Babu Banarasi Das University, Lucknow
School of Computer Applications
Master of Computer Applications
Evaluation Scheme

SEMESTER I									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
Theory									
C	MCA2101	Discrete Structure & Graph Theory	3	1	0	40	60	100	4
F	MCA2102	Digital Computer Fundamental	3	1	0	40	60	100	4
C	MCA2103	Principles of Programming with 'C'	3	1	0	40	60	100	4
C	MCA2104	Principles of Management	3	1	0	40	60	100	4
C	MCA2105	Information System Analysis and Design	3	1	0	40	60	100	4
C	MCA2106	Professional Communication	3	1	0	40	60	100	4
Practical									
F	MCA2151	Digital Computer Fundamental Lab	0	0	4	40	60	100	2
C	MCA2152	Principles of Programming with 'C' Lab	0	0	4	40	60	100	2
	GP2101	General Proficiency	-	-	-	-	-	100	1
Total			18	6	8			900	29

SEMESTER II									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
Theory									
C	MCA2201	Probability & Statistical Inference	3	1	0	40	60	100	4
C	MCA2202	Operating System	3	1	0	40	60	100	4
C	MCA2203	Computer Organization and Architecture	3	1	0	40	60	100	4
C	MCA2204	Financial Accounting & Management	3	1	0	40	60	100	4
C	MCA2205	Data Structure Using 'C'	3	1	0	40	60	100	4
C	MCA2206	E Governance	3	1	0	40	60	100	4
Practical									
C	MCA2251	Data Structure Using 'C' Lab	0	0	4	40	60	100	2
C	MCA2252	Computer Organization and Architecture Lab	0	0	4	40	60	100	2
	GP2201	General Proficiency	-	-	-	-	-	100	1
Total			18	6	8			900	29

SEMESTER III									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
Theory									
C	MCA2301	Analysis & Design of Algorithm	3	1	0	40	60	100	4
C	MCA2302	Data Communication & Computer Networks	3	1	0	40	60	100	4
C	MCA2303	Object Oriented Programming using Java	3	1	0	40	60	100	4
C	MCA2304	Computer Based Numerical & Statistical Techniques	3	1	0	40	60	100	4
C	MCA2305	Database Management System	3	1	0	40	60	100	4
C	MCA2306	Environmental Issues of IT and Green Computing	3	1	0	40	60	100	4
Practical									
C	MCA2351	Object Oriented Programming using Java Lab	0	0	4	40	60	100	2
C	MCA2352	Database Management System Lab	0	0	4	40	60	100	2
	GP2301	General Proficiency	-	-	-	-	-	100	1
Total			18	6	8			900	29

SEMESTER IV									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
Theory									
C	MCA2401	UNIX and Shell Programming	3	1	0	40	60	100	4
C	MCA2402	Management Information System	3	1	0	40	60	100	4
C	MCA2403	Computer Graphics	3	1	0	40	60	100	4
C	MCA2404	Computer Based Optimization Techniques	3	1	0	40	60	100	4
C	MCA2405	Dataware Housing & Data Mining	3	1	0	40	60	100	4
GE		Generic Elective I	3	1	0	40	60	100	4
Practical									
C	MCA2451	UNIX and Shell Programming Lab	0	0	4	40	60	100	2
C	MCA2452	Management Information System Lab	0	0	4	40	60	100	2
	GP2401	General Proficiency	-	-	-	-	-	100	1
Total			18	6	8			900	29

SEMESTER V									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
Theory									
C	MCA2501	Software Engineering	3	1	0	40	60	100	4
C	MCA2502	Web Technology & Application Development	3	1	0	40	60	100	4
C	MCA2503	.Net Framework & C#	3	1	0	40	60	100	4
C	MCA2504	Enterprise Resource Planning	3	1	0	40	60	100	4
C	MCA2505	Decision Support System and Business Intelligence	3	1	0	40	60	100	4
GE		Generic Elective II	3	1	0	40	60	100	4
Practical									
C	MCA2552	Web Technology & Application Development	0	0	4	40	60	100	2
C	MCA2552	.Net Framework & C#	0	0	4	40	60	100	2
	GP2501	General Proficiency	-	-	-	-	-	100	1
Total			18	6	8			900	29

SEMESTER VI						
Course Category	**Course Code**	**Course Title**	**Evaluation Scheme**			**Credits**
			CIA	**ESE**	**Course Total**	
C	MCA2651	Industrial Training-cum-Project	350	450	800	28
	GP2601	General Proficiency	-	-	100	1
Total					900	29

Legends:

L Number of Lecture Hours per week
T Number of Tutorial Hours per week
P Number of Practical Hours per week
CIA Continuous Internal Assessment
ESE End Semester Examination

Credit Summary Chart

Course Category	Semester						Total Credits	%age
	I	II	III	IV	V	VI		
Basic Sciences	4						4	2.2
Humanities	4	4					8	4.4
Social Sciences								
Professional Subject - Core	20	24	28	24	24		120	69.5
Professional Subject – Generic Elective				4	4		8	4.4
Professional Subject – Open Elective								
Project Work, Seminar and/or Internship in Industry or elsewhere	1	1	1	1	1	29	34	19.5
Total	29	29	29	29	29	29	174	100

Category of Courses:

F Foundation Course
C Core Course
GE Generic Elective
OE Open Elective

Discipline wise Credit Summary Chart

Course Category	Semester						Total Credits	%age
	I	II	III	IV	V	VI		
F	6						6	3.4
C	22	28	28	28	20	28	154	88.8
GE				4	4		8	4.4
OE								
GP	1	1	1	1	1	1	6	3.4
Total	29	29	29	29	29	29	174	100

Generic Elective Subject List

Generic Elective I

MCA2411: Mobile Communication System
MCA2412: Distributed System
MCA2413: Artificial Intelligence
MCA2414: Theory of Computation
MCA2415: Software Quality Assurance

Generic Elective II

MCA2511: Distributed Database Management System
MCA2512: Cryptography and Network Security
MCA2513: Compiler Design and Construction
MCA2514: Electronic and Mobile Commerce
MCA2515: Software Project management

I Semester

MCA2101: Discrete Structures and Graph Theory

Course Objective:

1. Students should be able to distinguish between the notion of discrete and continuous mathematical structures.
2. Students should be able to understand the basic concepts of set theory.
3. Students should be able to apply fundamental counting algorithms to solve applied problems in the area of computer science.
4. Students should be able to prove mathematical statements by means of inductive reasoning.
5. Students should be able to understand the principle of recursion and apply it to the study of sequences and sets.

Learning Outcomes: On completion of this course students will be able to:

1. Verify the correctness of an argument using propositional and predicate logic and truth tables.
2. Demonstrate the ability to solve problems using counting techniques and combinatorics.
3. Solve problems of recurrence relations and generating functions.
4. Use graphs and trees as tools to visualize and simplify network related problems.
5. Perform operations on discrete structures such as sets, functions, relations, and sequences.
6. Construct proofs using direct proof, proof by contraposition, proof by contradiction, proof by cases and mathematical induction.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Set Theory, Relation & Function:** Set Theory: Definition of Sets, Type of Sets, Venn Diagrams, Operation on Sets, Subsets, Power Set, Cartesian Product, Principle of Inclusion and Exclusion, Multisets; Relation: Binary Relations, Inverse Relation, Composition of Relations, Properties of Relations, Equivalence Relations, Partial Order Relations, Ordered Set, Hasse Diagram of Poset; Function: Definition & Type of Functions, One-to-One Function, Onto Function, Inverse Function, Compositions of Functions.	30 Hours	1
II	**Groups and Rings:** Binary Operation, Type of Binary Operations, Algebraic Systems: Semi group, Monoid; Groups, Abelian group, Properties of Groups, Subgroups, Permutation Group, Cyclic Groups, Cosets, Homomorphism and Isomorphism of Groups, Ring and Field	30 Hours	1
III	**Discrete Numeric Function and Recurrence Relation:** Numeric Function, Generating Function, Recurrence Relation, Linear Recurrence , Relation with Constant	30 Hours	1

	Coefficients, Homogeneous and Particular Solution, Solution by Method of Generating Function		
IV	**Fundamentals of Logics & Graph Theory:** Fundamentals of Logics: Proposition, First order Logic, Logical Operation, Truth Values, Compound Proposition, Tautologies & Contradiction, Logical Equivalences, De-Morgan's laws. Predicates, Universal and Existential Quantifiers; Graph**:** Graph Terminology, Bipartite, Regular and Planar Graph, Euler Graphs, Directed Graph, Hamiltonian Path and Circuits, Graph Coloring, Chromatic Number; Tree: Spanning Tree, Minimal Spanning Tree, Kruskal's Algorithms, Prim's Algorithms	30 Hours	1

Suggested Readings:

1. J. P. Tremblay and R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", TMH, New Delhi, 2000.
2. Kolman, Busby and Ross "Discrete Mathematical Structures" PHI/Pearson., 6th Ed., 2009.
3. Kenneth H. Rosen, "Discrete Mathematics & Applications", TMH, 6th Ed., 2007.
4. C. L. Liu, "Elements of Discrete Mathematics", McGraw Hill Book Company, 2nd Ed., 1985.
5. Narsingh Deo, "Graph Theory", PHI, 24th Indian Print, 2003.

MCA2102: Digital Computer Fundamentals

Course Objective:

1. Provide a better understanding of Computer Organization, its designing & implementation.
2. Provide the understanding and uses of flip flops.
3. To enable student to implement synchronous state machine using flip flops.

Learning Outcome: On completion of this course students will be able to:

1. Understand the concept of logic family in order to build digital circuits and the obsolescence curve associated to a given logic family.
2. Simplify or minimize logic functions with up to 5 input variables by means of Karnaugh maps.
3. Use digital timing diagrams to specify a combinational circuits' behavior or to verify its operation.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction & Components of a Computer System** Definitions; History & Generation of Computer; Computer Concepts: Characteristics Computer Hardware, Computer Software: System Software, Application software, Utility Software: Firmware; Compiler; Interpreter and Assembler; Types of Computer; Block Structure of CPU: ALU, Memory Unit, Control Unit; Input/output Functions and Characteristics, Computer Memory: Concept of Primary & Secondary Memory, RAM & ROM, Types of ROM. Cache Memory; I/O devices; Concept of Operating System: Types of Operating System: Batch Processing, Multiprogramming, Multiprocessing, Time Sharing and Real time System. Function of Operating System; CLI & GUI Interface; Booting, Buffering.	30 Hours	1
II	**Software Language** High Level Languages and Low Level Languages; Computer Virus: Types of Viruses, Characteristics of Viruses. **Number System & Boolean Algebra** Number System: Binary, Octal, Decimal, Hexadecimal; Conversion of Number System; Binary Arithmetic & Complement; Binary Codes : Weighted & Non Weighted, Gray Code, Excess-3 Code, Error Detection Codes (Hamming Code); Boolean Function; Boolean Postulates; De-Morgan's Theorem; Boolean Expressions: Sum of Product , Product of Sum, Minimization of	30 Hours	1

	Boolean Expressions using K-Map; Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR; Implementations of Logic Functions using Gates; NAND- NOR Implementations; Multilevel gate Implementations.		
III	**Combinational Circuits** Adders & Sub tractors; Magnitude Comparator; Multiplexer & De-Multiplexer; Decoder & Encoder; Parity Checker & Generator; Code Converter. **Sequential Circuit** Introduction to Flip Flops: SR, JK, T, D, Master Slave; Conversion of Flip Flops; Characteristic Table & Equation; Edge Triggering & Level Triggering; Excitation Table; State Diagram; State Table; State Reduction; Design of Sequential Circuit.	30 Hours	1
IV	**Registers** Introduction of Registers; Classification of Registers; Register with Parallel Load; Shift Registers; Bidirectional Shift Register with Parallel Load; Serial Adder. **Counter** Introduction of Counter; Synchronous/Ripple Counters; Synchronous Counters; BCD Counter; 4-bit Binary Counter with Parallel Load; Design of Synchronous Counters; Ring Counter; Johnson Counter.	30 Hours	1

Suggested Readings:

1. V. Rajaraman, "Fundamental of Computers", PHI Publications, 3rd Edition, 2004.
2. P. K. Sinha , "Fundamental of Computers".
3. M. Mano, "Digital Logic and Computer Design", 2nd Edition, PHI.
4. R. P. Jain, "Modern Digital Electronics", Tata Mc Graw Hill, 2003.
5. P. Raja, "Switching Theory", Fourth Edition, Umesh Publication.

MCA2103: Principles of Programming with 'C'

Course Objective:

1. To provide the basic fundamental knowledge about various concepts of programming.
2. Clear understanding of the basic terminology required for programming.

Learning Outcome: On completion of this course students will be able to:

1. Knows how a computer works and provides a basic knowledge about the hardware and software of a computer.
2. Understand various constructs of the C Language along with proper syntax.
3. Develop programs on various topics.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Introduction to Software; Software Classification: Application Software, System Software; Utilities; Translators: Compiler, Interpreter, Assembler; Programming Languages: Why study Programming Languages, Attributes of Good Programming Languages; **Introduction to C Languages** Compilation, Loaders, linkers; Design Approaches: Top-down Approaches, Bottom-up Approaches; Flow Charts; Algorithms: Characteristics of good algorithms; Source Code; Object code; **Fundamental Data Types and Storage Classes** Data Types; Storage Classes	30 Hours	1
II	**Operators and Expressions** Operators: Numeric, Relational, Mixed operands, Bit operations; Operator precedence and associativity; Type conversion; Basic input/output library functions; Library functions: Mathematical, Character Functions; If Statement: Nesting if an else; Switch Statement: Restrictions on switch values, Break, Default	30 Hours	1
III	**Program Loops and Iteration** Loops: While, Do-While, For; Multiple loop variables; Assignment operators; Break and Continue; Modular Programming: Passing Parameters, Scope Rule, Global Variables; Separate Compilation, Linkage, Building your own modules; Arrays: Array Notation, Array Reprsentation, Manipulating array elements, Multidimensional arrays ; Sequential Search; Sorting: Bubble Sort, Selection Sort	30 Hours	1
IV	Structures: Declaring structures, Assigning of structures; Pointers to Objects: Address arithmetic, Pointer Operations, Declarations, Using pointers as function	30 Hours	1

	arguments; Dynamic memory allocation; Standard library Functions & File Handling: Strings, Text files, The Standard C Preprocessor; File management: Defining & opening a File, Closing a File, Input output operations on File, Error Handling During I/O Operations, Random Access Files, Command Line Arguments		

Suggested Readings:

1. Peter Norton's, "Introduction to Computers", TMH
2. Kernighan, Ritchie, "The C Programming Language", PHI
3. Yashwant Kanitakar, "Let us C", BPB
4. E.Balagurusamy, "Programming in ANSI C", TMH

MCA2104: Principles of Management
Course Objective:

1. Principles of management is a comprehensive introductory course on the management process from a manager's perspective, with particular emphasis on the skills, competencies, techniques and knowledge needed to successfully manage an organization.
2. It focuses on the entire organization from both, short and long-term perspective for forming a strategic vision, setting objectives, crafting a strategy and then implementing it.

Learning Outcome: On completion of this course students will be able to:

1. Understand how managers manage business organizations in the dynamic global environment.
2. Comprehend effective management planning and organizing staff.
3. Understand contemporary management concepts and skills and put these concepts and skills into practice.
4. Get an understanding of the basic principles of staffing and leadership.
5. Investigate how organizations develop and maintain competitive advantage within a changing business environment.
6. Appreciate and use of the range of controlling tools available in the management.
7. Reach a systematic understanding of management-related challenges.
8. Apply conceptual tools and techniques in analyzing, evaluating and addressing management issues.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Concept, nature, process and significance of management. Managerial levels, skills, functions and roles. Management Vs. Administration. Coordination as essence of management. Development of management thought: classical, neo-classical, behavioral, systems and contingency approaches.	30 Hours	1
II	**Planning and Organizing I** Planning: Nature, scope and objectives of planning, Types of plans, Planning process, Business forecasting. MBO: Concept, types, process and techniques of decision-making, Bounded Rationality. Organizing: Concept, nature, process and significance. Principles of an organization Span of Control, Departmentation, Types of an organization. Authority-Responsibility, Delegation and Decentralization, Formal and Informal Organization.	30 Hours	1
III	**Staffing and Motivation**	30 Hours	1

	Staffing: Concept, Nature and Importance of Staffing; Motivating and Leading: Nature and Importance of motivation, Types of motivation, Theories of motivation: Maslow, Herzberg, X, Y and Z. Leadership: meaning and importance, Traits of a leader, Leadership Styles: Likert's Systems of Management, Tannenbaum and Schmidt Model and Managerial Grid.		
IV	**Controlling** Nature and Scope of control, Types of Control, Control process, Control techniques: traditional and modern, Effective Control System.	30 Hours	1

Suggested Readings:

1. Stoner, Freeman and Gilbert Jr., Management, Prentice Hall of India, New Delhi, 2003.
2. Gupta, C.B., Management Concepts and Practices, Sultan Chand and Sons, New Delhi, 2003.
3. Koontz. O Donnel and Weirich, Management, Tata McGraw Hill Publishing Company, New Delhi, 2001.

MCA2105: Information System Analysis and Design
Course Objective:

1. To presents a comprehensive introduction to the system analysis and design skill in information management.
2. To provide the students with the skills to identify business problems which may be solved by technology based solutions and develop design which form the basis for implementing systems as well as a strong foundation in systems analysis and design concepts, methodologies, techniques and tools.
3. This also include waterfall model (system development life cycle), system analysis and Design Technique (Process Modeling (DFDs), Logical Modeling (decision tree, decision table, structured English).

