Courses of Study

MCA

(Master of Computer Application)

Programme

Department of Computer Applications

राष्ट्रीय प्रौद्योगिकी संस्थान, जमशेदपुर
National Institute of Technology, Jamshedpur

Course Structure

SEMESTER – I

Sl. No.	Subject Code	Course Name	L-T-P	Credits
1.	MH31101	Discrete Mathematics	3-1-0	4
2.	CA31101	Computer Programming and Problem Solving	3-1-0	4
3.	CA31102	Computer Organization and Architecture	3-1-0	4
4.	CA31103	Optimization Techniques	3-1-0	4
5.	GE32101	Financial Management	3-1-0	4
6.	CA31201	Computer Programming Lab.	0-0-3	2
7.	CA31202	Optimization Techniques Lab.	0-0-3	2
		TOTAL	**15-5-6**	**24**

SEMESTER – II

Sl. No.	Subject Code	Course Name	L-T-P	Credits
1.	MH32102	Computer Oriented Numerical Techniques	3-1-0	4
2.	CA32104	Object Oriented Programming	3-1-0	4
3.	CA32105	Data Structures	3-1-0	4
4.	CA32106	Object Oriented Analysis and Design	3-1-0	4
5.	CA32107	Operating System	3-1-0	4
6.	CA32203	Numerical Computing Lab. Using OOP	0-0-3	2
7.	CA32204	Data Structure Lab.	0-0-3	2
		TOTAL	**15-5-6**	**24**

SEMESTER – III

Sl. No.	Subject Code	Course Name	L-T-P	Credits
1.	CA33108	Data Base Management Systems	3-1-0	4
2.	CA33109	Computer Communication and Networks	3-1-0	4
3.	CA33110	Design and Analysis of Algorithms	3-1-0	4
4.	CA33111	Interactive Computer Graphics and Multimedia	3-1-0	4
5.	CA33112	*Elective – I*	3-1-0	4
6.	CA33205	Data Base Management Lab.	0-0-3	2
7.	CA33206	Computer Graphics and Multimedia Lab.	0-0-3	2
		TOTAL	**15-5-6**	**24**

SEMESTER – IV

Sl. No.	Subject Code	Course Name	L-T-P	Credits
1.	CA34113	Software Engineering	3-1-0	4
2.	CA34114	Artificial Intelligence	3-1-0	4
3.	CA34115	Internet and Web Technology	3-1-0	4
4.	CA34115	*Elective – II*	3-1-0	4
5.	CA34116	*Elective – III*	3-1-0	4
6.	CA34207	Web Technology Lab.	0-0-3	2
7.	CA34208	*Elective* Lab.	0-0-3	2
		TOTAL	**15-5-6**	**24**

SEMESTER – V

Sl. No.	Subject Code	Course Name	L-T-P	Credits
1.	GE35102	Organization Behavior and Management	3-1-0	4
2.	CA35117	Network Programming	3-1-0	4
3.	CA35118	Decision Support System	3-1-0	4
4.	CA35119	*Elective –IV*	3-1-0	4
5.	CA35120	*Elective –V*	3-1-0	4
6.	CA35209	DSS and Network Programming Lab.	0-0-3	2
7.	CA35301	Seminar/Colloquium/Comprehensive Viva	0-0-3	2
		TOTAL	**15-5-6**	**24**

SEMESTER – VI

Sl. No.	Subject Code	Course Name	L-T-P	Credits
1.	CA36401	Thesis/Project	0-0-20	20
		TOTAL	**0-0-20**	**20**

Total Credits of six semesters = 140

LIST OF ELECTIVES

1. System Analysis and Design
2. E-Commerce and E-Business
3. Information Storage and Management
4. Supply Chain Management
5. Managerial Economics
6. Data-ware Housing and Data Mining
7. ERP System
8. Client-Server Technology
9. Java Programming
10. Information Security
11. Systems Simulation and Modeling
12. Graph Theory and Network Flows
13. Parallel and Distributed Processing
14. Image Processing
15. Windows Application Programming
16. Microprocessors and their interfacing
17. Computer-Aided Design
18. Industrial Robotics and Automation
19. Soft Computing
20. Pattern Recognition
21. Advanced Computer Architecture
22. Advanced Database Management System
23. Neural Networks
24. Embedded System
25. Formal Language and Automata Theory
26. Computer Oriented Statistical Methods
27. Mathematical Logic and Logic Programming
28. Software Project Management
29. Software Reliability
30. Software Safety
31. Fault-Tolerant Computing
32. Bluetooth Technology
33. Multimedia Technology
34. Mobile Computing
35. Real Time Systems
36. Compiler Design
37. Unix and Shell Programming
38. Cluster and Grid Computing

SEMESTER – I

MH31101: Discrete Mathematics	L – T – P 3 – 1 – 0

Unit-I:
Function: Definition, type of functions, one to one, into and onto function, inverse function, composition of functions, recursively defined functions.
Algebraic Structures: Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, example and standard results, Rings and Fields: definition and standard results.

