Wesley.
3. Majumdar, Bhattacharya, "Database Management System", TMH.

Reference Books:

1. Date C J, "An Introduction to Database Systems", Addision Wesley.
2. O'Neil, "Databases", Elsevier Pub.
3. Leon & Leon, "Database Management Systems", Vikas Publishing House.
4. Bipin C. Desai, "An Introduction to Database Systems", Gagotia Publications.
5. Ramkrishnan, Gehrke, "Database Management System", McGraw Hill.

MCA-205
DATA STRUCTURES AND ALGORITHM USING 'C' LANGUAGE

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Learn how to represent arrays, linked lists, stacks, queues, trees, and graphs in memory using the algorithms and their common applications.
- **CO-2.** Understanding the concept of recursion, application of recursion and its implementation and removal of recursion.
- **CO-3.** Learn the computational efficiency of the sorting and searching algorithms.
- **CO-4.** Learn implementation of Trees and Graphs, and various operations on these data structure.
- **CO-5.** Identify the alternative implementations of data structures with respect to its performance to solve a real world problem.

Unit-I **(09)**

Introduction: Basic terminology, elementary data organization, abstract data types, data structure operations, and concept of algorithm. **Arrays:** Array definition, address calculation of single and multidimensional arrays. **Linked lists:** Implementation of singly linked list using array, and pointer, doubly linked list, circularly linked list, operations on a linked list: insertion, deletion, and traversal.

Unit-II **(10)**

Stacks: Array and linked list implementation of stack, basic operations, application of stack: prefix and postfix expressions, and evaluation of postfix expression. **Recursion-** Principles of recursion, tail and non-tail recursion, removal of recursion problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Trade-offs between iteration and recursion. **Queues:** Array and linked list implementation of queues, basic operations: create, add, delete, circular queues, dequeue and priority queue.

Unit-III **(08)**

Trees: Basic terminology, binary trees, binary tree representation: array and linked list representation, strictly binary tree, complete binary tree. Extended binary trees, tree traversal algorithms: in-order, pre-order and post-order, and constructing binary tree from given tree traversal.
Binary Search Trees: Insertion, deletion, and searching & modification of data in binary search. Huffman coding using binary tree. Concept & basic operations for AVL tree, B tree and binary heaps.

Unit-IV **(06)**

Hashing and Sorting: Concept of hashing & collision resolution techniques, insertion sort, selection sort, bubble sort, quick sort, merge sort, and heap sort.

Unit-V **(07)**

Graphs: Terminology and Representations: Adjacency Matrices, Adjacency List, and Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, and Spanning Trees. **Minimum Cost Spanning Trees:** Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.

Text Books:

1. Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C and C++", Pearson Education Asia.
2. Ellis Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi.
3. S. Lipschutz, "Data Structures", Mc-Graw Hill International Editions.

Reference Books

1. Jean-Paul Tremblay, Paul. G. Soresan, "An introduction to data structures with Applications", Tata Mc-Graw Hill International Editions.
2. A. Michael Berman, "Data structures via C++", Oxford University Press.
3. Robert Kruse, Cl Tondo, "Data Structures and Program Design in C", Pearson Education India.

MCA-206
CYBER LAW AND ETHICS

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand the need of information security and threats to information system.
- **CO-2.** Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
- **CO-3.** Locate and apply case law and common law to current legal dilemmas in the technology field.
- **CO-4.** Understand about the various security standard and intellectual properties law.
- **CO-5.** Understand about internet security threats.

Unit-I **(8)**

Introduction to Information Systems: Types of information systems, development of information systems, introduction to information security, need for information security, threats to information systems, information assurance, cyber security, and security risk analysis.

Unit-II **(10)**

Security and Threats: Application security (database, e-mail and internet), data security considerations, security technology-firewall and VPNs, intrusion detection, and access control. Security threats- viruses, worms, trojan horse, bombs, trapdoors, spoofs, e-mail viruses, macro viruses, malicious software, network and denial of services attack, threats to e-commerce, digital signature, and public key cryptography.

Unit-III **(8)**

Security Policies: Why policies should be developed? WWW policies, email security policies, policy review process, corporate policies, publishing and notification requirement of the policies.

Unit-IV **(8)**

Information Security Standards: ISO, IT act, copyright act, patent law, IPR, cyber laws in India, IT act 2000 provisions, **Intellectual Property Law:** Copy right law, software license, and patent law.

Unit-V **(6)**

Ethics: Ethical issues, issues in data and software privacy, cyber-crime types and overview of cyber-crimes.

Text Books:

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.

3. Sarika Gupta & Gaurav Gupta, “Information Security and Cyber Laws”, Khanna Publishing House Anshul Kaushik, Cyber Security, Khanna Publishing House.

Reference Books:

1. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, ”Introduction to Information Security and Cyber Law”, Willey Dreamtech Press.
2. Schou, Shoemaker, “Information Assurance for the Enterprise”, Tata McGraw Hill.
3. Chander, Harsh,” Cyber Laws and It Protection”, PHI Learning Private Limited, Delhi.
4. V.K. Jain, “Cryptography and Network Security”, Khanna Publishing House, Delhi.

MCA-301
COMPUTER NETWORK

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand basic computer network technology.
- **CO-2.** Identify the different types of network topologies and protocols.
- **CO-3.** Enumerate the layers of the OSI model and TCP/IP.
- **CO-4.** Understand the concept of IP addressing, subnetting and routing mechanisms.

Unit-I **(08)**

Introduction: Goals and applications of networks, network structure and architecture, the OSI reference model, services. **Network Topology Design**: Delay analysis, back bone design, local access network design, physical layer transmission media, switching methods, ISDN, and terminal handling.

Unit-II **(08)**

Medium Access Sub Layer: Medium access sub layer - channel allocations, LAN protocols - ALOHA protocols - overview of IEEE standards - FDDI. Data Link Layer - Elementary data link protocols, sliding window protocols, and error handling.

Unit-III **(08)**

Network Layer: Point to point networks, routing, and congestion control.
Internet Working: TCP / IP, IP packet, IP address, and IPv6.

Unit-IV **(08)**

Transport Layer: Transport layer design issues, connection management, session layer design issues, and remote procedure call. Presentation layer design issues, data compression techniques, and cryptography - TCP - window management.

Unit-V **(08)**

Application Layer: File transfer, access and management, electronic mail, virtual terminals, other application. Example networks - Internet and public networks.

Text Books:

1. Forouzen, "Data Communication and Networking", TMH.
2. A.S. Tanenbaum, “Computer Networks”, Pearson Education.
3. W. Stallings, “Data and Computer Communication”, Macmillan Press.

Reference Books:

1. AnuranjanMisra, “Computer Networks”, Acme Learning.
2. S. Keshav, “An Engineering Approach on Computer Networking”, Addison Wesley.
3. G. Shanmugarathinam,”Essential of TCP/ IP”, Firewall Media.

MCA- 302
DESIGN AND ANALYSIS OF ALGORITHM

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Learn about analyzing the complexity of algorithms.
- **CO-2.** Implementation of various sorting algorithm and their comparisons.
- **CO-3.** Understand the concept of advance data structure.
- **CO-4.** Analysis of various problem solved using Divide & Conquer and Greedy techniques
- **CO-5.** Implementation of Dynamic Programming concept in solving various problems.

Unit-I **(09)**

Introduction: Algorithms, analyzing algorithms, complexity of algorithms, growth of functions, performance measurements, sorting and order statistics - shell sort, quick sort, merge sort, heap sort, comparison of sorting algorithms, and sorting in linear time.

Unit-II **(06)**

Advanced Data Structures: Red-Black trees, B – trees, binomial heaps, and Fibonacci heaps.

Unit-III **(10)**

Design and Analysis Technique: Divide and conquer with examples such as sorting, matrix multiplication, convex hull and searching, greedy methods with examples such as optimal reliability allocation, Knapsack, minimum spanning trees – Prim's and Kruskal's algorithms, single source shortest paths – Dijkstra's and Bellman ford algorithms.