Learning Outcomes On completion of this course students will be able to:

1. Describe the different phases of systems development life cycle.
2. Describe the different fact-finding techniques in system analysis and design.
3. Explain different methodologies of analysis and design of information systems.
4. Describe the concepts and theories of systems approach.
5. Design appropriate information systems.
6. Manage the development of systems based on system specifications.
7. Manage implementation and maintenance of information systems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview of Information Systems Concepts, Analysis and Design Life cycle** Introduction to System Concept: Characteristics of the system, Elements of a System; Types of Systems: Physical and Abstract System, Open and Closed System, Formal and Informal System; Software Development Life Cycle (SDLC); Role and Attributes of System Analyst; Introduction to Data and Information: Types of Information System, Categories of Information System; Information Gathering Tools and Techniques, Needs of Information Systems; Qualities of Information System.	30 Hours	1
II	**System Analysis** Requirements of Information at different Levels of Management, Requirements of Information for various Functions, Fact finding Techniques: Review of Written Documents, On Site Observation, Interview, Questionnaires; Fact Analysis; Systems Analysis and Design Tools; Decision Analysis Tools: Decision Tree, Data Dictionary, Decision Table ,Structured English, Functional Decomposition Diagram (FDDs) Process Modeling with Physical and Logical Data Flow Diagrams (DFDs), Components of a DFD, Zero Level DFD,DFD	30 Hours	1

	Transformation and Decomposition, Context Diagram, Leveling a DFD; Entity Relationship Diagram; Feasibility Study, Economic Feasibility (Cost & Benefit Analysis), Organizational Feasibility , Technical Feasibility study, Behavioral Feasibility		
III	**Information System Design and Implementation** Analysis to Design Transition, Elements of Design, Design of Output, Design of Input ,Design of File, Design of procedure; Audit Trail; Types of Files , Methods of File Organizations, Data Structure Design/Diagrams & Database, Design of Procedure & Program Specification; Information System Implementation: Operational and Test Environment, Conversion Preparation, Database installation, Users Training and Final Report to Management, Creating a new System	30 Hours	1
IV	**System Testing and Quality Assurance, IT infrastructure Selection and Evaluation of Processing and Maintenance** Test Plan: Activity Network for system Testing, Types of testing; Quality Assurance: Quality factors specifications, Levels of Quality Assurance; Computer Hardware And Software Selection, Computer Configuration Determination, Requesting Proposal from Vendors, Evaluation of Vendor's Proposals, Acceptance of system, Evaluation of Processing, Need of Maintenance	30 Hours	1

Suggested Readings:

1. James A. Senn ―Analysis & Design of Information System, McGraw Hill
2. Whitten, L. Bentley and K. Dittman, ―Systems Analysis & Design Methods, Fifth Edition, TMH.
3. Elias Awad ― Systems Analysis And Design, Galgotia Publications.
4. V. Rajaraman ―Analysis & Design of Information System, PHI.
5. Hussain & Hussain― Information Systems Analysis, Design and Implementation, McGraw Hill

MCA2106: Professional Communication

Course Objective:

1. To improve the knowledge of students with special regards to basics of communication and its various kinds.
2. To inculcate among student comprehension of concepts, process and importance of communication.
3. To make students comprehend the art of communication, through written medium, body, time distance and orally.

Learning Outcome: On completion of this course students will be able to:

1. Understand and apply the dynamics of communication and its application.
2. Understand and relate the oral communication with kinesics, chronemics, proxemics etc.
3. Able to read, write, articulate with precision.
4. Able to understand and apply the intricacies of art of communication.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Fundamentals of Communication: Definition, Nature, Origin, Scope, Features, Process, Types of Communication; The Flow of Communication: Upward, Downward, Lateral, Horizontal; Technical Communication: Definition; Oral & Written Communication; Distinction between Technical & General Communication; Importance of Technical Communication for Technocrats & Professionals; Barriers to Communication: Noise, Types of Barriers, Measures to Overcome Barriers	30 Hours	1
II	**Prerequisites of Technical Communication** Word Formation Process: Blending, Affixation, Compounding, Conversion, Homophones, Antonyms; **Written Comprehension** Developing Writing Skills: Note taking, Reviewing, Interpreting, Paraphrasing, Précis writing; Requisites of Good Sentences: Essentials of Good Sentences, Common Errors to be avoided, Requisites of Good Paragraph Writing: Unity, Coherence, Clarity, Proper Length, Emphasis, Logical Sequencing; Development of Paragraphs; Methods: Inductive, Deductive, Chronological, Spatial, Comparison & Contrast, Question to Answer, Interruptive, Illustrative	30 Hours	1
III	**Business Correspondence** Principles: 7 C's of Communication; Formats of Business Letters; Sales & Credit Letters; Inquiry, Quotation & Reply Letters; Letters for Placing & Fulfilling Orders; Complaint, Claim & Adjustment	30 Hours	1

	Letters; Job Letters: Cover letters; Resume: Chronological, Functional		
IV	**Presentation Strategies** Speech, Purpose, Understanding Audience & Locale Organizing the Material, Audio-Visual Aids; Methods of Speaking: Manuscript, Impromptu, Memorization, Extempore; Non-Verbal Dimensions of Communication: Paralanguage, Kinesics, Proxemics, Haptics, Chronemics, Oculecsis; Audio-Visual Aids	30 Hours	1

Suggested Readings:

1. Minakshi Raman et al. Technical Communication, New Delhi: Oxford University Press, 2014.
2. Singh, R.P. Functional Skills in Language & Literature, New Delhi: Rupa, 2007.
3. Sharma, Sangeeta et al. Communication Skills for Engineers and Scientists, New Delhi: PHI, New Delhi, 2009.
4. Shukla, Aditya. Professional Communication, Pune: Technical Publications, 2013.

MCA2151: Digital Computer Fundamentals Lab

Module	Course Topics	Credits
I	1. Implementation of Gates. 2. State & Prove De Morgan's Law. 3. Verification of Expressions using Gates. 4. Verification of various gates (NOT, OR, AND, Ex-OR, Ex-NOR) using universal gates (NAND & NOR). 5. Implementation of Adders & Subtractors. 6. Implementation of Code Converters. 7. Implementation of Parity Checker & Generators. 8. Implementation of Parity Magnitude Comparator.	1
II	1. Proving of Characteristic table of different Flip Flops. 2. Prove the Conversion Logic of various Flip Flops. 3. Design & Prove the State Table and State Diagram of various flip flop input functions. 4. Design of sequential Circuit using different Flip Flops. 5. Design of various counters using various Flip Flops. 6. Design the sequential circuit using a 2-bit register and combinational gates. 7. Construct the Johnson counter.	1

MCA2152: C Programming Lab

Module	Course Topics	Credits
I	1. Implementation of Fundamental Data Types. 2. Implementation of Fundamental Operators. 3. Implementation of Conditional Program such as if, switch etc. 4. Implementation of Basic Control Constructs such as for loop, while loop, do while loop. 5. Implementation of Modular programming.	1
II	1. Implementation of Advance Control Constructs such as Arrays & structures etc. 2. Implementation of Searching. 3. Implementation of Sorting. 4. Implementation of Pointers. 5. Implementation of Pointers as Function Arguments. 6. Implementation of File. 7. Implementation of Command Line arguments.	1

II Semester
MCA2201: Probability and Statistical Inference
Course Objective:

1. To present the fundamental concepts of Statistics.
2. To make the students aware regarding the importance of statistics in businesses.
3. To make the students learn about the various probability distributions.
4. To develop understandings to deal with hypothesis testing.
5. The subject also deals the concepts and applications of decision theory as well as SQC.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Develop the understanding of Probability and its Applications.
2. Methods to solve various real life estimation problems with various probability distributions.
3. How to draw probability based inferences.
4. Handles the Issues related with Decision Theory as well as Statistical Quality Control.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Probability and Expected Value** Concept of Experiment, Event and Sample Space; Types of Events; Concept of Probability; Classical, Subjective, Axiomatic and modern definition of probability; Additive and multiplicative Theorem of Probability; Conditional Probability; Bayes's Theorem; Mathematical Expectation; Concept of Random Variable; Probability Distribution of Random Variable.	30 Hours	1
II	**Technical Strategy and Planning–Emerging Technology Monitoring** Introduction to Theoretical Distributions; Difference between theoretical and observed frequency Distributions; Binomial Distribution: Properties and Constants of Binomial Distribution, Characteristics and Applications Binomial Distribution; Poisson Distribution: Characteristics and Applications of Poisson Distribution, Properties and Constants Poisson Distribution; Normal Distribution: Graph of Normal Distribution, Properties and Constants of Normal Distribution, Relation among Binomial, Poisson and Normal Distribution.	30 Hours	1
III	**Statistical Inference** Introduction to Statistical Inference: Concept of Statistical Hypothesis, Types of Statistical Hypothesis, Procedure of testing Hypothesis, Types of Statistical Errors, Level of Significance and Degree of Freedom;	30 Hours	1

	Chi-Square Distribution: Properties and Constants of Chi-Square Test, Uses of Chi-Square Test, Conditions for applying Chi-Square Test; Students' 't' Distribution: Properties of 't' Test, Applications of 't' Test; F Distribution: Applications of F Test, Conditions for applying F Test, One and Two-way ANOVA.		
IV	**Statistical Quality Control and Decision Theory** Concept of Statistical Quality Control: How to set control Limits, Type of Control Charts, X-Bar, R and C-Charts (Number of Defects per Unit), Advantages and Limitations of SQC; Introduction to Decision Theory: Ingredients of Decision Problem, Types of Decision Making Problems, The Maximin and Minimax Principle, Pay-Off Table, Expected Monetary Value [EMV], Decision Making with Uncertainty, Expected value of Perfect Information (EVPI), Decision Tree Analysis.	30 Hours	1

Suggested Readings:

1. D. C. Sancheti V. K. Kapoor; "Statistics", Sultan Chand and Sons, Seventh Edition, 2008
2. B. M. Agarwal, "Problems and Solutions in Business Mathematics", Second Edition, 2005
3. V. K. Kapoor; "Problems and Solutions in Statistics", Sultan Chand and Sons, Seventh Edition, 2008
4. S. P. Gupta, "Statistical Methods", Sultan Chand and Sons, Thirty-Fourth Edition, 2006
5. B**.** Jhunjhunwala, "Business Statistics", Sultan Chand and Sons, First Edition, 2008
6. S. C. Gupta, V. K. Kapoor; "Fundamental of Applied Statistics", Sultan Chand and Sons, Third Edition, 2005
7. S. C. Gupta, V. K. Kapoor; "Fundamental of Mathematical Statistics", Sultan Chand and Sons, Eleventh Edition, 2005

MCA2202: Operating Systems
Course Objective:

1. To provide a good understanding of the underlying concepts of operating systems.
2. To provide an opportunity to apply the concepts learned through implementation of the components of operating systems.

Learning Outcome: Upon successful completion of the course the student will:

1. Understand the main principles and techniques used to implement processes and threads as well as the different algorithms for process scheduling.
2. Understand the main mechanisms used for inter-process communication.
3. Be able to give the rationale for virtual memory abstractions in operating systems.
4. Have the ability to evaluate security risks in operating systems and understand the role operating systems can and should play in establishing security.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction and Process Management** Role, Evolution and Types of Operating Systems, Structural Overview: Components, Services, System Calls; Virtual Machines and Microkernel; Processes: Process States, State Transitions, Process Control Block, Schedulers, Process Queues, Context Switch, Cooperating and Independent Processes; Threads : Thread States, Thread Operations, Threading Models; CPU Scheduling: Scheduling Objectives, Scheduling Criteria, Scheduling Policies-Preemptive and Non Preemptive, Scheduling Algorithms, Algorithm Evaluation	30 Hours	1
II	**Process Synchronization and Deadlocks** Critical-Section Problem , Synchronization Hardware Semaphores, Classical Problems of Synchronization, Monitors ,Deadlock System Model, Deadlock Characterization, Deadlock Handling Methods, Deadlock Prevention, Deadlock Avoidance Mechanisms, Deadlock Detection, Recovery from Deadlock	30 Hours	1
III	**Storage Management** Memory Management: Logical and Physical Address Space, Address Binding, Dynamic Linking, Swapping, Contiguous and Noncontiguous Allocation, Static and Dynamic Allocation, Fragmentation, Compaction, Paging, Segmentation; Virtual Memory: Demand Paging, Page Replacement Policies, Allocation of Frames, Thrashing, Demand Segmentation; File System Interface: Files and Directories, Access Methods, Directory Structure; File System Implementation: File System Structure, Allocation Methods, Free space Management;	30 Hours	1

	Secondary Storage Structure: Disk Structure, Disk Scheduling Algorithms, Disk Management		
IV	**Protection and Security** Goals of Protection, Domain of Protection, Access Matrix and its implementation, Revocation of Access Rights, Security Problem, Authentication, One Time Passwords, Program Threats, System Threats, Threat Monitoring, Encryption and Decryption, Computer Security Classifications	30 Hours	1

Suggested Readings:

1. Abraham Silberschatz and Peter Baer Galvin, "Operating System Concepts", Addison-Wesley.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall.
3. Harvey M. Deitel, "An introduction to Operating Systems", Addison-Wesley.
4. Milan Milankovic, "Operating Systems, Concepts and Design", TMH.
5. William Stallings, "Operating Systems: Internal and Design Principles", PHI.
6. D.M. Dhamdhere, "Operating Systems: A Concept Based Approach", Second Edition, TMH.

MCA2203: Computer Organization and Architecture

Course Objective:

1. To provide a good understanding of the underlying concepts of Computer organization.
2. Explain Computer performance measurement methods.
3. Student should learn how to quantitatively evaluate different designs and organizations.
4. Student should be able to articulate design issues in the development of processor or other components that satisfy design requirements.

Learning Outcome: Upon successful completion of the course the student will:

1. Describe software and hardware interaction layers in computer architecture.
2. Describe various machine language instructions.
3. Be familiar with the terminology and basic principles of Computer organization systems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Register Transfer and Micro-operation** Register Transfer Language: Register Transfer, Bus and Memory Transfer; Micro operations: Arithmetic, Logical, Shift micro- operations; Arithmetic logic shift unit; Timing and control; Instruction codes; Computer instructions; Machine language instructions. **Basic Computer Organizations and Design** Instruction Cycle; Memory Reference Instructions; Register Reference Instructions; Input-Output Instructions; Design of Accumulator Logic Shift Unit; Instructions Format.	30 Hours	1
II	**Central Processing Unit** Accumulator based organization; General register organization; Stack organization; Addressing modes; RISC vs. CISC, Hard wired & micro programmed control Unit; **I/O Organizations** Introduction to system buses; Input/ output interface; Interrupt and Interrupt handling: S/W Interrupt, Vectored Interrupt, Daisy Chaining, Priority Interrupt; Device Polling; Serial Vs Parallel communications; I/O Processor; Synchronous Data Transfer; Asynchronous Data Transfer methods: Strobe Control, handshaking; Modes of Data Transfer: Programmed I/O, Interrupt initiated I/O. DMA; DMA: DMA Controller, DMA Transfer; CPU-IOP Communication.	30 Hours	1

III	**Memory organizations** Memory hierarchy; Main Memory: RAM Chips, ROM Chips; Concept of address space & Memory Space; Address Mapping; Auxiliary Memory; Cache memory: Mapping Techniques: Direct mapping, Associative mapping, Set associative mapping; Associative memory; Concept of Virtual Memory; Paging: Page Table, Page replacement policies.	30 Hours	1
IV	**Concept of Parallel Processing & Microprocessor** Uniprocessor System; Multiprocessor System; Pipelining Vs Parallelism; Flynn's and Fang's Classification; 8085 & 8086 Architecture: Pin diagram, Register Sets, Instruction sets, Flags, Interrupt; Termination of Program; Instructions Vs Arithmetic Pipelining; Assembly Language Programming of 8085/8086: Mnemonics, Conditional Statements, Subroutine call.	30 Hours	1

Suggested Readings:

1. M. Morris Mano, "Digital Logic & Computer Design", PHI
2. R. P. Jain, "Modern Digital Electronics", TMH
3. M. Morris Mano, "Computer System Architecture", PHI
4. B. Ram, "Computer Fundamental Architecture & Organization", NewAge
5. William Stalling, "Computer Organization & Architecture", Pearson Education Asia
6. V. Carl Hamacher, "Computer Organization", TMH
7. A.S. Tannenbaum, "Structured Computer Organization", PHI
8. R. S. Goankar, "Microprocessor architecture, Programming and application with 8085", Pen Ram International

MCA2204: Financial Accounting & Management

Course Objective:

1. The objective of this course is to help students to understand and demonstrate their knowledge of the fundamental and technical concepts of accounting and provide knowledge about basic accounting vocabulary.
2. To prepare basic entries for business transactions and present the data in an accurate and meaningful manner.
3. The course focuses on understanding how economic events like investments, financing transactions and operating activities are recorded in the three main financial statements (i.e., the income statement, balance sheet, and statement of cash flows).
4. The main objective of this course is to develop knowledge on the type and characteristics of problems and the possibility of the occurrence of financial management problems, and to increase the ability to handle the problems through reliable approach and problem solving strategy development.
5. The course in this area gives illustration on financial management practices and policies, processes, techniques and strategies and to develop planning skill and monitoring skill in financial management functions effectively, so the students would be able to apply the appropriate management strategy to face the company challenges.

Learning Outcome: After successful completion of this course, the students would be able to:

1. State the uses and users of accounting information.
2. Explain and apply accounting concepts, principles and conventions.
3. Record basic accounting transactions and prepare annual financial statements and
4. Analyze, interpret and communicate the information contained in basic financial statements and explain the limitations of such statements.
5. Understand the main aim of financial management and the role that a financial manager plays.
6. Understand Investment, financing and dividend decisions to maximize the value of the firm and shareholder's wealth maximization.
7. Understand the concept of risk and return and calculate future and present values.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview & Mechanics of Financial Accounting** Definition & Objective of Financial Accounting, Users of Accounting information, Accounting Concepts, Conventions and Principles; Types of Accounts- Debit–Credit Rule, Difference between Financial Accounting and Management Accounting; Journalization of Transactions, Ledger and Preparation of Trial Balance. Depreciation: Types of Depreciation- Straight Line Method and Written Down Value Method.	30 Hours	1

II	**Financial Statements: Analysis & Interpretation** Preparation of Trading and P & L Account and Balance Sheet with simple adjustments. Financial Statement Analysis- Meaning, Importance & objectives, Methods of Analysis- Ratio Analysis- Classification of Ratios: Liquidity, Solvency, and Profitability Ratios.	30 Hours	1
III	**Financial Statements: Analysis & Interpretation (contd.)** Funds Flow Statement: Meaning, Significance and limitations of Fund Flow Statement, Preparation of Schedule of Change in Working Capital, and Preparation of Fund Flow Statement. Cash Flow Statement: Meaning, Significance and limitation of Cash Flow Statement, Preparation of Cash Flow Statements.	30 Hours	1
IV	**Introduction to Financial management** Nature, Scope & objectives of Financial Management, Areas of Financial Decisions, and Financial Goals: Profit maximization Vs. Wealth Maximization, Time Value of money: Compounding, Discounting, Future Value: Single Flow & Multiple Flow, Present Value. Introduction to the concept of Risk & return.	30 Hours	1

Suggested Readings:

1. S N Maheshwari, “An Introduction to Accountancy”.
2. M N Arora, “Cost and Managment Accounting”.
3. R.P. Rustagi , ”Financial Management”.
4. I.M. Pandey, “Financial Mangement”.