Unit-II:
Posets, Hasse Diagram and Lattices: Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, and complemented lattices.
Combinatorics: Basic Counting Technique, Pigeon-hole Principle, Recurrence Relation, Generating function, Polya's Counting Theorem
Paths and Circuits : Isomorphism, Subgraphs, Walks, Paths and Circuits, Connected and disconnected graphs, Euler graphs, Operations on graphs, Hamiltonian graphs, Travelling salesman problem.

Unit-III:
Introduction and Basic Concepts : Definition, Representation of graphs, Finite and infinite graphs, Directed graphs, Incidence and degree, Bipartite graph, Planar graphs, Matrix representation of graphs, Applications of graph in computer science.

Graphs: Simple graph, multi graph, graph terminology, representation of graphs, Bipartite, Regular, Planar and connected graphs, connected components in a graph, Euler graphs, Hamiltonian path and circuits, Graph coloring, chromatic number, isomorphism and Homomorphism of graphs.
Trees and Fundamental Circuits : Definition, Properties of trees, Spanning trees, Fundamental circuits and cut-sets, Connectivity and separability, Minimal spanning tree and connected algorithms, Rooted and Binary trees, Applications of trees.

Unit-IV:
Tree: Definition, Rooted tree, properties of trees, binary search tree, tree traversal.
Shortest Path Problems : Shortest path algorithms, Generalized shortest path algorithms, Applications of shortest path problems.
Network Flow Problems : Flows in network, formulation, Max-flow min-cut theorem, Minimum cost flow problems, Ford-Fulkerson algorithm for maximum flow.

Unit-V:
Propositional Logic: Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradictions, Algebra of Proposition, logical implications, logical equivalence, predicates, Universal and existential quantifiers.
Formal language & Automata: Grammars, Languages, regular expression, regular languages, phrase structure grammars, types of grammars, Chomsky's hierarchy, finite state automata, finite state machine, deterministic finite automata, non-deterministic finite automata, conversions.

Text books
1. Discrete Mathematics and Its Applications, By Kenneth H Rosen, McGraw Hill, Sept.2002.
2. Discrete Mathematical Structures with Applications to Computer Science, By J. P.Tremblay, R.Manohar, McGraw Hill Pub, 1975.
3. "Graph Theory With Applications to Engineering and Computer Science" Prentice Hall, Englewood Cliffs, 1974
4. Combinatorics: Theory and Applications, By V. Krishnamurthy, East-West Press Pvt. Ltd., New Delhi, 1986.
5. K. L. P. Mishra, N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation, PHI Publication

CA31101: Computer Programming and Problem Solving	L – T – P 3 – 1 – 0

Unit I
Programming language, introduction to Operating System, Write and Execute the first program, Introduction to the design and implementation of correct, efficient and maintainable programs, Structured Programming, Trace an algorithm to depict the logic.

Unit – II
Introduction: Algorithms, Flow charts, Problem solving methods, Need for computer languages, Structure of a C program, Data type, Constants, Variables, Identifiers, Key words, Declarations, Expressions, Statements and Symbolic constants.
Input and Output: getchar, putchar, scanf, printf, gets, puts, functions, Pre-processor commands, Preparing and running a complete C program.
Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators, Library functions.
Control statements: While, do-while, for statements, nested loops, if-else, switch, break, continue and goto statements, comma operator.

Unit III
Functions: Defining and accessing function, passing arguments, function prototypes, recursion, use of library functions, storage classes.
Arrays: Defining and processing an array, Passing array to a function, Multi dimensional arrays, String handling, Operations on strings.

Unit IV
Pointers: Declarations, Passing pointer to a function, Operations on pointers, Pointers and arrays, Arrays of pointers.
Structures and unions: Defining and processing a structure, Passing structure to a function, Pointers and structures, Unions, Dynamic memory allocation, defining and using stacks and linked lists.
File handling: Open, Close, Create, File operations, Unformatted data files, Command line arguments.
Fundamental notations: Primitive and composite data types, Times and space complexity of algorithms.

UNIT – V
Sequential search, Sorting arrays, Strings, Text files, **The Standard C Preprocessor:** Defining and calling macros, utilizing conditional compilation, passing values to the compiler, **The Standard C Library:** Input/Output : fopen, fread, etc, string handling functions, Math functions : log, sin, alike Other Standard C functions.

Text book:
1. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.

2. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition [India Edition], 2007.

CA31102: Computer Organization and Architectures	**L – T – P** 3 – 1 – 0

Unit I:
Representation of information: Number systems, Integer and floating point representation, Character codes (ASCII, EBCDIC), Error detection & correction codes.
Basic building blocks : Boolean Algebra and logic gates, Combinational Circuits.

Unit II:
Flip-Flops, Finite state machines: State table diagrams, state minimization. Excitation functions of memory elements. Synthesis of synchronous sequential circuits, Introduction to asynchronous sequential circuits, Decoders, Multiplexers, Registers, Counters, Logic Implementation on ROM, PAL, PLA and Gate Array.

Unit III:
Central processing unit: Stack organization, Instruction formats, Addressing modes, Instruction types, Instruction cycle and execution cycle.