Unit-IV **(09)**

Dynamic Programming: Knapsack, all pair shortest paths – Floyd-Warshall algorithms, backtracking, branch and bound with examples such as travelling salesman problem, graph coloring, n-Queen problem, and sum of subsets problems.

Unit-V **(06)**

Selected Topics: String Matching, theory of NP-completeness, approximation algorithms, and randomized algorithms.

Text Books:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Printice Hall of India.
2. RCT Lee, SS Tseng, RC Chang and YT Tsai, "Introduction to the Design and Analysis of Algorithms", McGraw Hill, 2005.
3. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education, 2008.

Reference Books:

1. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",Galgotia Publication.

2. Berman, Paul," Algorithms", Cengage Learning.
3. Basse, "Computer Algorithms: Introduction to Design & Analysis", Addision Wesley.

MCA-303
SOFTWARE ENGINEERING CONCEPT

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand the basic concepts of software engineering.
- **CO-2.** Understand the requirement analysis and importance of SRS documentation.
- **CO-3.** Understand the design of software product.
- **CO-4.** Apply various software measures and metrics for estimation.
- **CO-5.** Understand various software testing techniques.

Unit-I **(09)**

Introduction: Software components, software characteristics, software crisis, software engineering processes, similarity and differences from conventional engineering processes, and software quality attributes. **SDLC Models:** Water fall model, prototype model, spiral model, evolutionary development models, iterative enhancement models, and agi1e software development model.

Unit-II **(08)**

Software Requirement Specifications: Requirement engineering process, elicitation, analysis, documentation, review and management of user needs, feasibility study, information modeling, data flow diagrams, entity relationship diagrams, decision tables, SRS document, and IEEE standards for SRS. **SQA:** Verification and validation, SQA plans, software quality frameworks, ISO 9000 models, and SEI-CMM model.

Unit-III **(08)**

Software Design: Basic concept, architectural design, low level design: modularization, design structure charts, pseudo codes, flow charts, coupling and cohesion measures, design strategies: function oriented design, object oriented design, top-down and bottom-up design.

Unit-IV **(07)**

Software Measurement and Metrics: Halestead's software science, function point (FP) based measures, and cyclomatic complexity measures: Control flow graphs. Constructive cost models (COCOMO).

Unit-V **(08)**

Software Testing: Testing objectives, unit testing, integration testing, acceptance and regression test, testing for functionality and performance. **Top-down and Bottom-up Testing Strategies:** test drivers and test stubs, structural testing (white box testing), functional testing (black box testing), test data suit preparation, alpha and beta testing of products, **Static Testing Strategies**: Formal technical reviews, walk through, code inspection, and compliance with design & coding standards.

Text Books:

1. R. S. Pressman, "Software Engineering: A Practitioners Approach", McGraw Hill.

2. Rajib Mall, “Fundamentals of Software Engineering”, PHI Publication.
3. Pankaj Jalote, “Software Engineering”, Wiley.

Reference Books:

1. K. K. Aggarwal and Yogesh Singh, “Software Engineering”, New Age International Publishers.
2. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, “Fundamentals of Software Engineering”, PHI Publication.
3. Ian Sommerville, "Software Engineering", Addison Wesley.

MCA-3041
ARTIFICIAL INTELLIGENCE

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COURSE OUTCOMES (COs)
After the completion of the course, students are expected to have the ability to:

CO-1. Understand how to apply knowledge representation techniques to common AI applications.

CO-2. Analyze a problem in hand and do the inference to identify the computing requirements that are essential to solve the problem.

CO-3. Understand the concepts related to Searching, reasoning and handling uncertainty.

CO-4. Understand the concept and type of learning.

CO-5. Understand the need and various component of expert system.

CO-6. Understand soft computing technologies like fuzzy logic, neural network etc.

Unit-I **(09)**
Scope of AI: Natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction. problem solving-state space search; production systems, search space control: Depth-first, breadth-first search, heuristic search - hill climbing, best-first search, branch and bound.

Unit-II **(09)**
Knowledge Representation: Predicate logic: Unification, modus pones, resolution, dependency directed backtracking. Rule based systems: forward reasoning: conflict resolution, backward reasoning: uses of no backtrack.

Unit-III **(07)**
Structured knowledge representation: Semantic nets- slots, exceptions and default frames, conceptual dependency, and scripts.

Unit-IV **(08)**
Handling Uncertainty: Non-monotonic reasoning, probabilistic reasoning, use of certainty factors, and fuzzy logic. **Learning:** Concept of learning, learning automation, genetic algorithm, learning by inductions, and neural nets.

Unit-V **(07)**
Expert Systems: Need and justification for expert systems, and knowledge acquisition, and component of an expert system.

Text Books:

1. E. Rich and K. Knight, “Artificial intelligence”, TMH.
2. N.J. Nilsson, “Principles of AI”, Narosa Publ. House.
3. Peter Jackson, “Introduction to Expert Systems”, AWP, M.A.

Reference Books:

1. D.W. Patterson, “Introduction to AI and Expert Systems”, PHI.
2. R.J. Schalkoff, “Artificial Intelligence - an Engineering Approach”, McGraw Hill Int Ed.
3. Charnick “Introduction to A.I.”, Addision Wesley.
4. Marcellous, “Expert System Programming”, PHI.
5. Elamie, “Artificial Intelligence”, Academic Press.
6. Lioyed, “Foundation of Logic Processing”, Springer Verlag.

MCA-3042
DATA WARE HOUSING AND DATA MINING

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Explore data warehouse and multi-dimensional data models.
- **CO-2.** Learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications. Gain insight into the challenges and limitations of different data mining technology.
- **CO-3.** Provide an overview of the methodologies and approaches to data mining.
- **CO-4.** Describe the various tasks of mining such as classification, clustering, association rule mining.

Unit-I **(08)**

Data Warehousing: Overview, definition, data warehousing components, building a data warehouse, warehouse database, mapping the data warehouse to a multiprocessor architecture, difference between database system and data warehouse, multi dimensional data model, data cubes, stars, snowflakes, fact constellations, concept hierarchy, process architecture, 3 tier architecture and data marting.

Unit-II **(08)**

Data Warehouse Process and Technology: Warehousing strategy, warehouse management and support processes, warehouse planning and implementation, hardware and operating systems for data warehousing, client/server computing model & data warehousing. Parallel processors & cluster systems, distributed DBMS implementations, warehousing software, warehouse schema design, data extraction, cleanup & transformation tools and warehouse metadata.

Unit-III **(07)**

Data Mining: Overview, definition & functionalities, data processing, form of data preprocessing, data cleaning: missing values, noisy data,(binning, clustering, regression, computer and human inspection),inconsistent data, data integration and transformation. Data reduction:-data cube aggregation, and dimensionality reduction.

Unit-IV **(10)**

Data Mining Techniques: Classification: definition, data generalization, analytical characterization, analysis of attribute relevance, mining class comparisons, statistical measures in large databases, statistical-based algorithms, distance-based algorithms, decision tree-based algorithms. Clustering: Introduction, similarity and distance measures, hierarchical and partitional algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method –Statistical Approach. Association rules: Introduction, large itemsets, basic algorithms, parallel and distributed algorithms and neural network approach.

Unit-V **(07)**

Data Visualization and Overall Perspective: Aggregation, historical information, query facility, OLAP function and tools. OLAP Servers, ROLAP, MOLAP, HOLAP, data mining interface, security, backup and recovery, tuning data warehouse, testing data warehouse. Warehousing

applications and recent Trends: Types of warehousing applications, web mining, spatial mining and temporal mining.

Text Books:

1. Alex Berson, Stephen J. Smith "Data Warehousing, Data-Mining & OLAP", TMH
2. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, " Data Warehousing: Architecture and Implementation", Pearson
3. Margaret H. Dunham, S. Sridhar, "Data Mining: Introductory and Advanced Topics" Pearson Education

Reference Books:

1. Arun K. Pujari, "Data Mining Techniques", Universities Press
2. Pieter Adriaans, Dolf Zantinge, "Data-Mining", Pearson Education
3. S. Prabhu, N. Venatesan, "Data Mining and Warehousing", New Age International Publisher.