MCA2305: Data Structure Using C

Course Objective:

1. The objective of this course is to make the student learn fundamental data structures algorithms.
2. The course describes and implements algorithms such as stacks, queues, linked lists, trees, searching techniques, sorting techniques, hashing techniques and graphs.
3. Comprehend alternative implementations using the differing logical relationships and appreciate the significance of choosing a particular logical relationship for implementation within real-world setting.
4. Demonstrate the ability to plan, design, execute and document sophisticated technical programs to handle various sorts of data structures.
5. Be familiar with the use of data structures as the foundational base for computer solutions to problems.
6. Become introduced to and investigate the differing logical relationships among various data items.

Learning Outcome: Having successfully completed this course, the student will be able to:

1. Apply advance C programming techniques such as pointers, dynamic memory allocation, structures to developing solutions for particular problems.
2. Design and implement abstract data types such as linked list, stack, queue and tree by using C as the programming language using static or dynamic implementations.
3. Analyse, evaluate and choose appropriate abstract data types and algorithms to solve particular problems.
4. Design and implement C programs that apply abstract data types.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Introduction to Data Structures; Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, Address Calculation, Application of arrays, Character String in C, Character string operation, Array as Parameters, Sparse Matrices. **Continuous Implementation (Stack):** Array Representation, Operations on Stacks: Push & Pop, Applications of stack, Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack; Recursion. **Continuous Implementation (Queue**): Array representation and implementation of Queues, Operations on Queue: Create, Add, Delete. Full and Empty Queue, Circular Queue, Dequeue and Priority Queue	30 Hours	1
II	**Non Continuous Implementation:** Link Lists: Linear List concept, List v/s Array, Create list,	30 Hours	1

	Insert node (empty list, beginning, middle, end), Delete node(first, general case), Search list, Retrieve node, Add node, Print list, Append linked list, Array of linked lists, Complex linked list structures, Circular-linked list, Doubly linked list, Multilinked lists. Linked representation and Implementation of queues and Stacks		
III	**Trees:** Introduction to Tree, n-ary Trees, Binary trees, Traversals, (breadth-first, depth-first), Expression trees, Infix, Prefix, Postfix Traversals, General trees, Binary search trees, AVL Trees. **Heaps:** Basic algorithms, Re-heapup , Re-heapdown, Build heap, Insert, Delete. Multiway trees: M-way search trees, B-trees, B-tree Traverse, B-tree search. **Sorting & Searching Techniques**: Bubble, Selection, Insertion, Shell, Quick, Merge, Heap, Radix Sort. Sequential, Binary search	30 Hours	1
IV	**Graph & Files** **Graphs:** Graphs Terminology, Traverse Graph (depth-first, breadth-first), Graph storage structures (adjacency matrix, Adjacency list), Minimum spanning tree, Shortest path algorithm: (Dijkstra's, Kruskal's, Prim's). **File structures:** Physical storage media file organization , Different , Types of File Structures, Organization of records into blocks , Sequential files, Indexing and Hashing , b+ tree index files, Hash function, Address calculation techniques, Common hashing functions	30 Hours	1

Suggested Readings:

1. Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C and C++", Pearson Education Asia, 2nd Edition, 2002.
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, 1986.
4. Jean-Paul Tremblay, Paul. G. Soresan, "An Introduction to Data Structures with Applications", Tata Mc-Graw-Hill International Editions, 2nd edition 1984.
5. A. Michael Berman, "Data Structures via C++", Oxford University Press, 2002.

MCA2206: E Governance
Course Objective:

1. Generating human resources with the right skills, knowledge, and aptitude and leadership qualities for effective implementation of e-Governance Projects.
2. To study about e-Governance models and its characteristics.
3. Conceptualization of ideas and development of service delivery models for improving the quality of service to citizen.
4. To make aware students about scope of e-Governance in the State through various sectors and services.

Learning Outcomes On completion of this course students will be able to:

1. Understand and critique the various roles attributable to government.
2. Explore current understandings of the relationship between public services and the rights, entitlements and responsibilities of citizens, clients and stakeholders.
3. Use terms such as 'good governance', 'accountability' and 'consultation' with a critical understanding of their meaning.
4. Understand different models of evaluation and their application in the public sector context with cases.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview of E-Governance and its Models** Introduction to E-Governance: Needs of E-Governance, Issues in E-Governance applications and Digital Divide; Evolution of E-Governance, its scope and content; Present global trends of growth in E-Governance; Introduction of Models of E-Governance ; Types of Digital Governance Models: Broadcasting/ Wilder Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive-service Model/Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Key areas; Towards Good Governance through E-Governance Models	30 Hours	1
II	**E-Governance Infrastructure, Strategies and applications of Data Mining in E-Governance** E-readiness: Digital System Infrastructure, Legal Infrastructural Preparedness, Institutional Infrastructural Preparedness, Human Infrastructural Preparedness, Technological Infrastructural Preparedness; Evolutionary Stages in E-Governance; Introduction of Data warehousing and Data mining in E-Governance; National Data Warehouses: Census Data, Prices of Essential Commodities; Other areas for Data Warehousing and	30 Hours	1

	Data Mining: Agriculture , Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors.		
III	**Case Studies of E-Governance in Indian perspective** • NICNET-Role of Nationwide Networking in E-Governance • Collectorate 2000 • Computer-aided Administration of Registration Department (CARD) • Smart Nagarpalika-Computerization of Urban Local Bodies (Municipalities) • Ekal Seva Kendra • Pahal: Direct Benefit Transfer of LPG • E-Suvidha • IT in Indian Judiciary • Bhoomi • Koshvani	30 Hours	1
IV	**Case Studies of E-Governance in Global perspective** • E-Governance initiative in USA • E-Governance in China • E-Governance in Brazil • E-Governance in Sri Lanka	30 Hours	1

Suggested Readings:

1. C.S.R. Prabhu, "E-Governance: Concepts and Case Studies", Prentice-Hall of India Private Limited, 2004.
2. N. Gopalsamy, "Information Technology & e-Governance", New Age Publication, First Edition 2009.
3. Backus, Michiel, "e-Governance in Developing Countries", IICD Research Brief, No. 1, March 2001.
4. Subhash Bhatnagar, "Unlocking E-Government Potential: Concepts, Cases and Practical Insights", SAGE Publications India Pvt. Ltd.

MCA2251: Data Structure Using C Lab

Module	Course Topics	Credits
I	1. Implementation of Arrays (Single & Double Dimension). 2. Implementation of String. 3. Implementation of Recursive Procedures. 4. Array implementation of Stack, Queue, Circular Queue, Linked List. 5. Implementation of Stack, Queue, Circular Queue, Linked List using dynamic memory allocation. 6. Implementation of Binary tree.	1
II	1. Implementation of Tree Traversals (preorder, inorder, postorder). 2. Implementation of B-Tree. 3. Implementation of AVL tree. 4. Implementation of Searching techniques: Linear Search, Binary Search. 5. Implementation of Sorting techniques: Bubble sort, Merge sort, Insertion sort, Selection sort, and Quick sort. 6. Implementation of graph traversal (BFS, DFS). 7. Implementation of minimum cost spanning tree, shortest path.	1

MCA2252: Computer Organization & Architecture Lab

Module	Course Topics	Credits
I	1. Study Architecture of 8085/8086 and familiarization with its Software mnemonics of Microprocessor 8085/8086. 2. Write a program using 8085 & verify for: A. Addition of two 8-bit numbers. B. Addition of two 16-bit numbers (with carry). 3. Write a program using 8085 & verify for: A. Subtraction of two 8-bit numbers (display of barrow). B. Subtraction of two 16-bit numbers (display of barrow). 4. Write a program using 8086 for arranging an array of numbers in descending order & verify. 5. Write a program using 8085 for finding First and second compliment of an 8-bit number. 6. Write a program using 8085 for finding first and second compliment of a 16-bit number. 7. Write a program using 8085 for left shift 8-bit number by 2. 8. Write a program using 8085 for left shift 16-bit number by 2.	1
II	1. Write a Program using 8085 for masking 8-bit number. 2. Write a program using 8085 for. Largest and Smallest number in an array. 3. Write a program using 8085 to find table of any number. 4. Write a program using 8085 to Sum of elements in an array. 5. Write a program using 8085 to code conversion from Binary to BCD code. 6. Write a program using 8085 for Sorting in Ascending and Descending Order of 8-bit number. 7. Binary to BCD code conversions.	1

III Semester
MCA2301: Analysis & Design of Algorithm
Course Objective:

1. To know the importance of studying the complexity of a given algorithm.
2. To study various algorithmic design techniques.
3. To utilize data structures and/or algorithmic design techniques in solving new problems.
4. To know and understand basic computability concepts and the complexity classes P, NP, and NP-Complete.
5. To study some techniques for solving hard problems.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
2. Apply the algorithms and design techniques to solve problems.
3. Analyze the complexities of various problems in different domains.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Basic Concepts of Algorithms** Definitions; Explanation & Scope, Time and Space Complexity; Asymptotic Notations (Growth of Functions); Pseudo Codes & Time Complexity of Basic Control Structures; Insertion Sort; Heap Short; Merge Sort; Quick Sort; Recurrences; Sorting in Linear Time	30 Hours	1
II	**Analysis of Data Structures** Elementary Data Structure; Dictionaries & Hash Tables; Binary Search Tree; AVL Trees; Red Black tree; B-Trees; Binomial Heaps; Fibonacci Heaps; Data Structures for Disjoint Sets; Augmenting Data Structures	30 Hours	1
III	**Advanced Design & Analysis Techniques** **Dynamic Programming:** Assembly Line Scheduling, Matrix Chain Multiplications, Longest Common Subsequence, Optimal Binary Search Tree, Activity Selection Problem, Knapsack Problem; **Greedy Algorithms:** Knapsack Problem, Huffman Codes, An Activity Selection Problem, Task Scheduling Problem ; **Back Tracking:** Hamiltonian Circuit Problem; Subset-Sum Problem: N-Queens Problem; **Branch & Bound:** FIFO Branch-and-Bound Algorithm, Knapsack Problem, Assignment Problem, Traveling Salesman Problem; Amortized Analysis.	30 Hours	1
IV	**Analysis of Graph Algorithms** BFS & DFS; Minimum Spanning Trees: Kruskal & Prim; Single Source Shortest Path: The Bellman-Ford	30 Hours	1

	Algorithm, Dijkstra's Algorithm; All Pairs Shortest Path: The Floyd Warshall Algorithm; Maximum Flow: Ford-Fulkerson Method; **NP Completeness:** Polynomial Time, NP-completeness, NP- complete problems; String Matching; Approximation Algorithms; Randomized Algorithms.		

Suggested Readings:

1. Thomas H. Coremen, "Introduction to Algorithms", PHI.
2. Horowitz & Sahani, "Fundamental of Algorithms", Galgotia.
3. Aho, "Design & Analysis of Computer Algorithms", Pearson.
4. Johnsonbaugh, "Algorithms", Pearson.
5. Bressard "Fundamental of Algorithm", PHI.
6. Jon Kleinberg and Eva Tardos "Algorithm Design", Pearson Education, 2006.

MCA2302: Data Communication & Computer Networks
Course Objective:

1. To introduce basic elements of communication system.
2. Techniques, channels and devices used to transmit data between distant locations.
3. To introduce the functions of different layers.
4. Understand different protocols and network components.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Describe and analyze the hardware, software, components of a network.
2. Explain networking protocols and their hierarchical relationship hardware and software. Compare protocol models and select appropriate protocols for a particular design.
3. Explain concepts and theories of networking and apply them to various situations, classifying networks, analyzing performance and implementing new technologies.
4. Identify infrastructure components and the roles they serve, and design infrastructure including devices, topologies, protocols, systems software, management and security.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Data Communications** Analog and Digital: (Data and Signals); Transmission Systems: Asynchronous and Synchronous Transmission; Bandwidth & Channel Capacity: Nyquist Bandwidth, Shannon Capacity Formula; Transmission Impairments; Modulation; Transmission Mode (Parallel, Serial); Multiplexing: SDM FDM, TDM, WDM; Transmission Media (Guided, Unguided); Switching; PSTN & ISDN; **Introduction to Computer Network** Types of Network: Based on Topology (Bus, Star, ring Mesh, Tree) ,Based on Size Technology and Ownership (LAN, MAN, WAN), Based on Computing (Centralized, Distributed and Collaborative), Based on Connection Management (Connection-Oriented and Connectionless Oriented)	30 Hours	1
II	**Network Architecture** Network Architecture: Monolithic v/s Layered Approach; Protocol Hierarchies; Design Issues for the Layers; Interfaces and Services; ISO-OSI Reference Model and TCP/IP Model ; Concept of Subnet & Host-to-Host Communication; Intermediate Devices; **Subnet Communication** **Physical Layer:** Design Issues, Services provided to the Upper Layer, Physical Layer Specifications: Analog (RS232) & Digital(X.21)	30 Hours	1

	Data Link Layer Design Issues; Services Provided to Upper Layer: Framing, Error Control, Flow Control, Link Management, Acknowledgement; LLC Sublayer (BISYNC , HDLC); MAC Sublayer: Access (Random Access, Controlled Access), Unrestricted Simplex Protocol, Stop-and-wait Protocol, Sliding Window Protocols		
III	**Subnet Communication** IEEE Standards for LAN (802.3, 802.4, 802.5, 802.6, 802.11, 802.16); **Network Layer** Design Issues; Services provided to the Upper Layer: Routing Algorithms, Congestion Control, Token Based, Non Token Based, Internetworking (Negotiation across subnet); IP Addressing: IPV4 & IPV6; ICMP.	30 Hours	1
IV	**Host-to-Host Communication Part I** **Transport Layer** Design Issues , Services provided to the Upper Layer; Elements of Transport Control Protocols; Connection Management, Multiplexing; Host-to-Host Flow Control and Buffering , Crash recovery; Internet Transport Protocol: TCP and UDP; **Session Layer** Logical Session Handling; Token Management for Sessions; Synchronization; Quality of Service; **Host-to-Host Communication Part II** **Presentation Layer** Data Presentation and Compression; Introduction to Cryptography; Symmetric and Asymmetric Encryption; DES and RSA Algorithms; Digital Signature; IPSec; Firewalls; DNS; Application Layer Protocols	30 Hours	1

Suggested Readings:

1. W. Stallings, "Data and Computer Communication", Pearson Education.
2. A. S. Tanenbaum, "Computer Network", 4th, Edition, Pearson Education.
3. Forouzan, "Data Communication and Networking", 2nd Edition, Tata McGraw Hill.
4. W. Stallings," Computer Network with Internet Protocols", Pearson Education.
5. Eugene Blanchard "Introduction to Networking and Data Communications".
6. J. Martin "Computer Network and Distributed Data Processing", PHI.

MCA2303: OOPS & Core Java
Course Objective

1. To present the fundamental concepts of Data Modelling.
2. To develop skill of Programming with respect to Object Oriented Programming
3. To familiarize the students with the concepts of Networking.
4. To study Java as an Application Programming Language.
5. To study various Applications of Java.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Understand the Data Modeling concepts and be able to design system models.
2. Students will be able to learn how and why java came about and what makes it so important.
3. Techniques needed to effectively use the AWT when creating Applets.
4. Will develop more powerful and flexible components using swing.
5. Build complex system from software components.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Data Modeling:** **Object Model:** Classes & Object, Encapsulation, Abstraction, Links and Association, Generalization, Aggregation, Inheritance, Polymorphism using Instantiation, Candidate keys, Constraints. **Dynamic Model:** Events & States, State Diagram, Nested state diagrams, Advanced Dynamic Model, Relation of Object and Dynamic Model. **Functional Model:** Data Flow Diagram, Relation of Functional to Object and Dynamic Model, Class Diagrams, Use case Diagrams , Interaction Diagrams , State Diagrams, Comparisons of methodologies , SA/SD, JSD, Examples and Case Studies to demonstrate methodologies	30 Hours	1
II	**Programming Using JAVA** **Introduction of Java:** The JDK Directory Structure, Compiling and Interpreting Applications. **Introduction to Object-Oriented Programming**: Classes and Objects: Data Types And Variables, Arrays, Operators and Expressions, Control Flow Statements, Access Control. Methods: Defining & Calling Methods, Scope of Method, Method Parameters, Constructors. Packages and Interfaces: Defining Packages, Package Scope, Interfaces and Abstract Classes. String Handling, Exception Handling, Input/output Streams	30 Hours	1
III	**AWT Controls & SWING**	30 Hours	1

	Inheritance. Introduction to Threads: Multithreading. Java applet, Applet Architecture, Applet Class. Introduction to AWT: AWT controls, Layout managers, Menus **Event Handling:** The Delegation Model of Event Handling, Event Classes, Sources, Listeners, Adapter Classes as Helper Classes in Event Handling. Java Swing: Creating a Swing Applet and Application, Programming using Panes, Labels, Text fields, Buttons, Toggle buttons, Checkboxes, Radio Buttons, View ports, Scroll Panes, Scroll Bars, Lists, Combo box, Progress Bar, Menus and Toolbars, Layered Panes, Tabbed Panes, Split Panes, Layouts, Windows.		
IV	**Java Beans** Java Beans Concepts and the Beans Development Kit, Using the Bean Box, Using Beans to Build an Application, Writing a Simple Bean Properties, Manipulating Events in the Bean Box, The Beaninfo interface, Bean customization, Bean Persistence, Networking Programming, Networking Basics, Client-Server Architecture, Socket Overview, Networking Classes and Interfaces, Network Protocols, Developing Networking Applications in Java.	30 Hours	1

Suggested Readings:

1. Grady Booch , "Object Oriented Analysis and Design".
2. Ram Baugh , "Object Oriented Modeling and Design", PHI.
3. E. Balagurusamy, "Programming with Java", Tata McGraw Hill.
4. Herbert Schildt, "Java 2 : Complete Reference", McGraw-Hill
5. Steve Holzner, "Java black book", Paraglyph Press; Second Edition (July 1, 2002)
6. Cay S Horstmann, Gary Cornell , "Core Java 2 Volume-II", Tata McGraw Hill