Unit IV:
Control unit : Hardwired control, Micro-programmed control, RISC, CISC, Pipelining in CPU design, Superscalar processors.

Unit V:
Memory system : Storage technologies, Memory array organization, Memory hierarchy, interleaving, cache and virtual memories and architectural aids to implement these.
Input-output devices and characteristics : Input-output processing, bus interface, data transfer techniques, I/O interrupts, channels.

Text Books:

1. Mano, M, "Computer System and Architecture", (3rd edition) Prentice Hall of India, New Delhi, 1994.

Reference Books:

1. Pal Chauduri, P., "Computer Organisation and Design", Prentice Hall of India, New Delhi, 1994.
2. Computer Architecture and Organization by John P. Hayes, McGraw- Hill International Editions.
3. "Computer Fundamentals by B. Ram", New Age International (P) Limited Publishers.
4. "Fundamentals of Computers by V. Rajaraman", Prentice Hall of India Private Limited.

CA31103: Optimization Techniques	**L – T – P** 3 – 1 – 0

Unit I:
Liner Programming: Structure of linear programming model, advantages and limitations of linear programming, application areas of linear programming,

Mathematical Model of Linear Programming Problem: Examples on production, marketing, finance, agriculture and transportation

Unit II:
Graphical Solution Methods of Linear Programming problem: Examples on minimization and maximization linear programming problem, examples on mixed constraints linear programming

Special cases in Linear Programming: Alternative (or multiple) optimal solutions, unbound solution, infeasible solution

Unit III:
Simplex Method: Standard form of linear programming, simplex algorithm (maximization case), simplex algorithms (minimization case): Two phase method, big-M method.

Unbound solution, infeasible solution

Unit IV:
Duality in Linear Programming: Formulation of dual linear programming problem, advantages of duality, dual simplex algorithm

Sensitivity Analysis: Changes in objective function coefficient, changes in the availability of resources, changes in input-output coefficients.

Unit V:
Transportation Problem: Methods for finding initial solution: North-West corner method, least cost method, Vogel's approximation method.

Test for Optimality: MODI method

Assignment Problem: Solution optimal solution, maximization case in assignment problem, travelling salesman problem.

Text Books:
1. J. K. Sharma, "Operations Research : Theory and Applications", 3/e Macmillan Publishers India
2. Ravindran, Phillips & Solberg, "Operations Research: Principles and Practice", 2nd Ed, Wiley India publisher

References:
1. Hadley, G.,"Linear Programming, and Massachusetts", Addison-Wesley
2. Taha, H.A, "Operations Research – An Introduction", Macmillian
3. Hiller, F.S., G.J. Lieberman, " Introduction to Operations Research", Holden-Day
4. Harvey M. Wagner, "Principles of Operations Rsearch with Applications to   Managerial   Decisions", Prentice Hall of India Pvt. Ltd.
5. Swarup K etal, "Operation Research", S. Chand

GE32101: Financial Management	**L – T – P** 3 – 1 – 0

Unit I:

Financial statements and ratio analysis : Balance sheet, profit and loss accounts, various types of ratios based on balance sheet, income statements and their usefulness.

Working capital management : Definition, need for working capital, sources and user of working capital, determination of appropriate level of working capital (Hedging principle), Inventory mode.

Budget and budgetary control : Nature, scope and importance, methods of finalization of master budget and functional budgets.

Unit II:

Cost and management accounting : Cost terminology, cost elements-labour, material, overhead, methods of distributing overhead, methods of costing-job and process costing.

Accounting for fixed assets and depreciation : Methods for calculating depreciation, accounting for depreciation, selecting methods for depreciation, intangible assets, financing engineering enterprises-shares, bonds, debentures etc.

Unit III:

Marginal costing : Nature, scope and importance, break-even analysis, its uses and limitations, construction of break-even chart, practical applications of marginal costing.

Standard costing : Nature and scope, computation and analysis of variances with reference to material cost, labour cost and overhead cost, interpretation of variances.

Uncertainty in economic studies : Risk & return concepts, expected return in a portfolio, portfolio risk, diversifiable and non-diversifiable risk, Markowitz model; the mean variance criterion, selection of optimal portfolio.

Unit IV:

Time value of money : Interest calculation, present value factor, annuities, capital recovery and sinking fund factors, perpetuities and capitalized value, gradient and geometric series of cash flow, continuous compounding, equivalence, capital recovery cost.

Unit V:

Project appraisal : project evaluation, social cost benefit analysis, bank guide lines, present worth method, annual equivalent amount method, alternatives having unequal live. Cost of capital, financial leverage and capital structure : component of cost of capital, cost of debt, cost of equity capital (Beta and dividend valuation model approach), weighted average cost of capital, economic value addition , financial leverage, EBIT-EPS analysis, optimal capital structure.

Text Books:

1) Narayanswami - Financial Accounting: A Managerial Perspective (PHI, 2nd Edition).

2) Mukherjee - Financial Accounting for Management (TMH, 1st Edition).

3) Ramchandran & Kakani - Financial Accounting for Management (TMH, 2nd Edition).

4) Ghosh T P - Accounting and Finance for Managers (Taxman, 1st Edition).