MCA-3043
COMPILER DESIGN

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Ability to analyze & design grammars for different formal languages.
- **CO-2.** Determine the decidability and intractability of computational problems.
- **CO-3.** Identify different formal language and design the recognizer for regular languages to establish their applicability.
- **CO-4.** Apply concepts learned in various domains of compiler construction.
- **CO-5.** Students will be able to design compiler.

Unit-I **(08)**

Introduction: Introduction to compiler, phases and passes, bootstrapping, finite state machines and regular expressions and their applications to lexical analysis,, LEX-compiler, formal grammars and their application to syntax analysis, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees.

Unit – II **(09)**

Basic Parsing Techniques: Parsers, shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers. Automatic Construction of efficient Parsers: LR parsers, the canonical collection of LR(0) items, constructing SLR parsing tables, constructing canonical LR parsing tables, constructing LALR parsing tables using ambiguous grammars, an automatic parser generator, and implementation of LR parsing tables.

Unit -III **(08)**

Syntax-directed Translation: Syntax-directed translation schemes, implementation of syntax directed translators, intermediate code, postfix notation, parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, and translation with a top down parser.

Unit- IV **(07)**

Symbol Tables: Data structure for symbols tables, and representing scope information.
Run-Time Error Detection & Recovery: Lexical Phase errors, syntactic phase errors and semantic errors.

Unit- V **(08)**

Code Generation: Target Language, addresses in the target code, basic blocks and flow graphs, optimization of basic blocks, and code generator. **Code Optimization:** Machine-independent optimizations, loop optimization, and DAG representation of basic blocks.

Text Books:

1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education.
2. V Raghvan, " Principles of Compiler Design", TMH.

3. Kenneth Louden," Compiler Construction", Cengage Learning.

Reference Books:

1. K. Muneeswaran, "Compiler Design", First Edition,Oxford University Press.
2. J.P. Bennet, "Introduction to Compiler Techniques", Tata McGraw-Hill.
3. HenkAlblas, Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI.
4. Charles Fischer, Ricard LeBlanc,"Crafting a Compiler with C", Pearson Education.

MCA-3044
ADVANCED DATABASE MANAGEMENT SYSTEM

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Learn fundamental concept of Query Processing and query optimization.
- **CO-2.** Understand about extended relational model and object Oriented Database System.
- **CO-3.** Explore advanced transaction models and issues in real time database design.
- **CO-4.** Understand the concept of Expert and Fuzzy Database System.

Unit-I **(08)**

Query Processing, Optimization and Database Tuning: Algorithms for executing query operations, heuristics for query optimizations, estimations of query processing cost, join strategies for parallel processors, database workloads, tuning decisions, DBMS benchmarks, clustering and indexing, multiple attribute search keys, query evaluation plans, pipelined evaluations, and system catalogue in RDBMS.

Unit-II **(08)**

Extended Relational Model and Object Oriented Database System: New data types, user defined abstract data types, structured types, object identity, containment, class hierarchy, logic based data model, data log, nested relational model and expert database system.

Unit-III **(08)**

Distributed Database System: Structure of distributed database, data fragmentation, data model, query processing, semi join, parallel and pipeline join, distributed query processing in R * System, concurrency control in distributed database system, recovery in distributed database system, distributed deadlock detection and resolution, and commit protocols.

Unit-IV **(08)**

Enhanced Data Model for Advanced Applications: Database operating system, introduction to temporal database concepts, spatial and multimedia databases, data mining, active database system, deductive databases, database machines, web databases, advanced transaction models, and issues in real time database design.

Unit-V **(08)**

Expert Database and Fuzzy Database System: Expert databases: Use of rules of deduction in databases, recursive rules. Fuzzy Databases: Fuzzy set & fuzzy logic, use of fuzzy techniques to define inexact and incomplete databases.

Text Books:

1. Korth, Silbertz, Sudarshan, "Database Concepts", Mcgraw Hill.
2. Elmasri, Navathe, "Fundamentals of Database Systems", Addison Wesley.

3. Ceri and Palgatti, “Distributed Databases”, McGraw Hill.

Reference Books:

1. Majumdar and Bhattacharya, “Database Management System”, TMH.
2. Data C J, “An Introduction to Database System”, Addison Wesley.
3. Ramakrishnan, Gehrke, “Database Management System”, Mcgraw Hill.
4. Bernstein, Hadzilacous, Goodman, “Concurrency Control and Recovery”, AddisonWesley.

MCA-3045
CLOUD COMPUTING

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand the concept of cloud computing and types of clouds.
- **CO-2.** Explore various types of cloud services.
- **CO-3.** Understand about collaboration and virtualization of cloud.
- **CO-4.** Learn various securities related challenges and standards in cloud computing.

Unit-I **(08)**

Introduction: Cloud-definition, benefits, usage scenarios, history of cloud computing, cloud architecture. Types of Clouds - Business models around clouds, major players in cloud computing, issues in clouds, eucalyptus, nimbus, open nebula, and cloud sim.

Unit-II **(08)**

Cloud Services: Types of cloud services: software as a service, platform as a service, infrastructure as a service, database as a service, monitoring as a service, and communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, and sales force.

Unit-III **(08)**

Collaborating using Cloud Services: Email communication over the cloud, CRM management, project management, event management, task management, calendar, schedules, word processing, presentation**,** spreadsheet, databases, desktop, social networks and groupware.

Unit-IV **(08)**

Virtualization for Cloud: Need for virtualization, pros and cons of virtualization, types of virtualization, system VM, process VM, virtual machine monitor, virtual machine properties, interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, and Hyper-V.

Unit-V **(08)**

Security, Standards and Applications: Security in Clouds: Cloud security challenges, software as a service security, common standards: the open cloud consortium, the distributed management task force, standards for application developers, standards for messaging, standards for security, end user access to cloud computing, mobile internet devices and the cloud.

Text Books:

1. John Rittinghouse & James Ransome, "Cloud Computing, Implementation, Management and Strategy", CRC Press.

2. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate", Que Publishing.

3. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers.

Reference Books:

1. David E.Y. Sarna Implementing and Developing Cloud Application, CRC press.

2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation.

3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing : A Practical Approach, Tata McGraw-Hill.

MCA-3051
DISTRIBUTED SYSTEM

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Learn architecture and limitation of distributed system.
- **CO-2.** Explore the concept of distributed deadlock.
- **CO-3.** Understand various agreement protocols and classification of agreement problems.
- **CO-4.** Learn working of distributed shared memory and issues in designing distributed system.

Unit-I **(08)**

Introduction: Introduction, system architecture, issues in distributed system; global knowledge, naming, scalability, compatibility, process synchronization, security, and theoretical foundation for distributed systems. **Limitations:** Absence of global clock and shared memory, Lamport's logical clock, vector clocks, causal ordering of messages, global state, and termination detection.

Unit-II **(10)**

Distributed Mutual Exclusion: Introduction, classification of mutual exclusion algorithms, requirement of mutual exclusion algorithms, non-token based and token based algorithms, and comparative performance analysis. **Distributed Deadlock Detection:** System model, resource vs communication deadlock, deadlock handling strategies: deadlock prevention, deadlock avoidance, deadlock detection and resolution, centralized and distributed deadlock detection algorithms.

Unit-III **(08)**

Agreement Protocols: Introduction, system model. **Classification of Agreement Problem:** Byzantine agreement problem, consensus problem, interactive consistency problem, solution to byzantine agreement problem, and application of agreement problem.

Unit-IV **(06)**

Distributed File Systems: Introduction, architecture. Building mechanism: Mounting caching, hints, bulk data transfer, and encryption. Design issues: Naming and name resolution, caches on disk or main memory, and writing policy.

Unit-V **(08)**

Distributed Shared Memory: Introduction, architecture and motivation, algorithm for implementing DSM, memory coherence, and coherence protocols.

Distributed Scheduling: Issues in load distribution, component of load distribution algorithms, and load distribution algorithms, performance comparison, task migration introduction to fault tolerance, data security, encryption, and multiprocessor operating systems.