MCA2304: Computer Based Numerical and Statistical Techniques
Course Objective:

1. To implement computational problems on machine.
2. To offer sound knowledge on statistical tools.
3. To compute the relevant statistical measures for different types of data.
4. To analyze the statistical data based on experiments.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. To apply statistical distributions for real life problems.
2. To draw valid inferences based on the analysis of statistical data.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Errors and Floating Point Numbers** Errors in numerical computation: Sources of Errors, Types of Errors, Representation of Floating point numbers: Arithmetic operations on Floating Point numbers, Normalization of Floating Point numbers, Pitfalls of Floating Point Representation. **Solution of Non Linear equations** Zero's of Single transcendental equations and zero's of polynomial: Bisection Method, Iteration or Successive Approximation Method, Regula-Falsi or False Position Method, Newton Rapson Method, Secant Method, Rate of Convergence of iterative Methods.	30 Hours	1
II	**Solutions of Simultaneous Linear equations** Solution of System of Linear equation using Direct Method and pivoting: Gauss Elimination Method, Gauss Jordan Method, Matrix Invasion Method, ILL Conditioned System of Equations; Solution of System of Linear equation using Iterative Method: Gauss Jacobi iterative method, Gauss Seidel iterative method. **Interpolation and Approximations** Finite Difference; Difference Tables; Polynomial Interpolation for equal intervals: Newton's Forward and Backward, Central Difference Formulas: Gauss Forward and Backward Formulas, Stirling's and Bessel's Formula	30 Hours	1
III	**Interpolation and Approximations** Polynomial Interpolation for Unequal intervals: Lagrange's Interpolation Formula, Newton divided difference Formula, Hermite interpolation Formula; Approximation of function by Taylor's series and Chebyshev polynomials. **Numerical Differentiation and Integration**	30 Hours	1

	Numerical Differentiation of Polynomial Interpolation: Newton's Formulae, Central Difference Formulae; Numerical Integration: Trapezoidal Rule, Simpson's Rule, Boole's and Weddle's Rule.		
IV	**Solution of Ordinary Differential Equation** Introduction and Methods of Ordinary Differential Equation**:** Picard's Method, Euler's Method, Taylor's Method, Runge-kutta Method, Predictor Corrector Method. **Curve Fitting** Curve Fitting Method of Least Squares: Fitting of Straight Line, Fitting of Polynomial, Fitting of Exponential Curves etc; Cubic spline and approximations. **Time Series and Forecasting** Introduction of Time Series; Methods of Measurement: Semi Averages, Moving Averages, Least Square Method; Models of Components of Time Series. **Statistical Quality Control Methods** Types of Control Charts: X-Bar Chart, R Chart, C-Chart; Advantages and Limitations of SQC	30 Hours	1

Suggested Readings:

1. Shastri S.S., "Numerical Analysis", PHI.
2. Balaguruswami E, "Numerical Methods", TMH Publications.
3. Gupta S.P., "Statistical Methods", Sultan and Sons.
4. Rajaraman V., "Computer Oriented Numerical Methods", PHI.
5. Francis Scheld, "Numerical Analysis", TMH.
6. Kandasamy P. "Numerical Methods", S. Chand Publications.
7. Curtis F. Gerald and Patrick O. Wheatley "Applied Numerical Analysis", Prientice Hall.
8. D. Kincaid and W. Cheney "Numerical Analysis", Thomson/Brooks-Cole, 2002

MCA 2305: Database Management System
Course Objective:

1. To present the fundamental concepts of Database Management.
2. To develop skill of Database Design, Database Languages and Database-System implementation with respect to Relational Database Management System.
3. To develop the concepts of Transaction Processing System , Concurrency control and Recovery procedures in database.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Understand the basic concepts of the database and data models.
2. Design a database using ER diagrams and map ER into Relations and normalize the relations.
3. Develop a simple database applications using normalization.
4. Acquire the knowledge about different special purpose databases and to critique how they differ from traditional database systems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Database System Concepts, Database Users, and Architecture** Introduction to Database System with example; Characteristics of the Database Approach; Users of Database System; Advantages and disadvantages of Using a DBMS; Implications of the Database Approach; Data Models, Schemas, and Instances; DBMS Architecture and Data Independence; Database Languages and Interfaces; The Database System Environment; Classification of Database Management Systems	30 Hours	1
II	**Data Modeling & Relational Database Management System** Data Modeling Using the Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design, Entity Types, Entity Sets, Attributes, and Keys, Relationships, Relationship Types, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues; Enhanced Entity-Relationship Modeling: Subclasses, Super classes, and Inheritance , Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization, Modeling of UNION Types Using Categories; The Relational Data Model: Relational Constraints and the Relational Algebra, Relational Model	30 Hours	1

	Concepts, Relational Constraints and Relational Database Schemas, Update Operations and Dealing with Constraint Violations , Basic Relational Algebra Operations, Additional Relational Operations, Examples of Queries in Relational Algebra		
III	**SQL and Database Design Theory and Methodology** Structured Query Language- The Relational Database Standard: Data Definition, Constraints, and Schema Changes in SQL, Types of SQL Commands, SQL Operators and their Procedure, Insert, Delete, and Update Statements in SQL, Queries and Sub Queries, Aggregate Functions, Joins, Unions, Intersection, Minus, Views (Virtual Tables) in SQL, Cursors, Triggers and PL/SQL; Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys , General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form	30 Hours	1
IV	**Transaction Processing, Concurrency Control and Database Recovery** Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Schedules and Recoverability, Serializability of Schedules, Transaction Support in SQL; Concurrency Control Techniques: Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Techniques, Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking; Database Recovery Techniques: Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Database Backup and Recovery from Catastrophic Failures	30 Hours	1

Suggested Readings:

1. Date C. J.—An Introduction to Data Base System, Addision Wesley.
2. Korth, Silbertz, Sudarshan —Data Base Concepts, McGraw-Hill.
3. Elmasri, Navathe —Fundamentals Of Data Base Systems, Addision Wesley.
4. Bipin C. Desai —An introduction to Data Base Systems, Galgotia Publication.
5. Ramakrishnan, Gehrke —Data Base Management System, McGraw-Hill.
6. Connolly & Begg —Database Systems: A Practical Approach to Design, Implementation and Management, Pearson Education.

7. R. S. Despandey --SQL/PL SQL for Oracle.
8. Ivan Bayross -- SQL, PL/SQL: The Programming Language Of Oracle

MCA2306: Environmental issues of IT and Green Computing
Course Objective:

1. The objective of this course is to provide students with an understanding of the role of ICTs and their impact on the global carbon footprint, This includes how to estimate the carbon footprint of the ICT operations of an organization and access ways to reduce the carbon footprint by changes to policies for procurement of ICT, changes to ICT operations and revising business processes.
2. To study about existing green computing strategies, fundamental challenges in achieving green operations of computing units and directions to solve some of them.
3. This course empowers students to reduce the energy use, waste, and other environmental impacts of Information Technology (IT) systems while reducing life cycle costs, thereby improving competitive advantage. Students learn how to measure computer power usage, minimize power usage, procure sustainable hardware, design green data centers, recycle computer equipment, configure computers to minimize power, use virtualization to reduce the number of servers, and other green technologies.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Assess enterprise-wide and personal computing and computing related energy consumption.
2. Acquire expertise for improving the energy efficiency of personal computers by reducing the power consumption requirements.
3. Choose the best sustainable hardware for their applications.
4. Evaluate the regulatory and governance issues surrounding IT.
5. Recognize the necessity for long-term sustainability in IT.
6. Formulate plans for reducing IT heating and cooling requirements.
7. Execute a virtualization plan.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Politics, Science and Business of Sustainability** The Basics of Green Computing: The Energy Problem, Types of IT Energy Wastes, Reducing Energy Waste, Problem of E-waste, Company's Carbon Footprint; Legal Mandates for Green IT: Regulations in the United States, Regulations Adopted around the World, Regulations in India, Waste Electrical and Electronic Equipment (WEEE)	30 Hours	1
II	**Technical Strategy and Planning–Emerging Technology Monitoring** Energy Usage: Energy Problems (Power Supplies), Monitoring Energy Usage, Reducing Energy Usage, Low Power Computers and Components; Cooling: Cooling Costs, Reducing Cooling Costs; Energy Saving	30 Hours	1

	Initiatives: The Challenges of Energy Efficiencies, Energy Star, 80Plus Program, Electronic Product Environmental Assessment Tool (EPEAT); Document Management: The Problem with Paper, Reducing Paper Usage, Electronic Document Management		
III	**IT Asset Disposal (E-Waste Management)** WEEE – The scale of the problem; Materials Used in Manufacturing Electrical and Electronic Products; Legislative Influences on Electronic Recycling: Producer Responsibility Legislation, The WEEE Directive, The RoHS Directive; Treatment Option for WEEE; Logistics of WEEE; WEEE– The International Perspective; Barriers to Recycling of WEEe, The Recycling Hierarchy, WEEE Health and Safety Implications	30 Hours	1
IV	**Business/IS Strategy and Planning** Virtualization: Basics of Virtualization, Types of Virtualization, Technology Options for Virtualization, Management Considerations for Virtualization; Improving Data Centre Energy Efficiency, Energy Consumption, Power Requirement of Equipment, Power Requirement for Cooling the Equipments; Green IT Department: The First Step – 5S, The Seven Wastes, Drawing a Process map; Green Supply Chain Management	30 Hours	1

Suggested Readings:

1. Toby J. Velete, Anthony T. Velete, Robert Elsenpeter - Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line; McGraw-Hill
2. Lawrence Webber, Michale Wallace - Green Tech: How to plan and Implement Sustainable IT Solutions; AMACOM (American Management Association)
3. R E Hester, R M Harrison – Electronic Waste Management; RSC Publishing
4. John Lamb - The Greening of IT: How Companies Can Make a Difference for the Environment; IBM Press
5. Marty Poniatowski - Foundation of Green IT; Prentice Hall
6. Bhuvan Unhelkar - Green IT Strategies and Applications; CRC Press
7. Carl H. Speshock - Empowering Green Initiatives with IT; John Wiley & Sons, Inc.
8. Bill Tomlinson - Greening through IT; The MIT Press

MCA2351: Object Oriented Programming using Java Lab

Module	Course Topics	Credits
I	1. Implementation of Fundamental Data Types & Testing and Debugging of Programs. 2. Implementation of Basic Control Constructs such as loops etc. 3. Implementation of Advance Control Constructs such as Vectors, Arrays & structures etc.. 4. Implementation of classes & objects. 5. Implementation of Methods in Java. 6. Implementation of constructors. 7. Implementation of Abstract Class, Interfaces & Packages. 8. Implementation of String Handling. 9. Implementation of Exception Handling.	1
II	1. Implementation of Input Output Streams. 2. Implementation of Inheritance. 3. Handling of Multiple Threads. 4. Implementation of Applets for display of Images, Texts and Animations etc. 5. Use of AWT controls. 6. Use of Layout Manager for creating different applications. 7. Implementation of Event Handling. 8. Implementation of Swing Applications. 9. Implementation of Java Beans to illustrates the procedure of handling session and print a Hello world using Java Bean. 10. Implementation of Network Programming.	1

MCA2352: DBMS LAB

Module	Course Topics	Credits
I	1. Use of DDL for creating objects(Table, Database). 2. Use of DML for performing retrieval operations. 3. Use of DCL for specifying constraints on tables. 4. Use of aggregate functions. 5. Use of String functions. 6. Grouping & Ordering Records. 7. Creating Views. 8. Performing queries for Union & intersection, difference and Cartesian product. 9. Performing queries for various Joins and nested queries.	1
II	1. Creating Indexes. 2. Write Programs in PL/SQL. 3. Understanding the concept of Cursors. 4. Writing Assertions Triggers. 5. Creating Forms, Reports etc. 6. Writing codes for generating read and update operator in a transaction using different situations. **7.** Implement of 2PL concerning central algorithm.	1

IV Semester
MCA2401: UNIX and Shell Programming
Course Objective:

1. To present the fundamental concepts of UNIX.
2. To get an understanding of Multiuser, Multitasking and Timesharing System.
3. To introduce the significance of Open Source Software.
4. Introduction of GUI of UNIX (i.e.LINUX).

Learning Outcome: Students who have successfully completed this course will have full understanding of the following concepts:

1. Develop the understanding of UNIX.
2. Develop the skills in Shell Programming.
3. Understand the Process and its synchronization.
4. Will get the understanding of System Administration in UNIX.
5. Get the understanding of PIPES, Filters, Redirection and Semaphore, Message Queues, and other process synchronization aides.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to UNIX** UNIX System Organization (the Kernel and the Shell); Files and Directories; Library Functions and System Calls; Open Source Software: Introduction to the Concept of Open Source Software, Linux, Linux Architecture, Linux File System (Block Structure: boot, super, inode and data blocks, Essential Linux Commands; Responsibilities of System Administrator: Identifying administrative files– configuration and log files, Role of system administrator, Managing user accounts- adding & deleting users and groups	30 Hours	1
II	**Shell Programming** Types of Shells; Shell Meta Characters; Shell Variables, Shell Scripts, Shell Commands, the Environment; Integer Arithmetic and String Manipulation, Special Command line Characters; Decision Making; Loop Control; Controlling Terminal Input, Trapping Signals; Arrays; I/O Redirection; Piping; Vi Editors; Shell Control Statements: if then else, case; Find; Shell Procedures and Reporting	30 Hours	1
III	**Process Management and Process Synchronization** Signal Handling; System Call for Files, Processes and Signals; Command line argument; Background processes; Changing Process Priority with Nice; Scheduling of Processes at Command: cron, Batch commands; Sharing	30 Hours	1

	of data; user-id, group-id; pipes; FIFOs; message queues; Semaphores; Coding, Compiling, Testing and Debugging; awk programming –report printing with awk		
IV	**System Administration** System administration Common administrative tasks changing permissions and ownerships, modifying group attributes, Temporary disable user‘s accounts; Creating, mounting and un-mounting file system; checking and monitoring system performance: file security & permissions, becoming super user using su; Advanced System Administration: Getting system information with name, host name, disk partitions & sizes, users, kernel, Backup and restore files, reconfiguration hardware with kudzu, installing and removing packages in Linux, Configure Xwindows starting & using X desktop, KDE & Gnome graphical interfaces, changing X windows settings	30 Hours	1

Suggested Readings:

1. Sumitabha Das ― Unix Concepts and Applications‖, TMH.
2. Yashwant Kanetkar ―Unix Shell Progamming‖, BPB.
3. Parata ―Advanced Unix–A Programmer‘s Guide‖, BPB.
4. Meeta Gandhi, ―The C Odyssey Unix–the open boundless C‖, BPB.

MCA2402: Management Information System

Course Objective:

1. To understand what IT components are available and how they can be utilized as appropriate IT applications for success.
2. To learn the terminology used in the field of IT and how IT principles can apply to businesses.
3. To understand the competitive advantage of using IT and the return on investment that can be realized.
4. To understand the basic principles of Information Technology: hardware and software components, database technology, telecommunications and networking, e-commerce and e-business, Enterprise Resource Planning (ERP), Decision Support Systems (DSS), Artificial Intelligence (AI) and Expert Systems (ES), and the ethical and societal issues involved in IT.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Understand basic information system concepts as applied to business operations and management.
2. Identify the major components of a computer system, including hardware, software, operating systems and operating environments as they apply to information systems.
3. Evaluate, select, and use computer-based information systems from a management perspective.
4. Understand how to utilize large-scale computer applications systems to assist with business management and operations.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**An Overview of Information System** Information System Concepts: Data vs. Information, The Characteristics of Valuable Information, The Value of Information, Types of Information; System and Modeling Concepts: System Components and Concepts, System Performance and Standards, System Variables and Parameters; What is an Information System?: Input, Processing , Output , Feedback, Manual and Computerized Information System, Computer-Based Information System; Business Information Systems: Transaction Processing Systems and E-Commerce, Management Information Systems, Decision Support Systems, Artificial Intelligence and Expert Systems **Structure and Classification of MIS** Structure of MIS: MIS Structure Based on Physical components, Information System Processing Functions, Levels of Management Activities, Organizational Functions; MIS Classification: Operations Support	30 Hours	1

	Systems, Management Support Systems		
II	**Information Technologies Concepts** Computer Hardware, Software and Emerging Technology: Computer System, Computer Software, Programming Languages; Organizing Data and Information (DBMS): Files – The Traditional Approach, Databases – The Modern Approach; Database Developments: Data Warehouses, Data Marts, and Data Mining, Online Analytical Processing (OLAP); Telecommunication and Computer Networks: Types of Signals, Communication Channels (Physical & Wireless), Communication Hardware, Network Topology, Classification of Networks (LAN, WAN, MAN), Internet, Intranet and Extranet, Applications of Telecommunications	30 Hours	1
III	**Business Applications of Information System** **Electronic and Mobile Commerce** An Introduction to Electronic Commerce**:** Business-to-Business (B2B) E-Commerce, Business-to-Consumer (B2C) E-Commerce, Consumer-to-Consumer (C2C) E-Commerce; Multistage Model for E-Commerce; E-Commerce Challenges; An Introduction to Mobile Commerce: Mobile Commerce in Perspective, M-Commerce Web Sites; Electronic and Mobile Commerce Applications; Threats to Electronic and Mobile Commerce **Enterprise Systems** An Overview of Enterprise Systems: Transaction Processing Systems and Enterprise Resource Planning: Traditional Transaction Processing Methods and Objectives, Transaction Processing Systems for Small and Medium-Size Enterprises (SMEs); Transaction Processing Activities; Control and Management Issues; Enterprise Resource Planning, Supply Chain Management, and Customer Relationship Management: An Overview of Enterprise Resource Planning, Advantages and Disadvantages of ERP Systems, ERP for Small and Medium-Size Enterprises (SMEs), Production and Supply Chain Management, Customer Relationship Management and Sales Ordering, Financial and Managerial Accounting	30 Hours	1
IV	**Business Applications of Information System cont...** **Information and Decision Support Systems** Decision Making and Problem Solving: Decision Making as a Component of Problem Solving, Programmed versus Nonprogrammed Decisions, Optimization, Satisfying, and	30 Hours	1

	Heuristic Approaches, Sense and Respond, The Benefits of Information and Decision Support Systems; An Overview of Management Information Systems: Management Information Systems in Perspective, Inputs to a Management Information System, Outputs of a Management Information System, Characteristics of a Management Information System; Functional Aspects of the MIS: Financial Management Information Systems, Manufacturing Management Information Systems, Marketing Management Information Systems, Human Resource Management Information Systems, Other Management Information Systems; An Overview of Decision Support Systems: Characteristics of a Decision Support System, Capabilities of a Decision Support System, A Comparison of DSS and MIS; Components of a Decision Support System: The Database, The Model Base, The User Interface or Dialogue Manager; Group Support Systems: Characteristics of a GSS that Enhance Decision Making, GSS Software, GSS Alternatives; Executive Support Systems: Executive Support Systems in Perspective, Capabilities of Executive Support Systems **Knowledge Management and Specialized Information Systems** Knowledge Management Systems: Overview of Knowledge Management Systems, Data and Knowledge Management Workers and Communities of Practice, Obtaining, Storing, Sharing, and Using Knowledge, Technology to Support Knowledge Management; An Overview of Artificial Intelligence: Artificial Intelligence in Perspective, The Nature of Intelligence, The Difference Between Natural and Artificial Intelligence, Artificial Intelligence Applications; An Overview of Expert System: When to Use Expert Systems, Components of Expert Systems, The Inference Engine, The Explanation Facility, The Knowledge Acquisition Facility, The User Interface, Participants in Developing and Using Expert System, Expert Systems Development Tools and Techniques		

Suggested Readings:

1. Ralph M. Stair & George W. Reynolds - Principles of Information System: A Managerial Approach; Course Technology
2. Laudon and Laudon - Management Information Systems; Pearson Education Asia.
3. Jawadekar - Management Information Systems; Tata McGraw-Hill.
4. Davis and Olson, "Management Information Systems; Tata McGraw-Hill.
5. O'Brien - Management Information Systems; Tata McGraw-Hill.
6. D P Goel - Management Information System; Macmillan

MCA2403: Computer Graphics

Course Objective:

1. This course is designed to provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
2. It provides a goal oriented approach to discuss the fundamental principles of computer graphics, the underlying mathematics and the algorithmic aspects of the computerized image synthesis process.