5) Maheshwari S.N & Maheshwari S K – An Introduction to Accountancy (Vikas, 9th Edition)

6) Ashish K. Bhattacharya- Essentials of Financial Accounting (PHI, New Delhi)

7) Ghosh T.P- Financial Accounting for Managers (Taxman, 3rd Edition)

8) Maheshwari S.N & Maheshwari S K – A text book of Accounting for Management (Vikas, 1st Edition)

9) Gupta Ambrish - Financial Accounting for Management (Pearson Education, 2nd Edition)

CA31201 : Computer Programming Lab.	**L – T – P** 0 – 0 – 3

Write programming using C:

- Data types and variables, operators and expressions, evaluation of expressions
- Conditional operators, If-if else-if statement, nested if, iteration
- Repeat ion structure in C, modular programming, iteration function
- Recursion, Storage classes, arrays, structures, pointers, unions
- Searching, sorting, selection, linked list
- Searching sorting on strings, multidimensional arrays, operations on files
- Std. C library, Use of Std. C library.

CA31202: Optimization Techniques Lab.	**L – T – P** 0 – 0 – 3

Program development using C/C++
1. Simplex Methods
2. Duality Techniques
3. Transportation Problem
4. Assignment Problem
5. Integer Programming
6. Dynamic programming
7. Queuing Theory

SEMESTER - II

MH32102: Computer Oriented Numerical Techniques	**L – T – P** 3 – 1 – 0

Unit-I:
Floating point Arithmetic: Representation of floating point numbers, Operations, Normalization, Pitfalls of floating point representation, Errors in numerical computation
Iterative Methods: Zeros of a single transcendental equation and zeros of polynomial using Bisection Method, Iteration Method, Regula-Falsi method, Newton Raphson method, Secant method, Rate of convergence of iterative methods.

Unit-II:
Simultaneous Linear Equations: Solutions of system of Linear equations, Gauss Elimination direct method and pivoting, Ill Conditioned system of equations, Refinement of solution. Gauss Seidal iterative method, Rate of Convergence

Unit-III :
Interpolation and approximation: Finite Differences, Difference tables, Polynomial Interpolation**:** Newton's forward and backward formula, Central Difference Formulae: Gauss forward and backward formula.
Interpolation with unequal intervals: Langrange's Interpolation, Newton Divided difference formula, Approximation of function by Chebyshev polynomial.

Unit-IV:
Numerical Differentiation and Integration: Introduction, Numerical Differentiation, Numerical Integration, Trapezoidal rule, Simpson's rules,
Solution of differential equations: Euler's Method, Taylor's Method,
Runge-Kutta methods, Predictor-corrector method.

Unit-V:
Curve fitting, Cubic Spline and Approximation: Method of least squares, fitting of straight lines, polynomials, exponential curves etc

References:

1. Rajaraman V., "Computer Oriented Numerical Methods", PHI
2. Gerald & Wheatley, "Applied Numerical Analyses", AW
3. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Int.
4. Grewal B. S., "Numerical methods in Engineering and Science", Khanna Publishers, Delhi
5. T. Veerarajan, T Ramachandran, "Theory and Problems in Numerical Methods", TMH
6. Pradip Niyogi, "Numerical Analysis and Algorithms", TMH
7. Francis Scheld, "Numerical Analysis", TMH
8. Gupta S. P., "Statistical Methods", Sultan and Sons

CA32104: Object Oriented Programming	**L – T – P** 3 – 1 – 0

Unit I

Object Oriented Paradigm: Basic concepts of Object Oriented Programming (OOP), Structured vs OOP, Benefits of OOP, Object Modeling-Association, Aggregation and Generalization.

Introduction to C++: Tokens, Keywords, Identifiers, Variables, Data types, Operators in C++, Expressions and Implicit Conversions, Control Structures.

Functions in C++: The Main Function, Function Prototyping, Passing arguments to a function, Inline Functions, Default Arguments, Function Overloading, Friend and Virtual Functions, Storage Classes.

Unit II

Classes and Objects: Class Declaration, Defining Member Functions, Nesting of Member Functions, Private Member Functions, Arrays within a class, Creating Objects, Arrays of Objects, Objects as Function Arguments, Pointers to Members, Difference between Structures and Classes.

Constructors and Destructors: Constructors, Constructors with arguments, Multiple Constructors, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Destructors.

Unit III

Operator Overloading: Defining Operator Overloading, Overloading of Unary and Binary Operators, Manipulation of Strings Using Operators, Rules for Over loading Operators, Type Conversions.

Inheritance: Introduction, Base and Derived Classes, Different forms of Inheritance, Virtual Base Classes, Abstract Classes, Constructors in Inheritance, Overriding Base Class Members.

Unit IV

Virtual Functions and Polymorphism: Introduction, Pointers to objects, this Pointer, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions, Friend Functions.

Files and Streams: Stream Classes, Opening and Closing of Files, File of Arrays, File of Structures, File Pointers and Their Manipulations, Error Handling During File Operations, Command-Line Arguments.