Text Books:

1. Tenanuanbaum, Steen," Distributed Systems", PHI.
2. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson.

3. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill.

Reference Books:

1. Ramakrishna, Gehrke," Database Management Systems", McGraw Hill.
2. Vijay K. Garg, "Elements of Distributed Computing", Wiley.
3. Gerald Tel, "Distributed Algorithms", Cambridge University Press.

MCA-3052
WEB TECHNOLOGY

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand the knowledge of the internet and related internet concepts that are vital in understanding web application development.
- **CO-2.** Analyze and apply the role of mark up languages like HTML, DHTML, and XML in the workings of the web and web applications.
- **CO-3.** Programming web pages with JavaScript.
- **CO-4.** Design and implementation of build dynamic web pages using client side programming Java Script and also develop the web application using servlet and JSP.

Unit-I **(08)**

Introduction: Introduction to web, protocols governing the web, web development strategies, web applications, web project, and web team.

Unit-II **(08)**

HTML: List, table, images, frames, forms, and CSS.

Unit-III **(08)**

XML: TAGS, DTD, XML schemes, presenting and using XML.

Unit -IV **(08)**

Java Script: Introduction, documents, forms, statements, functions, objects, event and event handling, introduction to AJAX, VB Script, and CGI.

Unit -V **(08)**

Server Site Programming: Introduction to active server pages (ASP), ASP.NET, java server pages (JSP), JSP application design, tomcat server, JSP objects, declaring variables and methods, debugging, and sharing data between JSP pages.

Text Books:

1. Xavier, C, "Web Technology and Design", New Age International.
2. Ivan Bayross, " HTML, DHTML, Java Script, Perl & CGI", BPB Publication.
3. Jackson, "Web Technologies" Pearson Education.

Reference Books:

1. Deitel, "Java for programmers", Pearson Education.
2. Ramesh Bangia, "Internet and Web Design", New Age International.
3. Patel and Barik, "Introduction to Web Technology & Internet", Acme Learning.

MCA-3053
MANAGEMENT INFORMATION SYSTEM

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

CO-1. Understand fundamental of information system.
CO-2. Visualize structure of management information system & decision support system.
CO-3. Learn various business application of information system.
CO-4. Explore ERP, supply chain management and CRM based information system.

Unit-I **(08)**

Foundation of Information Systems: Introduction to information system in business, fundamentals of information systems, solving business problems with information systems, types of information systems, effectiveness and efficiency criteria in information system.

Unit-II **(08)**

An Overview of Management Information Systems: Definition of a management information system, MIS versus data processing, MIS & decision support systems, MIS & information resources management, end user computing, concept of an MIS, and structure of a management information system.

Unit-III **(08)**

Concepts of Planning: Concept of organizational planning, the planning process, computational support for planning, characteristics of control process, and the nature of control in an organization.

Unit-IV **(08)**

Business Applications of Information Technology: Internet & electronic commerce and its applications enterprise solutions, information system for business operations(SDLC), information system for strategic advantage, decision support systems and its benefits and characteristics.

Unit-V **(08)**

Managing Information Technology: Enterprise & global management, security & ethical challenges, planning & implementing changes. **Advanced concepts in information systems:** Enterprise resource planning, supply chain management, customer relationship management, and procurement management.

Text Books:

1. Brian, "Management Information System", TMH.
2. Gordon B. Davis & Margrethe H. Olson, "Management Information System", TMH.
3. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.

Reference Books:-

1. Murdick, "Information System for Modern Management", PHI.
2. Jawadekar, "Management Information System", TMH.

MCA-3054

CLIENT SERVER COMPUTING

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand fundamental concept of client server computing & its advantages.
- **CO-2.** Explore various component of client server application.
- **CO-3.** Learn the working principle of RPC, dynamic data exchange & COBRA.
- **CO-4.** Explore various traditional paradigms for distributed computing and its implementation mechanism.

Unit-I **(08)**

Client/Server Computing: Client server architecture, mainframe-centric client server computing, downsizing and client server computing, and advantages of client server computing.

Unit-II **(08)**

Components of Client/Server Application: The client services, request for services, RPC, dynamic data exchange (DDE), common object request broker architecture (CORBA). The server: Detailed server functionality, the network operating system, available platforms, and the network operating system.

Unit-III **(08)**

Client/Server Network: Connectivity, communication interface technology, interposes communication, wide area network technologies, and network topologies (token ring, ETHERNET, FDDI, CDDI) network management.

Unit-IV **(08)**

Client Server Systems Development: Services and support, system administration, availability, reliability, serviceability, software distribution, performance, network management, and remote systems management security.

Unit-V **(08)**

Traditional paradigms for distributed computing: Web Services, Grid standards: OGSA and WSRF, Case Studies of Cluster Systems: Beowulf, COMPaS, NanOS and PARAM.

Text Book:

1. Dawna Travis Dewire, “Client/Server Computing”, TMH.
2. Shiva Sharma , "A Glimpse into Client/Server Computing", katson publication.
3. Patrick Smith & Steave Guengerich, “Client / Server Computing”, PHI

Reference Books:

1. Doug Lowe, "Client/server Computing for Dummies", IDG Books Worldwide.
2. Devendra Kumar, "Client Server Computing", Global Vision Publishing House.

MCA-3055

SIMULATION AND MODELING

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Explore concept of continuous & discrete system.
- **CO-2.** Understand simulation techniques and comparison of simulation & analytical methods.
- **CO-3.** Understand & visualize modeling and simulation of various types of system.
- **CO-4.** Learn basics of SIMSCRIPT, modeling and simulation through it.

Unit-I **(08)**

Introduction: System definition and components, stochastic activities, continuous and discrete systems, system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, and types of system study.

Unit-II **(08)**

Simulation: System simulation, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, distributed lag models, and cobweb model.

Unit-III **(09)**

Modeling: Simulation of continuous systems, analog vs. digital simulation, simulation of water reservoir system, simulation of a servo system, simulation of an autopilot, discrete system simulation, fixed time-step vs. even to even model, generation of random numbers, test for randomness, and Monte-Carlo computation vs. stochastic simulation.

Unit-IV **(08)**

Models: System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, and system dynamic diagrams.

Unit-V **(07)**

Introduction to SIMSCRIPT: Program, system concepts, origination and statements, defining the telephone system model.

Text Books:

1. Gordon G., "System Simulation", PHI.
2. Law A.M., Kelton W.D., "Simulation Modeling and Analysis", McGraw Hill.
3. V P Singh, "System Modeling and simulation", New Age International.

Reference Books:

1. Deo N., "System Simulation with Digital Computers", Prentice Hall of India
2. Jerry Banks, John S. C Barry, L. Nelson, David M. Nicol, "Discrete Event System Simulation", Pearson Education.

MCA-4011
SOFT COMPUTING

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Learn about soft computing techniques and their applications.
- **CO-2.** Analyze various neural network architecture.
- **CO-3.** Gain knowledge about fuzzy systems and its industrial applications.
- **CO-4.** Analyze the genetic algorithms and their applications.

Unit-I **(8)**

Neural Network-I (Introduction & Architecture): Neuron, nerve structure and synapse, artificial neuron and its model, activation functions, neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; Perception and convergence rule, auto-associative and hetro-associative memory.

Unit-II **(8)**

Neural Network-II (Back Propagation Networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model, back propagation learning methods, effect of learning rule co-efficient , back propagation algorithm, factors affecting back propagation training and applications.

Unit-III **(8)**

Fuzzy Logic-I (Introduction): Basic concepts of fuzzy logic, fuzzy sets and crisp sets, fuzzy set theory and operations, properties of fuzzy sets, fuzzy and crisp relations and fuzzy to crisp conversion.

Unit-IV **(8)**

Fuzzy Logic –II (Fuzzy Membership, Rules): Membership functions, interference in fuzzy logic, fuzzy if-then rules, fuzzy implications and fuzzy algorithms, fuzzification & defuzzification, fuzzy controller and industrial applications.

Unit-V **(8)**

Genetic Algorithm: Basic concepts, working principle, procedures and flowchart of genetic algorithm, genetic representations, initialization and selection, genetic operators, mutation, generational cycle and applications.