Learning Outcome: Upon successful completion of the course the student will:

1. Be able to discuss and implement the application of computer graphics concepts in the development of computer games, information visualization, and business applications.
2. Be able to discuss future trends in computer graphics and quickly learn future computer graphics concepts.
3. Know and be able to select among models for lighting/shading and surfaces.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview of Graphics Systems, Graphics Primitives and Scan Conversion** Classification , Characteristics , Components and Applications of Computer Graphics; Video Display Devices: Refresh CRT(Cathode Ray Tube), Raster Scan Displays, Random Scan Displays, Color CRT Monitors, Direct View storage Tubes (DVST), Flat Panel Displays, Raster Scan and Random Scan Systems, Display File & its Structure; Character Generation; Scan Conversion: Line Drawing Algorithms, Circle Drawing Algorithms, Ellipse Drawing Algorithm; Aliasing and Anti- Aliasing	30 Hours	1
II	**2D-Transformations, Polygons, Windowing & Clipping** Geometric Transformations: Basic and Combined, Homogenous Coordinates; Inside and outside Tests of Polygon: Even-odd and Winding Number Method; Polygon Filling: Neighborhood of a pixel, Filling Algorithms; Viewing Transformation: Viewing Pipeline, Window to View Port Transformation; Clipping: Point Clipping, Line Clipping, Polygon Clipping, Text Clipping, Interior & Exterior Clipping	30 Hours	1
III	**Curved lines and surfaces, 3D Transformation, Projections, Hidden Lines and Surfaces** Introduction, Splines: Interpolation and Approximation Splines, Geometric and Parametric Continuity, Spline specifications-Blending Functions, Cubic Spline Interpolation Methods, Natural Cubic Splines, Hermite Interpolation, Bezier Curve and Surfaces, B-Spline	30 Hours	1

	Curves & Surfaces, Octrees and BSP Tress;3-D Transformation: Translation, Scaling, Rotation, Reflection, Composite 3-D Transformations; Projections: Concept & classification of Projection, Parallel Projection, Perspective Projection; Hidden Lines and Surfaces: Classification, Back-face Detection and removal, z-Buffer Algorithm, Painter's Algorithm, Binary-space Partition Method, Warnock's Algorithm (Area Subdivision Method),Scan Line Method, Octree Method		
IV	**Rendering, Illumination and Color Models** Light Sources, Basic Illumination Models: Ambient Light, Diffuse and Secular Reflections, Phong Model, Combined Diffuse and Secular Reflections with Multiple Light sources; Polygon Rendering Methods: Constant-Intensity Shading, Gouraud Shading and Phong Shading, Fast Phong Shading; Ray-Tracing Methods;CIE Chromaticity Diagram, Intuitive Color Concepts, XYZ Color Model, Different Color Models: RGB, CMY, HSV, YIQ, HLS,Conversions between Color Models	30 Hours	1

Suggested Readings:

1. D.Hearn & M. Pauline Baker, "Computer Graphics C Version", Pearson Education.
2. Steven Harrington, "Computer Graphics: A Programming Approach", TMH.
3. Rogers, "Procedural Elements for Computer Graphics", TMH.
4. Rogers D., Adams .J, "Mathematical Elements of Computer Graphics", TMH.
5. Plastock & Kelly**,** "Computer Graphics; Schaum Series; McGraw Hill

MCA2404: Computer Based Optimization Techniques

Course Objective:

1. To present the fundamental concepts of Optimization Techniques.
2. To make the students aware regarding the importance of optimizations in real scenarios.
3. To make the students learn about the various methods to optimize various solutions.
4. To develop understandings to deal with Assignments Problems, Transportation Problem, Linear, Non-Linear as well as Integer Programming Problem**s.**
5. The subject also deals with the domains like inventory management, replacement and queuing theory.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Develop the understanding of Optimization Techniques.
2. Methods to solve Linear as well as Integer Programming Problem**s.**
3. Manage the Assignment Problems.
4. Handles the Issues related with optimum Transportation Cost.
5. Solve Inventory management as well as queuing theory related problems.
6. Solve Non-Linear Programming Problem.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Linear Programming Problem** Introduction to Linear Programming Problem; Components of L.P.P.; Formulation of L.P.P.; Graphical method for solving L.P.P.; Various Definitions (Slack variables, Surplus variables, Normal solution, Feasible solution, Basic solution, Basic feasible solution, Optimum solution, Unbounded solution, Degeneracy etc.); Computational procedure for Simplex method; Concept of Artificial Variables: Two – Phase Method, Big – M Method; Concept of Duality; Dual Simplex Method; Revised Simplex Method.	30 Hours	1
II	**Integer Programming, Assignment and Transportation Problem** Introduction to Integer Programming Problem: Gomory's Cutting Plane Method, Branch & Bound Method; Introduction to Assignment Problem: Algorithm for Hungarian method, Maximization case, Handle the Unbalanced Assignment Problem; Introduction to Transportation Problem: Methods to find Initial Basic Feasible Solution, Formation of Loops, Concept and resolution of Degeneracy, Optimum solution, Unbalanced Transportation Problem.	30 Hours	1
III	**Inventory Management and Replacement Problem**	30 Hours	1

	Introduction to Inventory Management: Types of Inventories, Concept of Economic Order Quantity, EOQ models without shortage, EOQ models with shortage, EOQ Problems With One Price Break, EOQ Problems With Two Price Break; Introduction to Replacement Problems: Replacement Problems with constant Money value, Replacement Problems with variable Money value, How to Select a Best Machine, Group Replacement Vs Individual Replacement.		
IV	**Queuing Theory and Non Linear Programming Problem** Introduction to Queuing Theory: Components of Queuing System, Transient and Steady States, Traffic Intensity or Utilization Factor, Pure Birth Process or Poisson Process, Derivation of Arrival Distribution, Memory-less Distribution or Exponential Distribution, Derivation of Inter-Arrival Time Distribution, Derivation of Service Time Distribution, Kendall's Notations for Queuing models; Introduction to Non Linear Programming Problem: Graphical Solution of NLPP, Kuhn-Tucker Necessary and Sufficient Conditions, Introduction to Quadratic Programming, Wolfe's Method.	30 Hours	1

Suggested Readings:

1. Edwin K.P. Chong and Stanislaw H. Zak—An Introduction to Optimization, Second Edition, Wiley-Interscience Series in Discrete Mathematics and Optimization, ISBN: 0471758000
2. Frederick S. Hillierand Gerald J. Lieberman —Introduction to Operations Research, McGraw-Hill, ISBN: 0073211141
3. Wayne L. Winston — Operations Research: Applications and Algorithms, Cengage Learning, ISBN:0534380581
4. S. D. Sharma -- Operations Research, S.Chand Publications
5. Man Mohan,P. K. Gupta,Kanti Swarup -- Operations Research, Sultan Chand & Sons.

MCA2405: Data Warehousing and Mining
Course Objective:

1. Understand the architecture of Data warehouse and its organization.
2. Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors.
3. Describing and demonstrating basic data mining algorithms, methods, and tools.
4. Identifying business applications of data mining.
5. Overview of the developing areas - web mining, text mining, and ethical aspects of data mining.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Define what knowledge discovery and data mining are; define the concept, structure and major issues of data warehousing.
2. Discover interesting patterns from large amounts of data to analyze and extract patterns to solve problems, make predictions of outcomes.
3. Select and apply proper data mining algorithms to build analytical applications.
4. Comprehend the roles that data mining plays in various fields and manipulate different data mining techniques.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Data Preprocessing Data Warehouse and OLAP Technology** Need of processing the Data; Descriptive Data Summarization: Measuring the Central Tendency, Measuring the Dispersion of Data, Graphic Displays of Basic Descriptive Data Summaries; Data Cleaning: Missing Values, Noisy Data, Data Cleaning as a Process; Data Integration and Transformation: Data Integration, Data Transformation; Data Reduction: Data Cube Aggregation, Attribute Subset Selection, Dimensionality Reduction, Numerosity Reduction; Data Warehouse; Differences between Operational Database Systems and Data Warehouses; A Multidimensional Data Model: Stars, Snowflakes, and Fact Constellations, Multidimensional Databases, Examples for Defining Star, Snowflake, and Fact Constellation Schemas; Data Warehouse Architecture: Steps for the Design and Construction of Data Warehouses, A Three-Tier Data Warehouse Architecture, Data Warehouse Back-End Tools and Utilities, Metadata Repository, Types of OLAP Servers	30 Hours	1
II	**Introduction to Classification: Na¨ıve Bayes and Nearest Neighbour**	30 Hours	1

	Classification; Naıve Bayes Classifiers; Nearest Neighbour Classification: Distance Measures, Normalization, Dealing with Categorical Attributes; Eager and Lazy Learning; Using Decision Trees for Classification; Decision Rules and Decision Trees: Decision Trees-The Golf Example, Terminology; The degrees Dataset; The TDIDT Algorithm; Types of Reasoning Mining Frequent Patterns, Associations, and Correlations Basic Concepts and a Road Map: Market Basket Analysis-A Motivating Example, Frequent Itemsets, Closed Itemsets, and Association Rules, Frequent Pattern Mining: A Road Map; Efficient and Scalable Frequent Itemset Mining Methods: The Apriori Algorithm: Finding Frequent Itemsets Using Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, Mining Frequent Itemsets without Candidate Generation, Mining Frequent Itemsets Using Vertical Data Format, Mining Closed Frequent Itemsets		
III	**Clustering** Introduction; *k*-Means Clustering: Example, Finding the Best Set of Clusters; Agglomerative Hierarchical Clustering: Recording the Distance Between Clusters, Terminating the Clustering Process; Text Mining: Multiple Classifications, Representing Text Documents for Data Mining, Stop Words and Stemming, Using Information Gain for Feature Reduction, Representing Text Documents-Constructing a Vector Space Model, Normalizing the Weights, Measuring the Distance Between Two Vectors, Measuring the Performance of a Text Classifier, Hypertext Categorization; Mining the World Wide Web: Mining the Web Page Layout Structure, Mining the Web's Link Structures to Identify Authoritative Web Pages, Mining Multimedia Data on the Web, Automatic Classification of Web Documents, Web Usage Mining	30 Hours	1
IV	**Applications and Trends in Data Mining** Data Mining Applications: Data Mining for Financial Data Analysis, Data Mining for the Retail Industry, Data Mining for the Telecommunication Industry, Data Mining for Biological Data Analysis, Data Mining in Other Scientific Applications, Data Mining for Intrusion Detection; Social Impacts of Data Mining: Ubiquitous and Invisible Data Mining, Data Mining, Privacy, and Data Security; Trends in Data Mining	30 Hours	1

Suggested Readings:

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques" Elsevier.
2. Max Bramer, "Principles of Data Mining", Springer.
3. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.
4. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill.
5. K. P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data mining Theory and Practice", PHI
6. G. K. Gupta, "Introduction to Data Mining with Case Studies", Prentice Hall of India.
7. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", PHI

MCA2411: Mobile Communication System:
Course Objective:

1. To explain and extend the concepts of networking and communication through wireless mode.
2. To develop an understanding of the various wireless communication systems for mobility.
3. To develop an understanding of various functional and design issues involved in Wireless LANs, Cellular Mobile Communication System and Satellite Communication System.

Learning Outcome: Students after successfully completing this course shall be able to:

1. Appreciate the distinctions of Wireless Communication from their Wired counterparts.
2. Understand the working of various Wireless Mobile Communication Systems and the associated protocols and standards.
3. Theoretically design the Wireless Communication Networks for LANs, Voice & Data Services using Cellular as well as Satellite Communication Systems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Wireless Communication** Wireless Communication; Wireless Transmission and related issues: Frequencies for Radio Transmission, Wireless Signal propagation and Propagation Modes, Wireless Antennas, Line-of-Sight Transmission, Characteristics and Impairments, Use of Frequency Hopped Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DHSS), Code Division Multiple Access (CDMA), Multiple Access in Wireless Communication: FDMA, TDMA, CDMA, SDMA, MACA, MACA-W, OFDM, Wireless Network Classification: Infrastructure vs Infrastructure-less, Wireless MAC Issues: Hidden and Exposed Nodes Problem, Wireless Communication Applications: PAN, LAN, Voice Networks, Data Networks, Integrated Services Network; Wireless Personal Area Network (WPAN): IEEE 802.15 & Bluetooth: Introduction to IEEE 802.15 and Bluetooth, Bluetooth User Scenarios and Applications, Bluetooth Protocol Stack, Pico-nets Vs Scatter-nets, Radio and Base Band Specification, Bluetooth Packet, Logical Channels, Error Correction and Channel Control; Revision of Wireless LAN Standard IEEE 802.11; Revision of Fixed Broadband Wireless Access Standard IEEE 802.16; Introduction to Cellular Mobile Communication System:	30 Hours	1

	Concept of Cells & Cellular Mobile Communication System, Fundamentals of Cellular Mobile Communication System: Principle of Operation and Basic Structure, Call Establishment, Handling and Transfer Operations,1.6.2.3 Analog and Digital Cellular Mobile Communication; Cellular Mobile Communication System Design Issues: Cellular Geometry, Frequency Reuse, Spectrum Efficiency, Cell Coverage Improvement and Capacity Enhancement using Cell Splitting, Cell Sectoring, Range Extensions, Micro and Pico cells; Channel Assignment, Hand-off Strategy, Co-Channel Interference and Adjacent Channel Interference		
II	**Cellular Mobile Communication System Part I** Evolution of Cellular Mobile Communication system, its Generations and candidate systems; First Generation of Cellular Mobile Communication System (1G): AMPS, TACS, NMT, NTT, C-450, Radiocom2000, RTMI, JTACS etc. (details of at-least 3 systems); Second Generation of Cellular Mobile Communication System (2G): TDMA based: IS-136 (Digital AMPS): GSM: Introduction to GSM, GSM Radio Aspects, GSM User Services, GSM Network Architecture, GSM Specification, Address and Identifiers, GSM Air Interface & Frame Structure, GSM Basic Call Flow, Registration and Roaming, Hand-off Techniques; PDC/iDEN, CDMA based: EIA/TIA IS-95 (cdmaOne), IS 95 Radio aspects, IS 95 Channels: Physical & Logical, IS 95 Modulation, Coding and Spreading, IS 95 Air Interface & Frame Structure, IS 95 Hand-offs, IS 95 Roaming; Data Services Extensions to 2G: General Packet Radio Service (GPRS) (2.5G): GPRS Sevices, GPRS Architecture, Reference Model and Interfaces, GPRS Transmission Plane Protocol, GPRS Procedures, Applications & Benefits; Enhanced Data Rates for GSM Evolution (EDGE) (2.75G): Enhanced GPRS/IMT-SC, EDGE Technology, Transmission Techniques, Modulation and Coding, Evolved EDGE	30 Hours	1
III	**Cellular Mobile Communication Systems Part II** Third Generation of Cellular Mobile Communication System (3G): Third Generation (3G) Features, International Mobile Telephone (IMT 2000), IMT 2000 Vision and Scope, IMT 2000 Evolution, IMT 2000 Radio Aspects & Radio Spectrum, IMT 2000 RTTs (Radio Transmission Technologies), IMT 2000 Family-of-	30 Hours	1

	systems Concept, IMT 2000 Functional Network Architecture, Regional Initiatives on IMT 2000; Universal Mobile Telecommunication System (UMTS): Introduction, Release & Standardization, System Architecture, UMTS Radio Interface: UTRA_FDD (Wideband-CDMA/WCDMA), UTRA_TDD (TD-CDMA), UTRAN (TD-SCDMA); UMTS Handover, Wideband CDMA: CDMA to WCDMA Evolution, Salient Features of WCDMA, WCDMA System Design, WCDMA Architecture; CDMA2000: cdmaOne to CDMA 2000, CDMA 2000 for Voice Communication: CDMA 2000 1x RTT, CDMA 2000 1x Advanced, CDMA 2000 for Data Communication: CDMA 2000 1xEV-DO (Evolution-Data Optimized) and UMB (Ultra Mobile Broadband), CDMA 2000 Key Features, CDMA 2000 Advantages, Comparison of UMTS-WCDMA & CDMA 2000; Mobile Broadband Systems (3.5G / 3G+ / Turbo 3G): High Speed Packet Access (HSPA / HSPA+), HSDPA; Fourth Generation of Cellular Mobile Communication System (4G): Introduction to 4G, its evolution and History, 4G Application & Advantages, 4G Technologies: Mobile WiMax (IEEE 802.16e), GPP Long Term Evolution (LTE), TD-LTE for China; Principal Working Concepts; Fifth Generation of Cellular Mobile Communication System (5G): Next Generation Mobile Network Alliance, Projected Specifications of 5G, State-of-art of 5G developments		
IV	**Satellite Communication System** Introduction to Satellite Communication System: 4.1.1 Brief History, Characteristics and Services, Configuration of Satellite Communication Services, Radio Regulations, Orbits and related issues; Transmission in Satellite Communication System: Modulation and Coding, Links, Link Configuration and Link Performance, Multiple Access and Demand Assignment; Satellite Networks: Reference Architecture for Satellite Networks, Satellite On-board Connectivity, Inter-Satellite Connectivity, Satellite Broadcast Networks, Broadband Satellite Networks; Earth Stations: Station Organization, Brief coverage of Antenna, RF, Communication, Network Monitoring & Control Subsystems; Introduction to Satellite Platform Systems; Satellite Installation: Basic Principle of Satellite Installation in Orbit, Introduction to Launch Vehicles; Space Environment; Overview of Existing Satellite Systems: Geo Stationary Orbit: IntelSat, INMARSAT, Non-Geo Stationary Orbits: IRIDIUM, GLOBSTAR, TELEDESIC; Global Positioning System	30 Hours	1