Unit V

Templates and Exception Handling: Introduction, Class Templates, Function Templates, Member function Templates, Concept of Exception Handling, Different Types of Exception, Throwing Exception from a Function, Multiple Catch Statements.

Text Books :

1. Lafore R., "Object Oriented Programming in Turbo C++", Galgotia Publication, New Delhi, 1995.
2. Balguruswami, E., 'Object Oriented Programming in C++', Tata McGraw Hill Pub., New Delhi, 1995.
3. D. Ravichandran : "Programming with C++", Tata McGraw Hill Publication.

Reference Books:

1. Schildt : "C++ : The Complete Reference", 3rd Ed., Tata McGraw Hill Publication.
2. Deitel & Deitel : "C++ : How to Program", 3rd Ed., Pearson Education Pvt. Ltd.

| **CA32105:** Data Structures | **L – T – P** 3 – 1 – 0 |

Unit -I
Introduction: Basic Terminology, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time-Space trade-off

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, Ordered List, Sparse Matrices, and Vectors.

Stacks: Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack.

Recursion: Recursive definition and processes, recursion in C, example of recursion, Tower of Hanoi Problem, simulating recursion. Backtracking, recursive algorithms, principles of recursion, tail recursion, removal of recursion.

Unit - II
Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, De-queue, and Priority Queue**.**

Linked list: Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.

Unit - III
Trees: Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree. Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees. Traversing Threaded Binary trees, Huffman algorithm**.**

Searching and Hashing: Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.

Unit - IV
Sorting: Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting.

Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees.

Unit - V
Graphs: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.

File Structures: Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons.

Text Books

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.

Reference Books
1. S. Lipschutz, Data Structures Mc-Graw Hill International Editions, 1986.
2. Jean-Paul Tremblay, Paul. G. Soresan, An introduction to data structures with Applications, Tata

CA32106: Object Oriented Analysis and Design	**L – T – P** 3 – 1 – 0

Unit I:
Overview of System Analysis and Design: System definition & concepts, System models, Systems development life cycle, Feasibility analysis, Project selection plan and proposal, Prototyping, Cost-benefit analysis.

Unit II:
Concept of structured analysis, Tools of structured analysis-Data flow diagrams, Data dictionaries, Structured English, Decision Trees and Decision Tables.
System Design: Process and stages of System Design, Logical and Physical Design, Process modelling with physical and logical DFD's, System flow charts and structured charts, Data modelling with ERD's.

Unit III:
Modular and Structured Design: Modularization, Module specification, Module coupling and cohesion, Top-down and Bottom-up design. Testing and validation System quality control and assurance, Reviews and walkthroughs, Maintenance activities and issues, Audit trails and system security.

Unit IV:
Analysis and Design in Object-oriented Platforms: An Overview of Object Oriented Systems Development - Object Basics – Object Oriented Systems, Introduction object modeling, Object oriented analysis and design through object modeling techniques, Dynamic modeling and functional modeling, Process of Object oriented design, Object oriented programming systems for implementation, Object oriented databases.

Unit V:
Rumbaugh Methodology - Booch Methodology - Jacobson Methodology - Patterns – Frameworks – Unified Approach – Unified Modeling Language – Use case - class diagram - Interactive Diagram - Package Diagram - Collaboration Diagram - State Diagram - Activity Diagram. Identifying use cases - Object Analysis - Classification – Identifying Object relationships - Attributes and Methods.
Design axioms - Designing Classes – Access Layer - Object Storage - Object Interoperability. Designing Interface Objects – Software Quality Assurance – System Usability - Measuring User Satisfaction   ,

Text Books

1. Systems Analysis and Design (Prentice Hall) –by Dr. Kenneth E Kendall, Julie E Kendall
2. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 1999
3. Martin Fowler, "UML Distilled", Second Edition, PHI/Pearson Education, 2002.

References

1. Stephen R. Schach, "Introduction to Object Oriented Analysis and Design", Tata McGraw Hill, 2003.
2. James Rumbaugh, Ivar Jacobson, Grady Booch "The Unified Modeling Language Reference Manual", Addison   Wesley,1999.

CA32107: Operating Systems	**L – T – P** 3 – 1 – 0

Unit-I:
Introduction: Definition and types of operating systems, Batch Systems, multi programming, time–sharing parallel, distributed and real-time systems, Operating system structure, Operating system components and services, System calls, system programs, Virtual machines.

Unit-II:
Process Management: Process concept, Process scheduling, Cooperating processes, Threads, Interprocess communication, CPU scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real-time scheduling and Algorithm evaluation.

Unit-III:
Process Synchronization and Deadlocks: The Critical-Section problem, synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions, Monitors, Deadlocks-System model, Characterization, Deadlock prevention, Avoidance and Detection, Recovery from deadlock, Combined approach to deadlock handling.

Unit-IV:
Storage management: Memory Management-Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation with paging, Virtual Memory, Demand paging and its performance, Page replacement algorithms, Allocation of frames, Thrasing, Page Size and other considerations, Demand segmentation, File systems, secondary Storage Structure, File concept, access methods, directory implementation, Efficiency and performance, recovery, Disk structure, Disk scheduling methods, Disk management, Recovery, Disk structure, disk scheduling methods, Disk management, Swap-Space management, Disk reliability.