Text Books:

1. SarojKaushik, SunitaTiwari, “Soft Computing”, McGraw Hill.
2. Sivanandam, Deepa, “Principles of Soft Computing”, Wiley.
3. Melanic Mitchell, “An Introduction to Genetic Algorithm”, MIT Press.

Reference Books:

1. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Wiley.

2. Simon Haykin, “Neural Networks and Learning Machines”, PHI.
3. Kumar Satish, “Neural Networks”, Tata McGraw Hill.

MCA-4012

CRYPTOGRAPHY & NETWORK SECURITY

L T P
3 1 0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Learn the basic concepts of security threats, mechanisms, symmetric cryptography.
- **CO-2.** Analytical understanding modern block cipher and public key encryption techniques analysis.
- **CO-3.** Understanding the concept of Hash functions and Digital Signature algorithms.
- **CO-4.** Applying the knowledge to authentication applications such as Kerberos & Mailing application.

Unit-I **(08)**

Introduction and Mathematical Foundations: Group, field, finite field of the form GF(p), modular arithmetic, prime and relative prime numbers, extended Euclidean algorithm, modular arithmetic, overview on modern cryptography, number theory, probability and information theory. **Introduction to Security:** Attacks, services & mechanisms, security, attacks, and security services. **Classical Cryptosystems:** Classical cryptosystems, cryptanalysis of classical cryptosystems, Shannon's Theory: I, II, and III.

Unit-II **(08)**

Symmetric Key Ciphers: Symmetric key ciphers, modern block ciphers (DES), modern block cipher (AES), block cipher design principles, and block cipher modes of operation. **Cryptanalysis of Symmetric Key Ciphers:** Linear cryptanalysis, differential cryptanalysis, other cryptanalytic techniques, overview on S-BOX design principles and modes of operation of block ciphers.

Unit-III **(08)**

Conventional Encryption Algorithms: Triples DES, blowfish, international data encryption algorithm, RCS, CAST-128, RC2 placement & encryption function, key distribution, random number generation, placement of encryption function, Fermat's & Euler's Theorem, the Chinese remainder theorem, discrete logarithmic problem. **Public Key Encryption:** Principles of public-key cryptosystems, RSA algorithm, key management, and Diffie-Hellman Key Exchange. **Modern Asymmetric Key Cryptography:** Elliptic curve based cryptography: I and II.

Unit-IV **(08)**

Hash Functions: Message authentication & hash functions: authentication requirements, authentication functions, message authentication codes, hash functions, birthday attacks, security of hash function &MACS, MD5 message digest algorithm, and secure hash algorithm (SHA). **Digital Signatures:** Digital signatures, authentication protocol, digital signature standard (DSS) and proof of digital signature algorithm.

Unit-V **(08)**

Network & System Security: Authentication applications: Kerberos X.509, directory authentication service, electronic mail security, pretty good privacy (PGP), and S/MIME, **Security**: architecture, authentication header, encapsulating security payloads, combining security associations, and key

management, **Web Security:** Secure socket layer & transport layer security, and secure electronic transaction, **System Security:** Intruders, viruses, firewall design principles and trusted systems.

Text Books

1. William Stallings, "Cryptography and Network Security: Principles and Practice" Prentice Hall.
2. Johannes A. Buchmann, "Introduction to Cryptography", Springer Verlag.
3. Atul Kahate , “Cryptography and Network Security” , TMH.

Reference Books

1. Bruce Schiener, "Applied Cryptography: Protocols, Algorithms, and Source Code in C", Wiley.
2. Douglas Stinson, "Cryptography Theory and Practice", Chapman & Hall/CRC.
3. B. A. Forouzan, "Cryptography & Network Security", Tata McGraw Hill.

MCA-4013
SOFTWARE PROJECT MANAGEMENT

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Successful development of the project's procedures of initiation, planning, execution, regulation and closure.
- **CO-2.** Guidance of the project team's operations towards achieving all the agreed upon goals within the set scope, time, quality and budget standards.
- **CO-3.** Project plans that address real-world management challenges.
- **CO-4.** Develop the skills for tracking and controlling software deliverables.
- **CO-5.** Understand about software quality assurane and testing.
- **CO-6.** Explore various software project management tools.

Unit-I **(08)**

Introduction and Software Project Planning: Fundamentals of software project management (SPM), need identification, vision and scope document, project management cycle, SPM objectives, management spectrum, SPM framework, software project planning, planning objectives, project plan, types of project plan, structure of a software project management plan, software project estimation, estimation methods, estimation models, and decision process.

Unit-II **(08)**

Project Organization and Scheduling: Project elements, work breakdown structure (WBS), types of WBS, functions, activities and tasks, project life cycle and product life cycle, ways to organize personnel, project schedule, scheduling objectives, building the project schedule, scheduling terminology and techniques, **Network Diagrams:** PERT, CPM, Bar charts, Milestone charts, and Gantt charts.

Unit-III **(08)**

Project Monitoring and Control: Dimensions of project monitoring & control, earned value analysis, earned value indicators: budgeted cost for work scheduled (BCWS), cost variance (CV), schedule variance (SV), cost performance index (CPI), schedule performance index (SPI), interpretation of earned value indicators, error tracking, software reviews, types of review: inspections, desk checks, walkthroughs, code reviews, and pair programming.

Unit-IV **(08)**

Software Quality Assurance and Testing: Testing objectives, testing principles, test plans, test cases, types of testing, levels of testing, test strategies, program correctness, program verification & validation, testing automation & testing tools, concept of software quality, software quality attributes, software quality metrics and indicators, the SEI capability maturity model (CMM), SQA activities, formal SQA approaches: proof of correctness, statistical quality assurance, and clean room process.

Unit-V **(08)**

Project Management and Project Management Tools: Software configuration management: software configuration items and tasks, baselines, plan for change, change control, change requests

management, version control, risk management: risks and risk types, risk breakdown structure (RBS), risk management process: risk identification, risk analysis, risk planning, risk monitoring, cost benefit analysis, software project management tools: CASE tools, planning and scheduling tools, and MS-project.

Text Books

1. M. Cotterell, "Software Project Management", Tata McGraw Hill Publication.
2. S. A. Kelkar, "Software Project Management", PHI Publication.
3. Hughes B., Cotterell M., Mall R., "Software Project Management", McGraw Hill Publishing Company.

Reference Books

1. Royce, "Software Project Management", Pearson Education.
2. Kieron Conway, "Software Project Management", Dreamtech Press.
3. Robert K. Wysocki, "Effective Software Project Management", Wiley.

MCA-4014
DATA ANALYTICS

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand concepts of Big data, neural networks and fuzzy logic.
- **CO-2.** Understand the statistical concepts used for sampling distributions.
- **CO-3.** Learn different types of modeling techniques for data analysis.
- **CO-4.** Learn about different frameworks used for data processing.

Unit-I **(08)**

Introduction to Big Data: Introduction to big data platform, challenges of conventional systems, web data, evolution of analytic scalability, analytic processes and tools, analysis vs reporting - modern data analytic tools. **Statistical Concepts:** Sampling distributions, resampling, statistical inference and prediction error.

Unit-II **(08)**

Data Analysis: Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods. **Analysis of Time Series:** Linear systems analysis, nonlinear dynamics, rule induction. **Neural Networks:** Learning and generalization, competitive learning, principal component analysis and neural networks.

Fuzzy Logic: Extracting fuzzy models from data, fuzzy decision trees and stochastic search methods.

Unit-III **(08)**

Mining Data Streams: Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, real-time analytics platform(RTAP) applications, case studies, real time sentiment analysis and stock market predictions.

Unit-IV **(08)**

Frequent Item Sets and Clustering: Mining frequent item sets, market based model, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent item sets in a stream, clustering techniques, hierarchical, K- means, clustering high dimensional data, CLIQUE and PROCLUS, frequent pattern based clustering methods, clustering in Non-Euclidean space, clustering for streams and parallelism.