	(GPS)		

Suggested Readings:

1. Gottapu Sasibhushana Rao, "Mobile Cellular Communications" Pearson Education, I Edition, 2009
2. William Stallings, "Wireless Communication and Networks", Pearson Education, I Edition, 2009
3. Gerard Maral & Michel Bousquet, "Satellite Communication Systems: Systems, Techniques & Technologies", John Wiley & Sons Ltd., V Edition, 2009
4. Jochen Schiller, "Mobile Communications", Pearson Education, 2003
5. William C. Y. Lee, "Mobile Cellular Telecommunications", Tata Mc.Graw Hill, II Edition
6. Raj Pandya, "Mobile and Personal Communication Systems and Services", IEEE Press, Prentice Hall International, 2001
7. "Hand Bok on Satellite Communication", ITU Geneva, 1988
8. Dennis Roddy, "Satellite Communication", Mc.Graw Hill, IV Edition, 2006

MCA2412: Distributed System
Course Objective:

1. To explain fundamental principles and models underlying the Distributed Systems.
2. To develop an understanding of the various practical-system like problems e.g. Global State and Time, Mutual Exclusion, Deadlock Detection, Failure Recovery, Authentication etc.
3. To expose the students to the emerging topics like Distributed System Security, Peer-to-Peer Computing etc.

Learning Outcome: Students after successfully completing this course shall be able to

1. Identify various design and operational issues of Distributed Systems like Concept of Distributed Object, Indirect Inter-process Communication in Distributed System; Logical Clocks, Global State and Message Ordering, Coordination and Agreement; Distributed Deadlock, Transaction & Concurrency Control, Replication; System Services like Security, Distributed File System, Naming Services & Directory Services etc.
2. Understand the working of various Algorithms required in modeling various functional aspects and designing the distributed systems.
3. Use the acquired skill to understand as well as design and develop distributed system application at the level of concept.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Distributed Systems:** Definition, Goals of Distributed Systems, Motivations for Distributed Systems, Relation to computer system components Motivation, Relation to parallel multiprocessor/multicomputer systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges; **Distributed Computation Model:** A distributed program and a model of distributed execution, Models of communication networks, Global state of a distributed system, Cuts of a distributed computation, Past and future cones of an event, Process Communication Model; **Concept of Logical time:** Introduction, A framework for a system of logical clocks, Scalar time: Lamport's Logical Time, Vector time: Singhal-Kshemkalyani's Diffrential Technique, Fowler-Zwaenepoel's Direct-Dependency Technique, Jard–Jourdan's Adaptive technique; Matrix time, Virtual time, Physical Clock Synchronization and Network Time Protocol (NTP); **Global State and Snapshot Recording Algorithms:** Introduction, System model and definitions, Snapshot algorithms for FIFO channels, Variations of the Chandy–	30 Hours	1

	Lamport algorithm: Spezialetti-Kearns Algorithm, Venkatesan's Incremental Snapshot Algorithm, Helary's Wave Synchronization Method; Snapshot algorithms for non-FIFO channels: Lai-Yang Algorithm, Li *et al*'s Algorithm, Mattern's Algorithm; Snapshots in a causal delivery system: Acharya-Badrinath Algorithm, Alagar-Venkatesan Algorithm; Monitoring global state, Necessary and sufficient conditions for consistent global snapshots, Finding consistent global snapshots in a distributed computation: Manivannan-Netzer-Singhal Algorithm		
II	**Message Ordering and Group Communication:** Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal Order: Raynal-Schiper-Toueg Algorithm, Total Order: Centalized Algorithm & 3 Phase Distributed Algorithm, A nomenclature for multicast, Propagation trees for multicast, Classification of application-level multicast algorithms, Distributed multicast algorithms at the network layer; **Distributed Mutual Exclusion Algorithms:** Introduction & Preliminaries: Requirements of Mutual Exclusion Algorithms, How to measure the performance?; Non-Token Based Mutual Exclusion Algorithms: Lamport's Algorithm, Ricart–Agrawala algorithm, Singhal's dynamic information-structure algorithm, Lodha and Kshemkalyani's fair mutual exclusion algorithm; Quorum-based mutual exclusion algorithms: Maekawa's algorithm, Agarwal–El Abbadi quorum-based algorithm; Token Based Mutual Exclusion Algorithms: Suzuki–Kasami's broadcast algorithm, Singhal's Heuristic Algorithm, Raymond's tree-based algorithm; **Distributed Deadlock Detection:** Introduction to Distributed Deadlocks, System model of Distributed Deadlock, Distributed Deadlock Handling Strategies, Issues in Deadlock Detection and Resolution, Deadlock Models, Control Organizations for Distributed Deadlock Detection, Knapp's classification of distributed deadlock detection algorithms: Path Pushing Algorithm: Obermarck's Algorithm; Edge Chasing Algorithm: Mitchell and Merritt's algorithm for the single resource model, Chandy–Misra–Haas algorithm for the AND model; Diffusion Computation Based Algorithm: Chandy–Misra–Haas algorithm for the OR model; Global State Detection Based Algorithm: Kshemkalyani–Singhal algorithm for the P-out-of-Q model; **Termination**	30 Hours	1

	Detection: Introduction, System model of a distributed computation, Termination detection using distributed snapshots, Termination detection by weight throwing, A spanning-tree-based termination detection algorithm, Message-optimal termination detection, Termination detection in a very general distributed computing model, Termination detection in the atomic computation model, Termination detection in a faulty distributed system; **Global Predicate Detection:** Stable and unstable predicates, Modalities on predicates, Relational predicates, Conjunctive predicates, Further classification of predicates		
III	**Distributed File Systems & Name Services:** DFS Architecture, DFS Building Mechanisms: Mounting, Caching, Hints, Bulk Data Transfer, Encryption etc., DFS Design Issues, DFS Case Study of SUN Network File System, Sprite & CODA, Log structured File System, Name Services and DNS (Domain Name Services), Directory Services, Case Study on Global Name System, X.500 Directory Services; **Distributed Shared Memory:** DSM Architecture, DSM Implementation Algorithms: Central Server Algorithm, Migration Algorithm, Read Replication Algorithm, Full Replication Algorithm; DSM Design & Implementation Issues: Structure, Synchronization Model, Memory Consistency and Consistency Model: Linearizability, Sequential Consistency, Causal Consistency, Pipelined RAM/ Processor Consistency, Other Consistency: Slow, Release, Weak, Entry; Granularity, Thrashing; Shared Memory Mutual Exclusion, Wait-freedom; **Distributed Scheduling:** Introduction to Distributed Scheduling, Load Distribution: Issues in Load Distribution, Components of Load Distribution Algorithm, Stability, Load Distribution Algorithms & their Performance Comparison, Task Migration and Task Migration Issues; **Failure Recovery:** Introduction & Basic Concepts, Classification of Failures, Backward and Forward Error Recovery, Issues in failure recovery, Recovery in Concurrent Systems, Consistent Set of Checkpoints, Synchronous Checkpointing and Recovery: Checkpoint-based recovery, Log-based rollback recovery; Asynchronous Checkpointing and Recovery, Checkpointing & Recovery in Distributed Database System; **Fault Tolerance:** Introduction to Fault Tolerance and it's Issues, Commit Protocols: 2 Phase Commit, Non-Blocking Commit Protocols for Single-site Failure, Non-Blocking Commit Protocols for Single and Multi-site Failures, Voting Protocols: Static Voting	30 Hours	1

	Protocol, Dynamic Voting Protocol: Majority Based Dynamic Voting Protocol, Dynamic Vote Reassignment Protocol; Failure Resilient Processes; **Consensus and Agreement Algorithms;** Introduction, System Model: Synchronous vs Asynchronous Computations, Failure Models, Network Connectivity, Sender Identification, Channel Reliability, Authenticated vs Unauthenticated Messages, Agreement Variables; Classification of Agreement Problems and their inter-relationships: Byzantine Agreement Problem, Consensus Problem, Interactive Consistency Problem; Solutions to the Byzantine Agreement Problem: The Upper bound on the number of faulty Processors, An Impossibility Result, Lamport-Shostak-Pease Algorithm, Dolev et. Al's Algorithm; Applications of Agreement Algorithms		
IV	**Distributed Transaction and Concurrency Control:** Flat and Nested Transactions, Transaction Conflicts and Transaction Processing, Concurrency Control Problems: Inconsistent Retrieval, Inconsistent Update; Serializability Theorem, Concurrency Control Algorithms: Lock Based Algorithms, Optimistic Concurrency Control, Timestamp Ordering; Concurrency Control in Distributed Transactions; **Replication:** Introduction to Replication and it's issues, System Model of Replica Management, Group Communication, Passive (Primary-backup) Replication, Active Replication, Architecture for Replicated Transactions; **Authentication in Distributed Systems:** Introduction, Background and definitions, Protocols based on symmetric cryptosystems, Protocols based on asymmetric cryptosystems, Password-based authentication, Authentication Protocol Failures; **Self-stabilization:** Introduction, System model, Definition of self-stabilization, Issues in the design of self-stabilization algorithms, Methodologies for designing self- stabilizing systems, Communication protocols, Self-stabilizing distributed spanning trees, Self-stabilizing algorithms for spanning-tree construction, A probabilistic self-stabilizing leader election algorithm, The role of compilers in self-stabilization, Self-stabilization as a solution to fault tolerance, Factors preventing self-stabilization, Limitations of self-stabilization; **Peer-to-peer Systems:** Introduction, Data Indexing and Overlays, Unstructured Overlays, Chord Distributed Hash Table, Content Addressable Networks (CAN), Case Study on Tapestry, Challenges in Peer-to-Peer system design, Graph structures of complex networks, Internet graphs, Generalized random graph networks, Small-world	30 Hours	1

	networks, Scale-free networks, Evolving networks		

Suggested Readings:

1. Kshemkalyani, Ajay D & Singhal, Mukesh " Distributed Computing: Principles, Algorithms & Systems", Cambridge University Press, 2008
2. Singhal, Mukesh & Shivaratri, Niranjan G "Advanced Concepts in Operating Systems", Tata Mc.Graw Hill, 2001
3. George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair,"Distributed Systems: Concepts and Design", Addison-Wesley, V Edition, 2012
4. Tanenbaum, Andrew S & Van Steen, M. " Distributed Systems", Pearson Education, 2004
5. Liu, M. L. " Distributed Computing: Principles and Applications", Pearson Education

MCA2413: Artificial Intelligence

Course Objective:

1. To introduce the fundamental concepts of artificial intelligence.
2. To equip students with the knowledge and skills in logic programming using Prolog.
3. To explore the different paradigms in knowledge representation and reasoning.
4. To understand the contemporary techniques in machine learning.
5. To evaluate the effectiveness of hybridization of different artificial intelligence techniques.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Understand the history, development and various applications of artificial intelligence.
2. Familiarize with propositional and predicate logic and their roles in logic programming.
3. Learn the knowledge representation and reasoning techniques in rule-based systems, case- based systems, and model-based systems.
4. Appreciate how uncertainty is being tackled in the knowledge representation and Reasoning, process, in particular, techniques based on probability theory and possibility theory (fuzzy logic).
5. Master the skills and techniques in machine learning, such as decision tree induction, artificial neural networks, and genetic algorithm.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Scope of AI:** Games, Theorem Proving, Natural Language Processing, Vision And Speech Processing, Robotics, Expert Systems; General Issues and Overview of AI; AI Techniques; AI Problems; **Intelligent Agents:** Definitions of a Rational Agent, Reflex, Model-Based, Goal-Based and Utility-Based Agents, The Environment In Which A Particular Agent Operates; **Problem Solving**: State Space Search, Production Systems, Search Space Control; **Uninformed Search:** Depth-First, Breadth-first search.	30 Hours	1
II	**Informed /Heuristic Search:** Hill Climbing, Best-First Search, A*, AO* Search, Branch And Bound; Problem Reduction; Constraint Satisfaction End; Means-End Analysis; **Knowledge Representation**: Predicate Logic, Unificatioin, Modus Ponens, Backward Chaining, Declarative And Procedural Representation, Rule Based Systems	30 Hours	1
III	**Structured Knowledge Representation:** Semantic Nets, Slots, Exceptions And Default Frames, Conceptual Dependency, Scripts; **Game Playing:** Game Tree,	30 Hours	1

	Minimax Algorithm, Alpha Beta Cutoff, Modified Minimax Algorithm; Natural Languages and NLP: Syntactic Processing, Parsing Techniques, Semantic Analysis, Case Grammar, Augmented Transition; **Handling Inconsistent And Incomplete Knowledge:** Truth Maintenance Systems, Reasoning Techniques, Concept of Uncertainty, Bayes' Theorem, Certainty Factors And Rule- Based Systems, Bayesian Networks, Dempster-Shafter Theory, Fuzzy Logic.		
IV	**Learning:** Concept of Learning, Learning Automation, Rote Learning; Genetic Algorithm; Learning By Inductions; Artificial Neural Nets; Expert Systems: Need and Justification for Expert Systems, Knowledge Acquisition; AI: Present and Future; **Case Studies:** Mycin, Black Board System.	30 Hours	1

Suggested Readings:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach" (2nd ed.), Pearson Education, 2005.
2. Elaine Rich and Kelvin Knight, "Artificial Intelligence", Tata McGraw Hill, 2002.
3. Eugene Charniak and Drew McDermott, "Introduction to Artificial Intelligence", Pearson Education, 2009.
4. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India, 2006.
5. George F. Luger, "Artificial Intelligence-Structures and Strategies For Complex Problem Solving", Pearson Education, 5th Edition, 2010.

MCA2414: Theory of Computation

Course Objective:

1. The primary objective of a Theory of Computation (TOC) is to introduce the fundamental mathematical and computational principles that are the foundation of computer science.
2. A secondary objective is to address students' misconceptions about computer science theory: that it is irrelevant for today's problems.
3. Objective of the course is to prepare students to be either well-rounded practitioners or potential candidates for computer science.

Learning Outcomes: Upon successful completion of this course students should be able to:

1. Understand basic properties of formal languages and formal grammars.
2. Understand basic properties of deterministic and nondeterministic finite automata.
3. Understand the relation between types of languages and types of finite automata.
4. Understand basic properties of Turing machines and computing with Turing machines.
5. Understand the concepts of tractability and decidability.
6. Understand the challenges for Theoretical Computer Science and its contribution to other sciences.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Languages & Finite Automata** Introduction to Alphabets; Strings and Language; Finite Automata: Transition Graph, DFA, NFA , Method of Conversion from NFA to DFA, FA with € -moves, Method of Conversion from NFA with € -moves to NFA, Equivalence of NFA with € -moves to DFA, Minimization of Automata.	30 Hours	1
II	**Regular Expressions & Languages** Introduction to Regular Expressions; Kleene Closures; Construction of DFA from Regular Expression; Construction of Regular Expression from DFA; Finite Automata with output: Mealy Automation, Moore Automation, Equivalence of Mealy and Moore Automations; Pumping Lemma for Regular Languages; Properties of Regular Languages; Decision Problem of Regular Languages.	30 Hours	1
III	**Non Regular Grammars** Definition of Grammar; Chomsky's Hierarchy; Sentential Forms; CFG & CFL; CSG; Derivation Tree; Ambiguous Grammar; CNF& GNF; Pumping Lemma for CFL; Properties of CFL; Decision Problem of CFL; Undecided Problems of CFL.	30 Hours	1
IV	**Push Down Automata (PDA) & Turing Machines** Push Down Automata (PDA): Description and definition,	30 Hours	1

	Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, Two stack PDA; Turing Machines: Introduction, Basic Features of Turing Machine, Languages of Turing Machine, Turing Machine as Acceptor, Computing Devices, Universal Turing Machine, Undecidable problems about Turing Machines; Rice's Theorem.		

Suggested Readings:

1. John E. Hopcroft & Jeffery D. Ullman, "Introduction to Automata Theory, Languages & Computation", Pearson.
2. K L P Mishra & N. Chandra Shekhran, "Theory of Computer Science", PHI 2010.
3. Kamala Krithivasan Rama R., "Introduction to Formal Languages, Automata theory & Computation", Pearson 2010.
4. E.V. Krishnamurthi, "Introductory Theory of Computer Science", East West Press.
5. ZVI Kohavi, "Switching & Finite Automata Theory", TMH.