Unit-V:
Security & Case Study: Protection and Security-Goals of protection, Domain of protection, Access matrix, Implementation of access Matrix, Revocation of Access Rights, language based protection, The Security problem, Authentication, One Time passwords, Program threats, System threats, Threat Monitoring, Encryption.
Windows NT-Design principles, System components, Environmental subsystems, File system, Networking and program interface, Linux system-design principles, Kernel Modules, Process Management, Scheduling, Memory management, File Systems, Input and Output, Interprocess communication, Network structure, security

References

1. Abraham Siberschatz and Peter Baer Galvin, "Operating System Concepts", Fifth Edition, Addision-Wesley
2. Milan Milankovic, "Operating Systems, Concepts and Design", McGraw-Hill.
3. Harvey M Deital, "Operating Systems", Addison Wesley
4. Richard Peterson, "Linux: The Complete Reference", Osborne McGraw-Hill.
5. Stalling, "Operating Systems", Pearson Education Pvt. Ltd..
6. Tanenbaum, A.S., "Modern Operating Systems", Prentice Hall of India Pvt. Ltd. 1995.

CA32203: Numerical Computing Lab. Using OOP	L – T – P 0 – 0 – 3

Experiments based on the course Object Oriented Systems to be done on C++/JAVA/UML/VISIO etc.

- implement floating point arithmetic operations i.e., addition, subtraction, multiplication and division.
- deduce errors involved in polynomial interpolation. Algebraic and trancedental equations using Bisection, Newton Raphson, Iterative, method of false position, rate of conversions of roots in tabular form for each of these methods.
- implement formulae by Bessels, Newton, Stirling, Langranges etc.
- implement method of least square curve fitting.
- Implement numerical differentiation.
- Implement numerical integration using Simpson's 1/3 and 3/8 rules, trapezoidal rule.
- show frequency chart, regression analysis, Linear square fit, and polynomial fit.

CA32204: Data Structures Lab.	L – T – P 0 – 0 – 3

Write Program in C or C++ for following:

- Sorting programs: Bubble sort, Merge sort, Insertion sort, Selection sort, and Quick sort.
- Searching programs: Linear Search, Binary Search.
- Array implementation of Stack, Queue, Circular Queue, Linked List.
- Implementation of Stack, Queue, Circular Queue, Linked List using dynamic memory allocation.
- Implementation of Binary tree.
- Program for Tree Traversals (preorder, inorder, postorder).
- Program for graph traversal (BFS, DFS).
- Program for minimum cost spanning tree, shortest path.

SEMESTER – III

CA33108: Database Management Systems

L – T – P
3 – 1 – 0

Unit- I :
Introduction: An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.

Data Modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.

Unit- II :
Relational data Model and Language: Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus.

Introduction to SQL: Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes, Queries and sub queries, Aggregate functions, Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors in SQL, Triggers.

Unit- III :
Data Base Design & Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependencies, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

Unit- IV :
Transaction Processing Concepts: Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.

Unit- V :
Concurrency Control Techniques: Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi-version schemes, Recovery with concurrent transaction. Transaction Processing in Distributed system, data fragmentation. Replication and allocation techniques for distributed system, overview of concurrency control and recovery in distrusted database.

References

1 Date C J, "An Introduction To Database System", Addision Wesley
2 Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
3 Elmasri, Navathe, "Fundamentals Of Database Systems", Addision Wesley
4 Paul Beynon Davies, "Database Systems", Palgrave Macmillan
5 Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication
6 Majumdar & Bhattacharya, "Database Management System", TMH
7 Ramakrishnan, Gehrke, "Database Management System", McGraw Hill
8 Bharti P.K, "An introduction to Database Systems", JPNP

CA33109: Computer Communication and Networks	**L – T – P** 3 – 1 – 0

Unit I:
Advantages of networks, structure of the communications network, point-to-point and multidrop circuits, data flow and physical circuits, network topologies, topologies and design goals, Hierarchical topology, horizontal topology (Bus), star topology, ring topology, mesh topology. The telephone network, switched and non-switched options, fundamentals of communications theory, channel speed and bit rate, voice communications and analog waveforms, bandwidth and the frequency spectrum, connecting the analog and digital worlds, digital worlds, digital signals, the modem, asynchronous and synchronous transmission.

Unit II:
Layered Protocols and the OSI model
Goals of Layered Protocols, networks design problems, communication between layers, introduction to standard organizations and the OSI model, standards organizations, Layers of OSI, OSI status. The Physical Layer: Digital communications, Data Link Layer Protocol, Error Correction and Detection techniques, Flow control
Switching and Routing in Networks
Message switching, Packet routing, packet switching support to circuit switching networks.

Unit III:
Polling / Selection Protocols
Character and bit protocols, binary synchronous control (BSC) HDLC, HDLC options, HDLC frame format, code transparency and synchronization, HDLC transmission process, HDLC subsets, SDLC, Protocol conversion.