Unit-V **(08)**

Frameworks and Visualization: Map reduce, Hadoop, Hive, Map-R, sharding, NoSQL databases, S3, Hadoop distributed file systems, visualizations , visual data analysis techniques, interaction techniques and systems and applications.

Text Books:

1. A. Rajaraman and J. David Ullman, "Mining of Massive Datasets", Cambridge University Press.
2. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers.

3. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers.

Reference Books:

1. DietmarJannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press.
2. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press.
3. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with Map Reduce", Synthesis Lectures on Human Language Technologies, Morgan Claypool publishers.

MCA-4015
BIG DATA

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Explore the fundamental concept of big data and its application areas.
- **CO-2.** Understand working of NoSQL and its data management concept.
- **CO-3.** Understand the concept of Hadoop, Hadoop streaming, and design of Hadoop distributed file system.
- **CO-4.** Explore various Hadoop related tools and their working.

Unit-I **(08)**

Understanding Big Data: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data ,credit risk management, big data and algorithmic trading, big data and health Care, big data in medicine, advertising and big data, big data technologies, introduction to hadoop, open source technologies, cloud and big data mobile business intelligence, crowd sourcing analytics ,inter and trans firewall analytics.

Unit-II **(08)**

NoSQL Data Management: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases ,materialized views, distribution models ,sharing , masters slave replication , peer-peer replication , sharing and replication , consistency , relaxing consistency , version stamps , map reduce , partitioning and combining and composing map-reduce calculations.

Unit-III **(08)**

Basics of Hadoop: Dataformat, analyzing data with hadoop, scaling out , hadoop streaming , hadoop pipes , design of hadoop distributed file system (HDFS) , HDFS concepts , Java interface , data flow ,hadoop I/O , data integrity , oppression ,serialization and avro file-based data structures.

Unit-IV **(08)**

Map Reduce Applications: mapReduce workflows, UNIT tests with MR UNIT, test data and local tests – anatomy of Map Reduce job run , classic Map-reduce , YARN , failures in classic Map-reduce and YARN , job scheduling , shuffle and sort , task execution , MapReduce types , input formats and output formats.

Unit-V **(08)**

Hadoop Related Tools: HBase, data model and implementations, Hbase clients, Hbase examples – praxis, cassandra, cassandra data model, cassandra examples , cassandra clients , hadoopintegration.pig , grunt , pig data model , Pig Latin , developing and testing PigLatin scripts. Hive, data types and file formats, HiveQL data definition and HiveQL data manipulation – HiveQL queries.

Text Books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging

Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional.

Reference Books:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley.
2. V.K. Jain, “Big Data & Hadoop”, Khanna Publishing House.

MCA-4021
MACHINE LEARNING

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Design and implement machine learning solutions to classification, regression, and clustering problems.
- **CO-2.** Evaluate and interpret the results of the algorithms.
- **CO-3.** Explore computational learning theories and illustrate example of genetic algorithms.

Unit-I **(08)**

Introduction: Well defined learning problems, designing a learning system, issues in machine learning; the concept learning task - general-to-specific ordering of hypotheses, find-S, list then eliminate algorithm, candidate elimination algorithm and inductive bias.

Unit-II **(08)**

Decision Tree Learning: Decision tree learning algorithm-inductive bias- issues in decision tree learning; artificial neural networks – perceptrons, gradient descent and the delta rule, adaline, multilayer networks, derivation of back-propagation rule, back-propagation algorithm, convergence and generalization.

Unit-III **(08)**

Evaluating Hypotheses: Estimating hypotheses accuracy, basics of sampling theory, and comparing learning algorithms. Bayesian learning: Bayes theorem, concept learning, Bayes optimal classifier, Naïve Bayes classifier, Bayesian belief networks and EM algorithm.

Unit-IV **(08)**

Computational Learning Theory: Sample complexity for finite hypothesis spaces, sample complexity for infinite hypothesis spaces, the mistake bound model of learning; instance-based learning – k-nearest neighbor learning, locally weighted regression, radial basis function networks and case-based learning.

Unit-V **(08)**

Genetic Algorithms: An illustrative example, hypothesis space search, genetic programming, models of evolution and learning; learning first order rules-sequential covering algorithms general to specific beam search-foil; reinforcement learning - the learning task and Q learning.

Text Books:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited.
2. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press.

Reference Books:

1. Bishop, C., “Pattern Recognition and Machine Learning”. Berlin: Springer-Verlag.
2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press.

MCA-4022
INTERNET OF THINGS

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand the application areas of IOT.
- **CO-2.** Understand building blocks of Internet of Things and characteristics.
- **CO-3.** Understand about radio frequency identification technology.
- **CO-4.** Learn resource management, privacy and security in IOT.

Unit-I **(08)**

Introduction: Internet of thing, history of IoT, about IoT, overview and motivations, examples of applications, internet of things definitions and frameworks: IoT definitions, IoT architecture, general observations, ITU-T views, working definition, IoT frameworks and basic nodal capabilities.

Unit-II **(08)**

Fundamentals of IoT Mechanisms and Key Technologies: Identification of IoT objects and services, structural aspects of the IoT, environment characteristics, traffic characteristics, scalability, interoperability, security and privacy, open architecture, key IoT technologies, device intelligence, communication capabilities, mobility support, device power, sensor technology, RFID technology and satellite technology.

Unit-III **(08)**

Radio Frequency Identification Technology: RFID introduction, principle of RFID, components of an RFID system, issues EPC global architecture framework- EPCIS & ONS, design issues, technological challenges, security challenges, IP for IoT, and web of things. **Wireless Sensor Networks:** History and context, WSN architecture, the node, connecting nodes, networking nodes, securing communication WSN specific IoT applications, challenges- security, QoS, configuration, various integration approaches, data link layer protocols, routing protocols and infrastructure establishment.

Unit-IV **(08)**

Resource Management in The Internet of Things: Clustering, software agents, clustering principles in an internet of things, architecture, design guidelines, and software agents for object representation, data synchronization, identity portrayal, identity management, various identity management models- local, network, federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, identity and trust.

Unit-V **(08)**

Internet of Things Privacy, Security and Governance: Vulnerabilities of IoT, security requirements, threat analysis, use cases and misuse cases, IoT security tomography and layered attacker model, identity establishment, access control, message integrity, non-repudiation, availability and security model for IoT.

Text Books:

1. A. Bahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press.
2. Matt Richardson, S. Wallace, “Getting Started with Raspberry Pi”, O'Reilly (SPD).

3. Olivier Hersent, D. Boswarthick, O.Elloumi, “The Internet of Things: Key Applications and Protocols”, Willy Publications.

Reference Books:

1. D. Uckelmann, M. Harrison, Michahelles, Florian , “Architecting the Internet of Things”, Springer.
2. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press.
3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stamatis ,Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier.

MCA-4023
PATTERN RECOGNITION

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Explain and define concepts of pattern recognition.
- **CO-2.** Explain and distinguish procedures, methods and algorithms related to pattern recognition.
- **CO-3.** Apply methods of pattern recognition for new complex applications.
- **CO-4.** Analyze and breakdown problem related to the complex pattern recognition system.

Unit-I **(08)**

Introduction: Basics of pattern recognition, design principles of pattern recognition system, learning and adaptation, pattern recognition approaches, mathematical foundations – linear algebra, probability theory, expectation, mean and covariance, normal distribution, multivariate normal densities and chi squared test.

Unit-II **(08)**

Statistical Patten Recognition: Bayesian decision theory, classifiers, normal density and discriminant functions.

Unit-III **(08)**

Parameter Estimation Methods: Maximum-likelihood estimation, Bayesian parameter estimation, imension reduction methods - principal component analysis (PCA), fisher linear discriminant analysis, expectation-maximization (EM), hidden markov models (HMM) and gaussian mixture models.

Unit-IV **(08)**

Nonparametric Techniques: Density estimation, parzen windows, k-nearest neighbor estimation, nearest neighbor rule and fuzzy classification.

Unit-V **(08)**

Unsupervised Learning & Clustering: Criterion functions for clustering, clustering techniques: iterative square – error partitioned clustering – k means, agglomerative hierarchical clustering and cluster validation.