MCA2415: Software Quality Assurance

Course Objective:

1. To present the fundamental concepts of Software Quality.
2. To make the students aware regarding the importance of Software Quality Concept and Quality Assurance.
3. To make the students learn about the various Software Quality Standards.
4. The subject also deals the topics like Software Quality Metrics and Quality Models.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Develop the understanding of Software Quality Concept and Quality Assurance.
2. Aware about various Software Quality Standards.
3. Aware about the various types of Software Quality Metrics and Quality Models.
4. Know how to ensure quality during software development life cycle.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Software Quality Concept and Quality Assurance** Introduction to Software Quality; Software Perspective: Components, Characteristics, Types and Myths; Software Quality: Factors and Planning; Software Quality Assurance; Software Quality Models; Software Quality Measurement and Metrics; Software Quality Assurance: Goals and Responsibilities; Software Quality Assurance Life Cycle; Establishing Software Quality Assurance Program: SQA Planning, SQA Monitoring & Controlling, Testing, Setting Standards & Procedures.	30 Hours	1
II	**Software Quality Standards** Journey of Standards; SQA Standards: Purpose and Role; SQA Standards: Requirements and Activities: Organization; SQA Plan, Standards, Practices; Procedures and Conventions; Requirements, Design Evaluation; Test Evaluation; Review and Audits; Evaluation of Software Development Process; Configuration Management; Problem Reporting and Corrective Action; Quality Records; Audit of SQA; ISO 9000 Quality Standard Series.	30 Hours	1
III	**Software Quality Metrics** Introduction to Software Metrics; Software Quality Metrics Framework; Software Quality Metrics Features; Developments of Software Quality Metrics: SATC's Approach, Jagdish Bansiya and Carl Devis's Attempt, Kitchenham's Approach, Abreu's Approach, Victor's Approach; Selection of Software Quality Metrics: Size Related Metrics, Complexity Metrics, Halstead Metrics.	30 Hours	1

IV	**Software Quality Models** Hierarchical Quality Models: Factor-Criteria-Metrics Model, McCall's Model, Boehm Model, ISO 9126 Model, REBOOT Quality and Reusability Models, Dromey's Quality Model, Quality Model for Object Oriented Design, SATC's Quality Model; Non-Hierarchical Quality Models: Bayesian Belief Networks, Star Model; Capability Maturity Models: Level 1: Initial, Level 2: Repeatable, Level 3: Defined, Level 4: Managed, Level 5: Optimizing.	30 Hours	1

Suggested Readings:

1. R. S. Pressman, "Software Engineering: A Practitioners Approach", McGraw Hill.
2. Pankaj Jalote, "Software Engineering", Wiley.
3. R. A. Khan and M. J. Ahson, "Software Quality Concepts & Practice", Narosa Publication.

MCA2451: UNIX and Shell Programming Lab

Module	Course Topics	Credits
I	Basic UNIX commands and scripts. 1. To Study basic Unix / Linux Commands. 2. Understanding filters & pipes to perform complex tasks - pr, head, tail, cut, paste, sort, uniq, tr, grep etc. 3. Learning vi editor. 4. Writing Shell script for Unix environment. 5. Shell programming - writing simple functions, basic tests, loops, patterns, expansions, substitutions.	1
II	Linux/Unix Processes and Process Control, System Administration 1. Fork, exec, getpid, wait, sleep etc. 2. Implementing Process Synchronization methods-fifos, semaphores, message queues. 3. Using Regular Expressions (including basic awk programming). 4. Writing, compiling and running a C program on Unix / Linux. 5. Study the basic System Administration commands- user authorization, grant of users rights and privileges, backup and recovery. 6. Practice sessions on X windows, KDE and Gnome.	1

MCA2452: Management Information System Lab

Module	Course Topics	Credits
I	1. Identify a Real time Business Domain Problem. 2. Documentations of the Problem (Preparation of Problem statement) by using process Analyst tools for making DFD/ER Diagrams. 3. Search for the solution of the problem 4. Perform Feasibility study of the solution.	1
II	1. Laboratory experiment in use of interactive SQL. 2. Designing and implementing fully functional Information System by using any language. 3. Development of an IT based Application for the Business. 4. Report Generation for Managerial Solutions.	1

V Semester
MCA2501: Software Engineering
Course Objective:

1. To present the fundamental concepts of Software Engineering.
2. To make the students aware regarding the importance of various phases in Software Development.
3. To make the students learn about the various methods to deal with different stages of SDLC.
4. The subject also deals the topics like CASE Tools and SPM.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Develop the understanding of Development Life Cycle.
2. Preparation of SRS, High Level, Low Level Design and Test Cases.
3. Aware about the various types of project management activities.
4. Know how to ensure quality during software development life cycle.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Software Engineering Models and Requirement Analysis** Introduction to Software Engineering; Introduction to Software; Types of software; Scope and necessity of Software Engineering; Software Components and Software Characteristics; Software Life Cycle Models: Classical Water Fall Model, Iterative Water Fall Model, Prototype Model, Evolutionary Model, Spiral Model; Comparison of different Life Cycle Models; Requirement Analysis; Feasibility Study: Software Requirements Specification (SRS), Characteristics of SRS, Components of SRS, IEEE Standards for SRS.	30 Hours	1
II	**Software Project Planning, Analysis & Design** Project Planning; Project Size Estimation Metrics; Software Cost Estimation: Basic COCOMO model, Intermediate COCOMO model, Complete COCOMO model; Characteristics of good software design; Cohesion and Coupling; Software design approaches; Function-Oriented Software design: Structured Analysis, Data Flow Diagrams, Structured Design; Object-Oriented Software design: Key concepts of Object-Oriented Software design, Object-Oriented Vs. Function-Oriented Software design, Graphical Representation of Object-Oriented design, Object-Oriented design methodology.	30 Hours	1
III	**Software Coding, Testing and Maintenance** Introduction to Software Coding: Coding Standards and	30 Hours	1

	Guidelines, Code Walk-through, Code Inspections; Unit Testing; Black Box Testing; White Box Testing; Integration Testing; System Testing; User Acceptance Testing; Roll out of Software & Deployment Issues; Software Maintenance; Need for Maintenance; Types of Software Maintenance: Corrective Maintenance, Adaptive Maintenance, Perfective Maintenance, Preventive Maintenance.		
IV	**CASE Tools and Software Project Management** Introduction to CASE Tools: Advantages and Applications of CASE Tools, CASE Support in Software Life Cycle, Characteristics of CASE Tools, Architecture of CASE Environment; Introduction to Software Project Management: Software Configuration Management (SCM), Software Version Control, Software Quality Management, Software Quality Assurance (SQA); Software Reliability & Reliability Models; Software Reverse Engineering.	30 Hours	1

Suggested Readings:

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.
4. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, "Fundamentals of Software Engineering", PHI Publication.
5. Ian Sommerville, "Software Engineering", Addison Wesley.
6. Kassem Saleh,"Software Engineering", Cengage Learning.

MCA2502: Web Technology and Application Development
Course Objective:

1. To focus on the process of Web Development.
2. To build sound concepts of several languages used in Web Technology.
3. To create a dynamic, interactive website quickly, confidently and successfully.

Learning Outcome: Students who have successfully completed this course will have understanding of the following concepts:

1. Gradually build a static website using HTML, DHTML and CSS.
2. Move this skill upward by creating some degree of user interactivity using Javascript.
3. Server side data processing by creating PHP scripts and the technologies like ASP and JSP.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Internet Protocols, HTML,DHTML** Introduction to Internet; History of Web; Internet Protocols Governing the Web; Introduction to Text Formatting tags; Various types of Lists: Ordered, Unordered ,Definition lists; Table tags: Methods to Create Tables ,Attributes of table tag, Col span and Rowspan; Frame tags and its Attributes; Form tag: Creation of Forms, Textbox, Radio Button, Hidden etc; Introduction to DHTML; Document Object Model; Style sheets: Need of CSS, Internal and External CSS	30 Hours	1
II	**Scripting Language** Introduction to JavaScript: Advantages of JavaScript, Difference between JavaScript and Jscript; Basic Programming Techniques: Data Types and Literal, Creating Variables and JavaScript Array; Operators and Expressions in JavaScript; JavaScript Programming Constructs: Conditional Checking, Loops; Functions in JavaScript: Built in Functions and User Defined Functions; Dialog Boxes; JavaScript Document Object Model (DOM): Object hierarchy in DOM, Event Handling; Form Object: Form Object's Methods and Properties, Text Element, Button Element, etc; Other Built in Objects in JavaScript: String, Math and Date Object; Writing Client Side Validations from HTML Form Elements	30 Hours	1

III	**Active Server pages(ASP) and Java Server Pages(JSP)** Introduction to ASP: Advantages of ASP, Running of ASP file; Variable Declaration and Constructs in Asp; Using HTML forms with ASP: Get and Post methods; Asp Object Model; Asp Objects: Request, Response, Server, Session, Application; Introduction to JSP: JSP Features, Architecture, Life Cycle; JSP Tags; Implicit objects in JSP: Request, Response, Out, Session etc; Using HTML forms with JSP	30 Hours	1
IV	**PHP** Introduction to PHP: Features of PHP, Basics of PHP, Data Types ,Variables ,Constants, Operators, Arrays; Conditional Statements and Iterations; Functions: User Defined and Built in Functions; Working with String Functions; Working with Forms : Adding elements to a form, Uploading files to the web server using PHP; Debugging and Errors: Types of Errors and Error handling in PHP; Database Connectivity with MySQL	30 Hours	1

Suggested Readings:

1. Burdman Jessica, "Collaborative Web Development", Addison Wesley. 2002.
2. Bayross Ivan,"HTML, DHTML. JavaScript, and PHP", BPB Publications,4th Edition ,2001.
3. Xavier,C,"Web Technology and Design", New Age International, 2000.
4. James Atkinson, "Sams Teach Yourself Active Server Pages 3.0 in 21 Days", SAMS Publications
5. Teodoru Gugoiu,"HTML, XHTML, CSS and XML by EXAMPLE" Firewall Media,2009
6. Achyut S Godbole and Atul Kahate, "Web Technologies", Tata McGraw Hill.
7. James L Mohler and Jon Duff, "Designing interactive web sites", Delmar Thomson Learning.

MCA2503: .Net Framework & C#

Course Objective:

1. To present the fundamental concepts of Windows Desktop and Website development through Microsoft Technologies.
2. To impart solid foundation and develop the skill of Web Development through C# Programming.
3. To develop the concepts of static and dynamic Web Pages and make the students familiar with Client Server Technology, Distributed Applications and Web Services.

Learning Outcome: Students who have successfully completed this course will have full understanding of the following concepts:

1. Develop the understanding of .Net technology.
2. Develop the skills in ASP.NET with C# Programming.
3. Understand the Microsoft Database Connectivity.
4. Will be able to understand the Static and Dynamic web pages.
5. Will be able to understand about Distributed applications.
6. Will be able to develop a light to medium weight website.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**.Net Framework** Introduction and Origin of .Net technology; Framework Components, Common Language Runtime(CLR) and FCL; Managed and Unmanaged Code; Common Type System (CTS) & Common Language Specification (CLS); Microsoft Intermediate Language (MSIL) and Metadata; Just-In-Time Compilation (JIT); Garbage Collection; Base Classes and Ms.Net Namespaces.	30 Hours	1
II	**C# Basics** Introduction and Evolution of C#; Types, Identifiers, Variables, Constants, Literals; Type Conversion and Casting; Operators; Checked, Unchecked Block and Overflow Checks; Data Structures in C#: Enum, Arrays, ArrayList, Strings; Control Statements and Looping: If Statement, Switch Statement, For Loop, While Loop, Do While Loop, For each Loop; Object and Classes: Properties(Read, Write), Indexers, Inheritance (Multilevel and Hierarchical), Polymorphism (Operational and Inclusion), Operator Overloading, Interfaces, Delegates and Events, Boxing and Unboxing.	30 Hours	1
III	**C# Libraries and Assemblies** Input output (Streams Classes);Multithreading; Networking and Sockets; Managing Consol I/O Operations; .NET	30 Hours	1

	Assemblies: Type of Assemblies, GAC (Global Assembly Cache), Concept of Strong Names, Global ASAX Files; Caching Concepts: Page Output Caching, Page Fragment Caching; State management: Session Object, Hidden Fields, View State, Cookies, Cross page posting; Introduction to Generics; Web Configuration and Machine Configuration Files.		
IV	**Windows and Website Development** Windows Forms (A Skeletal Form Based Windows Program, Handling Messages, Adding a Menu and introduction and usage of various Windows Form Controls); Remoting: Server Activated Object, Client Activated Object; Marshalling: Marshal by value, Marshal by reference; Debugging, Exceptions and Error Handling; ASP.NET Web Form Controls: User controls and Server Controls; Web Services: UDDI, DISCO, WSDL; ADO.NET: Architecture, Difference between Dataset and Data Reader, Connection and Command Object; Distributed applications; Reflection; Globalization and Localization; Authentication and Authorizations; XML in .NET	30 Hours	1

Suggested Readings:

1. Balagurusamy ―Programming .with c# ―, Tata McGraw Hill Publication.
2. ASP.NET 3.0 Black Book II, Dreamtech Press.
3. Beginning ASP.NET3.0 II, WROX Publication.
4. Stephen C. Perry, Atul Kahae, Stephen Walther, Joseph Mayo, ―Essential of .NET and Related Technologies with a focus on C#, XML, ASP.net and ADO.net‖, Pearson, 2nd Edition, 2009.

MCA2504: Enterprise Resource Planning

Course Objective:

1. To present the fundamental concepts of ERP.
2. To make the students aware regarding the need and importance of ERP in today's scenario.
3. To make the students learn about the various Technologies related to ERP.
4. To develop understandings about the concept like e-ERP, e-CRM, e-SCM.

Learning Outcome: After successful completion of this course, the students would be able to:

1. ERP and related Technologies like BPR, SCM, CRM, Data Warehouse and Data Mining etc.
2. Various phases of ERP Implementation life cycle.
3. Various ERP vendors and roles of Consultants in ERP Implementation.
4. Interdependance of ERP and E-Commerce.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**ERP and its Background** Pre History of ERP; Concept of ERP System; Reasons to go for ERP; Need of ERP; Structure of ERP; Common Misconception about ERP; Evolution of ERP: Concept of Material Requirement Planning (MRP), Manufacturing Resource Planning (MRP II); Benefits and Disadvantages of ERP; ERP and Related Technologies: MIS (Management Information System), EIS (Executive Information System), DSS (Decision Support System), Data Warehouse and Data Mining: Role and Importance of Data Warehouse in ERP, Role of Data Mining in ERP.	30 Hours	1
II	**BPR, SCM and CRM** Energy Introduction to Business Process Reengineering: How ERP is related with BPR, Barriers to the Success of BPR; Supply Chain Management (SCM): Evolution and Components of SCM, Characteristics of SCM, How ERP is related with SCM; Customer Relationship Management; Role and Need of, Integration of ERP, SCM and CRM; ERP Modules: Finance, Production, Marketing, Quality Management, Logistics, Material Management.	30 Hours	1
III	**ERP Market and its Implementation** Domain of ERP as well as areas affected by ERP; Market Players: SAP, BANN, JD Edwards, PeopleSoft, Oracle; Just in Time; Make-To-Order; Make- To-Stock; Evaluation Criteria for ERP Product; ERP Implementation Lifecycle; Critical Factors in the Success and Failure of ERP; Hidden Costs involved in ERP	30 Hours	1

	Implementation; Return On Investment of ERP Implementation; Useful Guidelines for ERP Implementation.		
IV	**Future Directions** Different Roles in ERP Implementation: Role and Need of ERP Vendor, Evaluation Criteria for Vendors, Role and Need of ERP Consultants, Role of End Users; ERP and Internet; ERP and E-Commerce; Future Directions in ERP; Concept of e-ERP, e-CRM, e-SCM; Case Studies on SAP, ORACLE, People Soft etc.	30 Hours	1

Suggested Readings:

1. Alexis Leon, "Enterprise Resource Planning Demystified", Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. Mahadeo Jaiswal and Ganesh Vanapalli, "Text Book of Enterprise Resource Planning", Macmillan India Ltd., Chennai.
3. Vinod Kumar Garg and N.K. Venkitakrishnan, "Enterprise Resource Planning– Concepts and Practice", Prentice Hall of India, New Delhi.
4. Rahul V. Altekar "Enterprisewide Resource Planning", Tata McGraw Hill.
5. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology.
6. Mary Summer, "Enterprise Resource Planning", Pearson Education.

MCA2505: Decision Support System and Business Intelligence
Course Objective:

1. The objective of this course is to provide students with an understanding of the role of Business Intelligence and Business Analytics in new age business.
2. To study about kinds of analytical tools come with a BI/BA suite.
3. To study about how do students use these tools.
4. To understand the management strategies those are used for developing Business Intelligence capabilities.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Assess enterprise-wide need of Business Intelligence.
2. Acquire expertise for developing enterprise-wide model for Decision Support and Business Intelligence.
3. Choose the best sustainable Hardware and Software for DSS and BI in Organizations.
4. Develop an implementation plan for BI and DSS.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Decision Support Systems and Business Intelligence** Changing Business Environments and Computerized Decision Support; Managerial Decision Making; Computerized Support for Decision Making; An Early framework for Computerized Decision Support; The Concept of Decision Support Systems; A Framework for Business Intelligence; A Work System View of Decision Support; The Major Tools and Techniques of Managerial Decision Support	30 Hours	1
II	**Computerized Decision Support-Decision Making, Systems, Modeling, and Support** Decision making process; Introduction and Definitions of DSS; Models of DSS; Phases of the Decision-Making Process; Decision Support Systems Concepts, Methodologies, and Technologies: Decision Support System Configurations, Decision Support System Description, Decision Support System Characteristics and Capabilities, Decision Support System Classification, Components of Management Subsystem, The Decision Support System User, Decision Support System Hardware	30 Hours	1
III	**Modeling and Analysis** Management Support Systems Modeling; Structure of Mathematical Models for Decision Support; Certainty, Uncertainty, and Risk; Management Support Systems Modeling with Spreadsheets; Mathematical Programming	30 Hours	1

	Optimization: Multiple Goals, Sensitivity Analysis, What-if Analysis, Goal Seeking; Decision Analysis with Decision Tables and Decision Trees; Multicriteria Decision Making with Pairwise Comparisons; Problem-Solving Search Methods: Simulation, Visual Interactive Simulation, Quantitative Software Packages and Model base Management		
IV	**Implementing Decision Support Systems and Business Intelligence** Business Intelligence and Data Mining: Data Mining Concept and Applications, Data Mining Process, Data Mining Methods, Data Mining Software Tools; RFID and New BI Application Opportunities: Reality Mining, Virtual Worlds, The Web 2.0 Revolution, Virtual Communities, Online Social Networking: Basics Examples; Cloud Computing and BI; The Impacts Of management Support Systems-An Overview: Management Support Systems Impacts on Organizations, Management Support Systems Impacts on Individuals; Automating Decision Making and the Manager's Job; Issues of legality, Privacy, and Ethics	30 Hours	1

Suggested Readings:

1. Turban, Sharda, & Delen, "Decision Support and Business Intelligence System", Pearson Education
2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley
3. Efrem G. Mallach, "Decision Support and Data Warehouse Systems", Tata McGraw Hill
4. Larissa Moss & Shaku Atre, **"**Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications", Addison-Wesley Information Technology Series

MCA2511: Distributed Database System

Course Objective:

1. To introduce principles and foundations of distributed databases, including architecture, design issues, integrity control, query processing and optimization, transactions, and concurrency control.
2. To enable students to understand the difference between different database system and integrate them.