Unit IV:
Wide area and local networks, connection oriented and connectionless networks, classification of communications protocols, time division multiple access (TDMA), time division multiplexing (TDM), carrier sense (Collision) systems, token passing, peer-to-peer priority systems, priority slot, carrier sense (Collision free) systems, token passing (Priority) systems.

Unit – V:
Network Layer: Point-to Point networks, routing algorithms, congestion control algorithms, internetworking.
TCP/IP
TCP/IP and internetworking, example of TCP/IP operations, related protocols ports and sockets. The IP address structure, major features of IP, IP datagram. Major IP services. IP source routing, value of the transport layer, TCP, Major features of TCP, passive and active operation, the transmission control block (TCB), route discovery protocols, examples of route discovery protocols, application layer protocols,

Text Books:
1. Behrouz A. Forouzan, "Data Communications Networking," (4th Edition), TMH Publication.
2. Stallings, W., "Computer Communication Networks", (7th edition), Prentice Hall of India, 1993.
3. Tannenbaum. A. S., "Computer Networks", Prentice Hall of India. 1981.

CA33110: Design and Analysis of Algorithms	**L – T – P** 3 – 1 – 0

Unit-I :
Introduction: Algorithms, Analysis of Algorithms, Design of Algorithms, Complexity of Algorithms, Asymptotic Notations, Growth of function, Recurrences and their solution methods.
Sorting in polynomial Time: Insertion sort, Merge sort, Heap sort, and Quick sort
Sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort, Medians and order statistics

Unit-II :
Advanced Data Structure: Red Black Trees, Augmenting Data Structure, Binomial Heap, B-Tree, Fibonacci Heap, and Data Structure for Disjoint Sets, All kinds of Algorithms on these data structures, Dictionaries and priority Queues, merge-able heaps, concatenable queues

Unit-III :
Advanced Design and Analysis Techniques: Dynamic programming, Greedy Algorithm, Backtracking, Branch-and-Bound, Amortized Analysis

Unit-IV :
Graph Algorithms: Elementary Graph Algorithms, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path, All pair Shortest Path, Maximum flow and Traveling Salesman Problem

Unit-V :
Dynamic Programming: Multistage graph problem, single-source and all pairs shortest paths, Traveling sales person problem, Longest common subsequence problem, matrix chain multiplication; Back Tracking: 8-queens problem, sum-of-subsets, graph colouring, Hamiltonian cycles; Branch-and-Bound: Least cost search, 15-puzzel problem;

Algorithms on Algebraic Problems: Evaluation and Interpolation, Fast Fourier Transform;
Randomized Algorithms, String Matching, NP-Hard and NP-Completeness, Approximation Algorithms, Sorting Network, Matrix Operations Number Theoretic Algorithms

References :
1. Design and Analysis of Computer Algorithms, Aho, Pearson Education Pub.
2. Fundamentals of Computer Algorithms by Horowitz and Sahani, Galgotia
3. Introduction to Algorithms by Thomas H Cormen Leiserson et al, PHI
4. Computer Algoritms : Introduction to Design and Analysis by Sara Baase and Allen Van Gelder, Pearson Education
5. Algorithm Design by Jon Kleinberg and Eva Tardos, Pearson Education
6. Fundamental of Algorithms by Brassard Bratley, PHI
7. Algorithms Design by M T Goodrich et al, John Wiley
8. The Design and analysis of Algorithms by A. V. Aho et. al., Pearson Education

CA33111: Interactive Computer Graphics and Multimedia

L – T – P
3 – 1 – 0

Unit – I :
Introduction and Line Generation: Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.

Unit – II:
Transformations: Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. **Windowing and Clipping:** Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.

Unit – III:
Three Dimensional: 3-D geometric primitives, 3-D Object representation, 3-D Transformation,
3-D viewing, projections, 3-D Clipping.

Unit – IV:
Curves and Surfaces: Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces. **Hidden Lines and Surfaces:** Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models – Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.

Unit – V:
Concept of Multimedia : Multimedia and interactivity, Multimedia technology (Sound & audio, image & graphics and animation & special effects, storage and access speed). Application Development. Multimedia Applications using UML.

References:
1. Donald Hearn and M Pauline Baker, "Computer Graphics C Version", Pearson Education
2. Amrendra N Sinha and Arun D Udai," Computer Graphics", TMH
3. Donald Hearn and M Pauline Baker, " Computer Graphics with OpenGL", Pearson education
4. Steven Harrington, "Computer Graphics: A Programming Approach", PHI or TMH
5. James D Foley, A V Dam, S K Feiner and John f Hughes, "Computer Graphics Principles and Practice" Second Edition in C.

| **CA33205:** Database Management Lab. | **L – T – P**
0 – 0 – 3 |

The programme to be implemented using SQL

1. Create Table, SQL for Insertion, Deletion, Update and Retrival using aggregating functions.
2. Write Programs in PL/SQL, Understanding the concept of Cursors.
3. Write Program for Join, Union & intersection etc.
4. Creating Views, 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.
8. Developing code for understanding of distributed transaction processing. Students are advised to use Developer 2000 Oracle 8+ version for above experiments. However, depending on the availability of Software's students may use power builder/SQL Server/DB2 etc. for implementation.

| **CA33206:** Computer Graphics and Multimedia Lab. | **L – T – P**
0 – 0 – 3 |

Program based on using C/C++

Line drawing, Circle generating, Mid-point circle generating
Parallel version of Line, Circle and Mid-point circle generating programme
Line clipping using Cohen Sutherland line clipping algorithm, Liang Barsky algorithm,
Sutherland Hodgeman polygon clipping,
Weiler and Atherton polygon clipping, Curve clipping, Text clipping.
Back Face Detection algorithm, Depth buffer method,
Multimedia Application Development. Multimedia Applications using UML.