Text Books:

1. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer.
2. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", Academic Press.
3. Narasimha Murty, "Pattern Recognition", Universities Press.

Reference Books:

1. Gose, Johnson baugh & Jost, "Pattern Recognition and Image Analysis", PHI Learning
2. Shinghal, "Pattern Recognition: Techniques and applications", Oxford University Press.

MCA-4024
DIGITAL IMAGE PROCESSING

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand the fundamentals of a digital image processing system.
- **CO-2.** Analyze images in spatial and frequency domain.
- **CO-3.** Understand and analyze the techniques for image enhancement and restoration.
- **CO-4.** Understanding and implementation of morphological image processing.
- **CO-5.** Interpret Image compression standards, image segmentation and representation techniques.

Unit-I **(08)**

Introduction: Fundamental steps in digital image processing, components of an image processing system, sampling and quantization, representing digital images (data structure), some basic relationships between pixels- neighbors and connectivity of pixels in image, applications of image processing: medical imaging, robot vision, character recognition and remote sensing.

Unit-II **(08)**

Image Enhancement in the Spatial Domain: Some basic gray level transformations, histogram processing, enhancement using arithmetic/logic operations, basics of spatial filtering, smoothing spatial filters, sharpening spatial filters and combining spatial enhancement methods.

Unit-III **(08)**

Image Enhancement in frequency Domain: Introduction, Fourier transform, discrete Fourier transform (DFT), properties of DFT, discrete cosine transform (DCT) and image filtering in frequency domain.

Unit-IV **(08)**

Image Segmentation: Introduction, detection of isolated points, line detection, edge detection, edge linking, and region based segmentation- region growing, split and merge technique, local processing, regional processing, hough transform and segmentation using threshold.

Unit-V **(08)**

Image Compression: Introduction, coding redundancy, inter-pixel redundancy, image compression model, lossy and lossless compression, Huffman coding, arithmetic coding, LZW coding, transform coding, sub-image size selection, blocking, DCT implementation using FFT and run length coding.

Text Books:

1. Rafael C G., Woods R E. and Eddins S L, "Digital Image Processing", Prentice Hall.
2. William K Pratt, "Digital Image Processing", PIKS Scientific Inside.
3. Jayaraman S, "Digital Image Processing", TMH.

Reference Books:

1. Milan Sonka, "Image Processing, analysis and Machine Vision", Thomson Press India Ltd.
2. Anil K. Jain "Fundamentals of Digital Image Processing", Prentice Hall of India.
3. S. Sridhar, "Digital Image Processing", Oxford University Press.

MCA-4025
SYSTEM ANALYSIS AND DESIGN

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Understand the concept of information system & its needs.
- **CO-2.** Learn various steps involve in system development life cycle.
- **CO-3.** Understand strategies for determination of information requirment and project intimation.
- **CO-4.** Learn working of various structural analysis tools.
- **CO-5.** Understand concept of feasiblility study & steps in feasibility analysis.

Unit-I **(8)**

System Concepts and Information Systems Environment: The system concept: definition, characteristics of systems, elements of a system, open and closed systems, formal and informal information systems, and computer based information systems, management information systems, decision support system, general business knowledge, and interpersonal communicational system.

Unit-II **(8)**

The System Development Life Cycle: Recognition of needs, impetus for system change, feasibility study, analysis, design, implementation, post implementation and maintenance. **The Role of the Systems Analyst:** Historical perspective, the war effort, what does it take to do system analysis, academic & personal qualifications, the multifaceted role of the analyst, the analyst/user interface, and behavioral issues.

Unit-III **(8)**

Systems Planning & Initial Investigation: Strategies for determining information requirement, problem definition & project initiation, background analysis, fact analysis, review of written documents, onsite observations, interviews & questionnaires, fact analysis, performance analysis, efficiency analysis, and service analysis.

Unit-IV **(8)**

Information Gathering: What Kind of Information do we need? Information about the firms, information gathering tools, the art of interviewing, arranging the interview, guides to a successful interview, types of interviews and questionnaires, the structured and unstructured alternatives. **The Tools of Structured Analysis:** Dataflow diagram (DFD), data dictionary, decision trees, and structured English.

Unit-V **(8)**

Feasibility Study: System performance, economic feasibility, technical feasibility, behavioral feasibility, steps in feasibility analysis. H/W & S/W selection and maintenance: the computer industry, S/W industry, a procedure for H/W & S/W selection, major phases in selection, criteria for S/W selection, and the computer contract.

Text Books

1. Awad E. M., “Systems Analysis & Design”, Galgotia Publication.
2. Mansoor A., “System Analysis & Design”, Pragya Publication.
3. Kenneth E. Kendall and Julie E. Kendall, “Systems Analysis and Design”, Pearson.

Reference Books

1. Hawryszkiewyez I., “System Analysis & Design”, PHI.
2. Brijendra Singh, “System Analysis & Design”, New Age International Publishers.
3. Jeffrey L. Whitten and Lonnie D Bentley, “Systems Analysis and Design”, McGraw Hill.

MCA-4031
MOBILE COMPUTING

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Explain the principles and theories of mobile computing technologies.
- **CO-2.** Describe infrastructures and technologies of mobile computing technologies.
- **CO-3.** Learn the concept of cellular network and GSM.
- **CO-4.** List applications in different domains that mobile computing offers to the public, employees, and businesses.
- **CO-5.** Understand the concept Ad-hoc Network and Routing Protocols
- **CO-6.** Explore the basic concept of android application development.

Unit-I **(08)**

Introduction to Mobile Communications and Computing: Introduction to mobile computing, applications, limitations, and architecture.

Cellular Overview: Cellular networks, cellular concept, channel allocation, location management, and handoff.

GSM: Air-interface, mobile services, and system architecture: radio subsystem, network and switching subsystem, operation subsystem, protocols: localization, calling, and handover.

Unit-II **(08)**

Wireless LANs and Application: WLAN, wireless standards, wireless LAN, infrared vs radio transmission, infrastructure networks, adhoc networks, wireless applications, MAC issues, and mobile IP.

Wireless Application Protocol: Architecture, protocol stack, and application environment.

Access Technologies: Bluetooth, GPRS, 802.11, and CDMA.

Mobile Phone Technologies: 1G, 2G, 2.5G, 3G, and 4G.

Unit-III **(08)**

Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Unit-IV **(08)**

Mobile Ad-Hoc Networks (MANET): Characteristics, performance issues, TCP issues, disconnected operations, data broadcasting, mobile agents, and routing in mobile hosts.

Routing Protocols: Global state routing (GSR), destination sequenced distance vector routing (DSDV), dynamic source routing (DSR), ad hoc on demand distance vector routing (AODV), and temporary ordered routing algorithm (TORA), QoS in ad hoc networks, and applications.

Unit-V **(08)**

Platform/Operating Systems for Application Development: Introduction to palm OS, windows CE, embedded Linux, J2ME, and Symbian.

Android Application Development: Overview of android, devices running android, development tools for android, features of android, architecture of android, libraries, and software development kit.

Text Book

1. J. Schiller, "Mobile Communications", Addition Wesley Publication.
2. A. Mehrotra, "GSM System Engineering", Addition Wesley Publication.
3. M. Heijden, M. Taylor, "Understanding WAP", Artech House Publication.

Reference Books

1. Charles Perkins, "Ad hoc Networks", Addison Wesley.
2. Asoke K Talukdar, Roopa R. Yavagal, "Mobile Computing", Tata McGraw Hill.
3. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer.

MCA-4032
COMPUTER GRAPHICS AND ANIMATION

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Knowledge about working of display systems.
- **CO-2.** Skill to execute various Scan Conversion algorithms in laboratory so as to draw Graphics primitives.
- **CO-3.** Familiarization with 2D and 3D graphic concepts.
- **CO-4.** Develop creativity to create 2D objects.

Unit-I **(08)**

Introduction and Line Generation: Types of computer graphics, graphic displays- random scan displays, raster scan displays, frame buffer and video controller, points and lines, line drawing algorithms, circle generating algorithms, midpoint circle generating algorithm, and parallel version of these algorithms.