Learning Outcome: Students who have successfully completed this course will have full understanding of the following concepts:

1. Design and implement distributed database for enterprise application.
2. Provides solutions for heterogeneous database.
3. Use XML for schema integration.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview, Principles, and Design of Distributed Database System** An overview of Distributed Database System: Features of Distributed versus Centralized Database, Need of Distributed Databases, Distributed Database Management System (DDBMSs); Levels of Distributed Transparency: Reference architecture for Distributed Databases, Types of Data Fragmentation, Distributed Transparency for Read-Only Applications (A case); Distributed Database Design: A framework for distributed database design, Objectives of the design of Data Distribution, The Design of Database Fragmentation, The Allocation of Fragments, General criteria for Fragment Allocation, Measures of Cost and Benefits of Fragment Allocation	30 Hours	1
II	**Translation of Global Queries to Fragment Queries and Optimization of Access Strategies** Equivalence Transformation for Queries: Operator tree of a query, Equivalence Transformation for the Relational Algebra, Operator graph and determination of common sub expression; Transforming Global Queries into Fragment Queries: Canonical expression of a fragment query, Algebra of qualified relation, Simplification of Horizontal Fragmented Relation, Simplification of joins between Horizontally Fragmented Relation, Using inference for further simplification, Simplification of Vertically Fragmented Relation, Semi-join programs; A framework for query optimization: Problems in query optimization, Objectives in query optimization, Summary	30 Hours	1

	of the assumption for Distributed Query Optimization, Importance of Query Optimization in Distributed Database		
III	**The Management of Distributed Transactions** A framework for Transaction Management: Properties of transactions, Goals of Transaction Management, Distributed Transactions; Supporting atomicity of Distributed Transactions: Communication failure in Distributed Databases, Recovery of Distributed Transactions, The 2-Phase-Commit Protocol; Concurrency Control in Distributed Database System: Serializability in a Distributed Database, Two-Phase-Locking as a Distributed Concurrency Control Method, Time and Timestamp in a Distributed Database, Concurrency Control based on Timestamps; Distributed Deadlocks: Deadlock detection using Centralized or Hierarchical Controllers, False Deadlocks, Distributed Deadlock prevention	30 Hours	1
IV	**Reliability & Distributed Transaction** Reliability; Determining a Consistent View of Network, Detection and Resolution of Inconsistency, Checkpoint, Cold Restart; Distributed Database Administration: Catalogue Management in Distributed Databases, Content of catalogs, The Distribution of Catalogs, Object naming and Catalog Management with site autonomy; Authorization and Protection: Site-to-Site Protection, User identification, Enforcing Authorization rules, Classes of users Authorization and Protection.	30 Hours	1

Suggested Readings:

1. Ceri & Pelagatti - Distributed Databases: Principles and Systems; McGraw-Hill Publications
2. M. Tamer özsu, Patrick Valduriez - Principles of Distributed Database Management System; Pearson Education
3. David Bell, Jane Grimson - Distributed Database Systems; Addison-Wesley
4. O. H. Bray - Distributed Database Management System; Lexington Books
5. P.A. Bernstein, V. Hadzilacos, N. Goodman - Concurrency Control and Recovery in Database Systems; Addison Wesly Publication
6. Chhanda Ray - Distributed Database System; Pearson Education.

MCA2512: Cryptography and Network Security

Course Objective:

1. To have a fundamental understanding of the objectives of cryptography and network security.
2. To become familiar with the cryptographic techniques that provides information and network security.
3. To impart knowledge on Encryption techniques, Design Principles and Modes of operation.
4. To analyze a given system with respect to security of the system.
5. To create an understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works.
6. To examine the issues and structure of Authentication Service and Electronic Mail Security.
7. To provide familiarity in Intrusion detection and Firewall Design Principles.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Describe computer and network security fundamental concepts and principles.
2. Identify and assess different types of threats, malware, spyware, viruses, vulnerabilities, and today's attacks.
3. Describe the inner-workings of today's remote exploitation and penetration techniques.
4. Describe the inner-workings of popular encryption algorithms, digital signatures, certificates, anti-cracking techniques, and copy-right protections.
5. Demonstrate the ability to select among available network security technology and protocols such as IDS, IPS, firewalls, SSL, SSH, IPSec, TLS, VPNs, etc.
6. Get hands-on experience using popular security tools, auditing, vulnerability scanning, and pen-testing.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Cryptography** Basic Terms: Plain Text, Cipher Text, Encryption, Decryption, Cryptography, Cryptanalysis, Cryptology, Secret Key; Cipher Principles: Security, Attacks, Services and Mechanisms; Symmetric Cipher Model; Classical Encryption Techniques: Substitution and Transposition Techniques, Steganography	30 Hours	1
II	**Encryption Algorithms** Theory of block cipher design: Feistel Cipher Network Structures, DES, Triple DES; Modes of Operation (ECB, CBC, OFB,CFB); Modern Symmetric Encryption Algorithms: IDEA, Blowfish; **Public and Private Key Cryptosystem;** Principles of Public Key Cryptosystem: Key Management – Key Distribution, Placement of Encryption Function, RSA.	30 Hours	1

III	**Key management**: Diffie-Hellman Key Exchange Algorithms; Hashes and Message Digests; Message Authentication: MD5, SHA-01; Digital Signatures; User Authentication; Digital Signature Standard (DSS and DSA); Digital Certificates: Public key Infrastructure, Private Key Management; Authentication of Systems: Kerberos V4, X.509	30 Hours	1
IV	**Network Security** Email Security: PGP (Pretty Good Privacy), S/MIME, IP; Web Security, IPSec; Virtual Private Networks; Secure Sockets and Transport Layer (SSL and TLS); Firewalls; Trusted Systems; Electronic Commerce Security: Secure Electronic Transaction (SET), Electronic Money Security.	30 Hours	1

Suggested Readings:

1. William Stallings, "Cryptography and Network Security- Principles and Practices", Prentice Hall of India, Third Edition, 2003
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, 2003.
3. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2001.
4. Charles B. Pfleeger, Shari L. Pfleeger, "Security in Computing", Third Edition, Pearson Education, 2003.
5. Christos Douligeris, Dimitrios N. Serpanos, "Network Security : Current Status and Future Directions", Wiley –IEEE Press, 2007
6. Charles P. Pfleeger, Shari Lawrence Pfleger, "Security in Computing", Prentice Hall, 3rd Edition, 2003.

MCA2513: Compiler Design & Construction

Course Objective:

1. Introduce the concepts and principles of compiler design.
2. Providing students with basic understanding of grammars and language definition.
3. Introduce students about the various phases of designing a compiler.
4. Introduce students about the various programming techniques and structures used in compiler construction.
5. Provide students with practical programming skills necessary for constructing a compiler.

Learning Outcomes: On completion of this course students will be able to:

1. Understand the structure of compilers.
2. Understand the basic techniques used in compiler construction such as lexical analysis, top-down, bottom-up parsing, context-sensitive analysis, and intermediate code generation.
3. Understand the basic data structures used in compiler construction such as abstract syntax trees, symbol tables, three-address code, and stack machines.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Compilers & Translators; Computational Model: Analysis & Synthesis; Phases of Compiler & Analysis of Source Code; Pass Structure of Compiler; Bootstrapping of Complier; Finite state machines and regular expressions and their applications to lexical analysis; lexical-analyzer generator; LEX-compiler; BNF notation; Ambiguity; YACC .	30 Hours	1
II	**The syntactic specification of programming languages & Parsing Techniques** Context free grammars; Derivation and parse trees; Capabilities of CFG; Parsing Techniques: Top-Down parsers with backtracking, Recursive Descent Parsers, Predictive Parsers, Bottom–up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR parsers (SLR, Canonical LR, LALR) .	30 Hours	1
III	**Syntax-directed Translation** Intermediate code; Postfix notation; Parse trees & syntax trees; Three address code: Quadruple, Triples; Translation of assignment statements; Boolean expressions; Statements that alter the flow of control; Postfix translation; Translation with a top down parser; Array references in arithmetic expressions; Procedures call; Declarations and case statements.	30 Hours	1
IV	**Code Optimization and Code Generation, Symbol**	30 Hours	1

	Table, Error Detection & Recovery Sources of optimization: Local optimization, Loop optimization, Peephole optimization; Basic blocks and flow graphs; DAG; Data flow analyzer; Machine Model; Order of evaluation; Register allocation and code selection; Symbol Table: Symbol Table Implementation, Data Structure for Symbol Table, Symbol Table Handler; Implementation of simple stack allocation scheme; Storage allocation in block structured language; Error Detection & Recovery: Error Representation, Sources of Errors, Lexical Phase Errors, Syntax Error Detection & Recovery, Semantic Errors.		

Suggested Readings:

1. Alfred V. Aho & Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools", Pearson, 2010.
2. R. Singh & Manish Varshney, "Design & Implementation of Compiler", New Age International Publisher, First Edition, 2009
3. Davis Galles, "Modern Compiler Design", Pearson, 2010.
4. J.P. Tremblay & P.G.Sorenson, "The Theory & Practice of Compiler Writing", BS Publications, 2005.
5. K. C. Louden, "Compiler Construction, Principle and Practice", Cengage Publication, 6th Edition, 2009.
6. S.S. Muchnick Harcourt Asra, "Advanced Compiler Design implementation", Morgan Kaufman, 2006.
7. Allen, "Modern Compiler Implementation in C", Cambridge University Press, 1997.
8. Alan I. Holub, "Compiler Design in C", PHI, 2009.

MCA2514: Electronic and Mobile Commerce

Course Objective: In this course, students will study

1. The fundamentals of the business and economic motivations for e-Commerce as well as the needs and desires of individuals.
2. The underlying computation, information and communication environments that encompass and enable e-Commerce transactions.
3. The evolving role of new highly portable, place-aware, always-with-you personal devices in e-Commerce, i.e., M-commerce.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Understand the nature and trends in e-Commerce and Mobile commerce.
2. Recognize the business impact and potential of e-Commerce.
3. Explain the technologies required to make e-Commerce viable.
4. Discuss the current drivers and inhibitors facing the business world in adopting and using e-Commerce.
5. Explain the economic consequences of e-Commerce.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Politics, Science and Business of Sustainability** Introduction to Electronic Commerce: What is E-commerce?, Traditional Commerce vs. E-commerce, Advantages and Disadvantages of E-commerce, Impact of E-commerce, Classification of E-commerce, Applications of E-commerce, Limitations of E-commerce; Electronic Commerce Business Models: Native Content based Model, Transplated Content Model, Native Transaction Model, Transplated Transaction Models; Architectural Framework of Electronic Commerce: Network Infrastructure, Information Distribution Technology, Networked Multimedia Content Publishing Technology, Security and Encryption, Payment Services, Business Service Infrastructure, Public Policy and Legal Infrastructure	30 Hours	1
II	**Electronic Commerce Infrastructure** Electronic Commerce: Network Infrastructure: Local Area Networks, Wide Area Networks, Internet, Domain Name Systems; Electronic Commerce: Information Distribution and Messaging, File Transfer Protocol (FTP) Application, Electronic Mail, World Wide Web Server, HTTP; Electronic Commerce: Information Publishing Technology: Information Publishing, Web Browser, Hypertext Markup Language, Common Gateway Interface, Multimedia Content	30 Hours	1

III	**Electronic Commerce Security and Payment System** Securing the Business on Internet: Vulnerability of Information on Internet, Security Policy, Procedures and Practices, Site Security, Protecting the Network, Firewalls; Securing Network Transaction: Transaction Security, Cryptology, Cryptographic Algorithms, Public Key Algorithms, Authentication Protocols, Digital Signatures, Electronic Mail Security, Security Protocols for Web Commerce; Electronic Payment System: Introduction to Payment Systems, Online Payment Systems, Pre-Paid Electronic Payment Systems, Postpaid Electronic Payment Systems	30 Hours	1
IV	**Mobile Commerce: Introduction, Framework, and Models** What is Mobile Commerce; Benefits of Mobile Commerce; Impediments in Mobile Commerce; Mobile Commerce Framework: Wireless Network Infrastructure, Information Distribution Protocols, Mobile Commerce Payment Systems, Mobile Payment Models; Mobile Commerce Applications	30 Hours	1

Suggested Readings:

1. Bharat Bhaskar, "Electronic Commerce: Framework, Technologies & Applications 4/e", TMH
2. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison-Wesley
3. Bajaj and Nag, "E-Commerce: The Cutting Edge of Business", Tata McGraw Hill
4. P. Loshin, John Vacca, "Electronic Commerce", Firewall Media, New Delhi
5. P. T. Joseph, "E-Commerce: An Indian Perspective", PHI Learning Pvt. Ltd.
6. Norman, Sadeh, "M Commerce: Technologies, Services, and Business Models", Wiley Computer Publishing

MCA2515: Software Project Management

Course Objective:

1. To present fundamentals of project management.
2. To cover software project management processes and techniques especially relevant to those likely to participate in or manage software projects.

Learning Outcome: Students who have successfully completed this course will have full understanding of the following concepts:

1. Develop the understanding of Software Project Management.
2. Develop the Risk Management Plan.
3. Understanding of Quality Management.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Project Management** What is a Project; Advantages of project management; Examples of information technology projects ;what is Project Management; Project stakeholders; Project management knowledge areas; Project management tools and techniques; Project success factors; The Project Manager's skills , role and responsibility: Job description, Skills for project manager, Role and responsibility of project manager; Systems View of Project Management: A systems approach, The three-sphere model for systems management, Stakeholder Management, The importance of top management commitment, The need for organizational commitment to information Technology, The need for organizational standards, Project Phases and the Project Life Cycle	30 Hours	1
II	**Project Integration Management** Project Integration Management ; Strategic Planning and Project Selection; Identifying potential projects ; Methods for Selecting Projects ;Categorizing information technology projects; Focusing on broad organizational needs, Cost benefit evaluation techniques: Net Present Value Analysis, Return on Investment and Payback Analysis; Project Charters; Preliminary Scope Statement; Project Management Plans; Project Execution &Monitoring and Controlling Project Work ;Integrated Change Control & closing projects	30 Hours	1

III	**Project Scope and Quality Management** Scope Definition and the Project Scope Statement ; Creating the Work Breakdown Structure; Scope Verification ;Scope Control; Improving user input; Suggestions for reducing incomplete and changing requirements; Project Quality Management: Importance of Project Quality Management, Quality planning, Quality assurance, Quality Control, Tools and Techniques for Quality Control, Pareto analysis, Statistical sampling, Testing, ISO standards for quality, cost of Quality .	30Hours	1
IV	**Project Risk and Procurement Management** The Importance of Project Risk Management ;Risk Management Planning; Qualitative Risk Analysis ;Quantitative Risk Analysis; Procurement Management: Tools and Techniques for Planning Purchases, Make or buy analysis, Expert judgment, Procurement Management Plan, planning Contracting, Requesting Seller Responses and Selecting Sellers, Administering and Closing the Contract.	30 Hours	1

Suggested Readings:

1. Kathy Schwalbe, "Information Technology Project Management", 4th ed., THOMSON Course Technology, 2007.
2. Bob Hughes and Mike Cotterell, "Software Project Management", 4th ed., Tata McGraw-Hill
3. Ramesh, Gopalaswamy, "Managing Global Projects ", Tata McGraw Hill, 2001.
4. Royce," Software Project Theory", Pearson Education, 1999.
5. Pankaj Jalote "Software Project Management In Practice", Pearson Education, 2000.
6. S.A. Kelkar, "Software Project Management: A Concise Study", 2nd ed., Prentice Hall.
7. Liffingwell, "Managing Software Requirements: A Use Case Approach", Pearson Education.
8. Tom Gilb, "Principles of Software Engineering Management", Addison Wesley, 1988.

Watts Humphrey, "Managing the Software Process", Addison

MCA2551: Web Technology and Application Development Lab

Module	Course Topics	Credits
I	1. Implementation of List Tags in HTML. 2. Implementation of Table Tag in HTML. 3. Implementation of Frameset Tag in HTML. 4. Implementation of different Form Tags in HTML. 5. Implementation of Cascading Style Sheet in Web Pages. 6. Implementation of control structure in Java Script. 7. Implementation of Looping structure in Java Script 8. Implementation of form validate in Java Script.	1
II	1. Implementation of control structure in Asp. 2. Implementation of Request objects in Asp. 3. Implementation of Request Object in JSP. 4. Implementation of mathematical functions in JSP. 5. Implementation of arrays in JSP. 6. Implementation of Session Object in JSP. 7. Implementation of Database Connectivity in JSP. 8. Implementation of looping structure in PHP 9. Implementation of functions in PHP 10. Implementation of string functions in PHP 11. Implementation of database connectivity using MySql.	1

MCA2552: .Net Framework & C# Lab

Module	Course Topics	Credits
I	1. Implementation of Decision Making and Branching Statements on Console Applications. 2. Implementation Iterative Statements on Console Applications. 3. Implementation of Enum on console Applications. 4. Implementation of Arrays on Console Applications. 5. Implementation of ArrayList on Console Applications. 6. Implementation of Strings on Console Applications. 7. Implementation of Inheritance and Polymorphism on Console Applications. 8. Implementation of Interfaces on Console Applications. 9. Construct the C# console application to implement the Operator Overloading. 10. Implementation of Delegates and Events on Console Applications.	1
II	1. Implementation of Server Side Controls in asp.net. 2. Implementation of Database Connectivity in asp.Net 3. Implementation of various Data Rendering Controls in asp.Net. 4. Implementation of Web Services in asp.Net Applications. 5. Implementation of Remoting in asp.Net Applications. 6. Implementation of private assemblies in .NET Applications. 7. Implementation of shared assemblies in .NET Applications.	1