Unit-II **(08)**

Transformations: Basic transformation, matrix representations and homogenous coordinates, composite transformations, reflections and shearing.

Unit-III **(08)**

Windowing and Clipping: Viewing pipeline, viewing transformations, 2-D clipping algorithms-line clipping algorithms such as liangbarsky algorithm, polygon clipping, curve clipping, and text clipping.

Unit-IV **(08)**

Three Dimensional: 3-D geometric primitives, 3-D object representation, 3-D transformation, 3-D viewing, projections, and 3-D clipping.

Unit-V **(08)**

Curves and Surfaces: Quadric surfaces, spheres, ellipsoid. hidden lines and surfaces: back face detection algorithm, depth buffer method, a- buffer method, scan line method, basic illumination models– ambient light, diffuse reflection, warn model, intensity attenuation, color consideration, transparency and shadows.

Text Books:

1. Donald Hearn, M Pauline Baker, "Computer Graphics C Version", Pearson Education
2. Amrendra N Sinha, Arun D Udai," Computer Graphics", TMH.
3. Foley, "Computer Graphics Principles & practice", AWL.

Reference Books:

1. Donald Hearn, M Pauline Baker, "Computer Graphics with OpenGL", Pearson.
2. Steven Harrington, "Computer Graphics: A Programming Approach", TMH.
3. Rogers, "Procedural Elements of Computer Graphics", McGraw Hill.

MCA-4033
SOFTWARE TESTING AND QUALITY ASSURANCE

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods to discuss various software testing issues and solutions in software unit test, integration, regression, and system testing.
- **CO-2.** Understanding about various quality assurance measures.
- **CO-3.** Learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
- **CO-4.** Expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.

Unit-I **(08)**

Review of Software Engineering: Overview of software evolution, SDLC, testing process, Terminologies in testing: error, fault, failure, verification, validation, difference between verification and validation, test cases, testing suite, test oracles, impracticality of testing all data; impracticality of testing all paths. Verification: verification methods, SRS verification, source code reviews, user documentation verification, and software project audit, tailoring software quality assurance program by reviews, walkthrough, inspection and configuration audits.

Unit-II **(08)**

Functional Testing: Boundary value analysis, equivalence class testing, decision table based testing, cause effect graphing technique. Structural testing: control flow testing, path testing, independent paths, generation of graph from program, identification of independent paths, cyclomatic complexity, data flow testing and mutation testing.

Unit-III **(08)**

Regression Testing: What is regression testing? regression test cases selection, reducing the number of test cases, code coverage prioritization technique, reducing the number of test cases: prioritization guidelines, priority category, scheme and risk analysis.

Unit-IV **(08)**

Software Testing Activities: Levels of testing, debugging, testing techniques and their applicability, exploratory testing automated test data generation: test data, approaches to test data generation, test data generation using genetic algorithm, test data generation tools, software testing tools and software test plan.

Unit-V **(08)**

Object Oriented Testing: Definition, issues, class testing, object oriented integration and system testing, testing web applications: what is web testing? User interface testing, usability testing, security testing, performance testing, database testing and post deployment testing.

Text Books:

1. Yogesh Singh, "Software Testing", Cambridge University Press, New York
2. K..K. Aggarwal, Yogesh Singh, "Software Engineering", New Age International Publishers
3. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", McGraw-Hill

Reverence Books:

1. Marc Roper, "Software Testing", McGraw-Hill Book Co., London
2. Boris Beizer, "Software System Testing and Quality Assurance", Van Nostrand Reinhold, New York.
3. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Addison-Wesley.

MCA-4034
MOBILE APPLICATION DEVELOPMENT

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Apply general programming knowledge in the field of developing mobile applications.
- **CO-2.** Understanding of the specific requirements, possibilities and challenges when developing for a mobile context.
- **CO-3.** Understanding of the interactions between user interface and underlying application infrastructure
- **CO-4.** Understand the Android Software development.

Unit-I **(08)**

Introduction: What is android, android versions and its feature to set the various android devices on the market, the android market application store, android development environment - system requirements, android SDK, installing java, and ADT bundle - eclipse integrated development environment (IDE), creating android virtual devices (AVDs), android architecture overview and creating an example. **Android Application:** The android software stack, the linux kernel and android runtime - Dalvik virtual machine

Unit-II **(08)**

Android Software Development Platform: Understanding java SE and the Dalvik virtual machine, the directory structure of an android project, common default resources folders, the values folder, leveraging android XML, screen sizes. **Launching Your Application:** The android manifest.xml file, creating your first android application, android framework overview and android application components.

Unit-III **(08)**

Understanding Android Views: View groups and layouts, designing for different android devices, views and view groups, android layout managers, the view hierarchy, designing an android user interface using the graphical layout tool. Graphical user interface screen with views, displaying text with text view, retrieving data from users, using buttons, check boxes and audio groups. Getting dates and times from users, using indicators to display data to users, adjusting progress with seek bar and working with menus using views.

Unit-IV **(08)**

Displaying Pictures: Gallery, image switcher, grid view, and image view, views to display images, creating animation files, content providers, and databases, saving and loading files, SQLite databases and android database design.

Unit-V **(08)**

Intents and Intent Filters: Intent overview, implicit intents, creating the implicit intent example project, explicit intents, creating the explicit intent example application, intents with activities and intents with broadcast receivers. A basic overview of android threads and thread handlers.

Text Books:

1. S. Sydhani Begum, “Mobile App Development”, Notion press.
2. Pradeep Kothari, “Android Application Development”, Dream Tech press.
3. Bill Phillips, Chris Stewart and Kristin Marsicano, ”Android Programming”, Big Nerd Ranch.

Reference Books:

1. Jonathan McCallister, “Mobile Apps”, Create Space Independent Publishing platform.
2. Dan Hermes , “Xamarin Mobile Application Development”, Apress.
3. Dawn Griffiths, ”Head First Android Development”, O’Reilly.

MCA-4035
SEMANTIC WEB

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- **CO-1.** Learn technical architecture of semantic web and its integration with the World Wide Web.
- **CO-2.** Underlying knowledge representation formalisms use on the semantics web.
- **CO-3.** Gain knowledge about ontology design patterns.
- **CO-4.** Common application vocabularies in use on the semantic web.
- **CO-5.** Understand the concept of social network analysis and semantic web.

Unit-I **(08)**

Web Intelligence: Thinking and intelligent web applications, the information age ,the world wide web, limitations of today's web, the next generation web, machine intelligence, artificial intelligence, ontology, inference engines, software agents, Berners-Lee www, semantic road map and logic on the semantic web.

Unit-II **(08)**

Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, ontologies languages for the semantic web, resource description framework(RDF) / RDF schema, Ontology Web Language(OWL), UML and XML/XML schema.

Unit-III **(08)**

Ontology Engineering: Ontology engineering, constructing ontology, ontology development tools, ontology methods, ontology sharing and merging, ontology libraries, ontology mapping, logic, rule and inference engines.

Unit-IV **(08)**

Semantic Web Applications, Services and Technology: Semantic web applications and services, semantic search, E-learning, semantic bioinformatics, knowledge base , XML based web services, creating an OWL-S ontology for web services, semantic search technology, web search agents and semantic methods.

Unit-V **(08)**

Social Network Analysis and Semantic Web: Social networks analysis, development of the social networks analysis, electronic sources for network analysis – electronic discussion networks, blogs and online communities, web based networks and building semantic web applications with social network features.

Text Books:

1. Berners Lee, Godel, Turing, "Thinking on the Web", Wiley.
2. Peter Mika, "Social Networks and the Semantic Web", Springer.
3. LiyangYu, "Introduction to the Semantic Web and Semantic Web Services", CRC Press.

Reference Books:

1. Pascal Hitzler, Markus, Sebastian, "Foundation of Semantic Web Technologies", CRC Press.
2. Javier Lacasta, Javier**, "**Terminological Ontologies: Design, Management and Practical Applications (Semantic Web and Beyond)**"**, Springer.
3. H. Peter Alesso, Craig F. Smith ,"Developing Semantic Web Services", CRC Press.