SEMESTER - IV

CA34113: Software Engineering	**L – T – P** 3 – 1 – 0

Unit-I:
Introduction: Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

Unit-II:
Software Requirement Specifications (SRS): Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS.
Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.

Unit-III:
Software Design: Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.

Unit-IV:
Software Testing: Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.

Unit – V:
Software Maintenance and Software Project Management: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

References:
1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
3. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
4. Pankaj Jalote, Software Engineering, Wiley
5. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.
6. Ian Sommerville, Software Engineering, Addison Wesley.
7. Kassem Saleh,"Software Engineering", Cengage Learning.
8. Pfleeger, Software Engineering, Macmillan Publication.

CA34114: Artificial Intelligence	**L – T – P** 3 – 1 – 0

Unit I:
Scope of AI: Games, theorem Proving, Natural language Processing; Vision & speech processing, Robotics, Expert Systems; AI techniques-Search, Knowledge, Abstraction.

Problem Solving: State space search, Control Strategies (Depth first search, Breadth first search, Production systems). Problem Characteristics (Decomposable, ignorable, recoverable, predictable).

Use of Heuristics: Hill climbing; Best first search; A* algorithm : Admissibility; AND/OR graph – AO*; Constraint satisfaction (Cryptoarithmetic, Waltz Line Labelling).

Game Playing: Minimax search; Alpha-Beta pruning.

Unit II:
Knowledge Representation: Predicate Logic (Well formed formulas, quantifiers, Prenex Normal Form, Skolemization, Unification, modus pones, Resolution refuation-various strategies).
Rule Based Systems: Forward reasoning: Conflict resolution; Backward reasoning: Use of No backtrack.
Structured Knowledge Representations: Semantic Net ; slots, inheritance; Frames-exceptions and defaults-attached predicates; Conceptual Dependency formalism. Object Oriented Representations.

Unit III:
Natural Language Processing: Syntactic analysis, Top down and bottom up parsing, Augmented Transition Networks, Semantic analysis, case grammars,

Handling uncertainty: Probabilistic reasoning (Bayes Net, Dempster Shafer Theory). Use of Certainty Factors, Fuzzy Logic Nonmonotonic reasoning (Dependency directed backtracking, Truth maintenance systems).

Learning: Concept of learning, Learning automation; The Genetic algorithm; Learning by induction; Neural Networks (Hopfield Networks; Perceptrons – Learning algorithm, Backpropagation Network, Boltzman Machine, Recurrent Networks).

Unit IV:
Planning: Components of Planning System; Plan Generation Algorithsm (Forward State Propagation, Backward State Propagation, Nonlinear Planning using constraint posting).
Expert Systems: Need & justification for expert systems-cognitive problems, Expert System Architectures (Rule Based systems, Non Production System), Knowledge acquisition, Case studies : MYCIN, R1.

Unit V:
AI Programming Languages:
PROLOG: Syntax; Procedural and Declarative meanings; Prolog unification mechanism; Anonymous variable, Lists; Use of fail, CUT, not.
LISP: Basic; Concepts; Eval Function; Functions and Variables; Scoping of LISP variables; Iteration and recursion. UML in Artificial Intelligence.

Test Books:
1. Artificial Intelligence (SIE), Kevin Knight, Elaine Rich, B. Nair, Mc-Graw Hill Publication

CA34115: Internet and Web Technology	**L – T – P** 3 – 1 – 0

Unit-1 :
Internet: Internet, Connecting to Internet: Telephone, Cable, Satellite connection, Choosing an ISP, Introduction to Internet services, E-Mail concepts, Sending and Receiving secure E-Mail, Voice and Video Conferencing. protocols governing the web, web development strategies,
Web applications, web project, web team.

Unit II: Web Page Designing:
HTML: list, table, images, frames, forms, CSS; XML: Document Type Definition (DTD), Namespaces, XML schemes, presenting and using XML, Entities, XSL, XLINK, XPATH, XPOINTER, XML Parser, Applications, Integrating XML with other applications.

Unit III: Scripting:
Java script: Introduction, documents, forms, statements, functions, objects; event and event handling; introduction to AJAX, VB Script

Unit IV: Server Site Programming:
Introduction to active server pages (ASP), ASP.NET, java server pages (JSP), JSP application design, tomcat server, JSP objects, declaring variables, and methods, debugging, sharing data between JSP pages, Session, Application: data base action , development of java beans in JSP, introduction to COM/DCOM.

Unit V: PHP (Hypertext Preprocessor):
Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form ,mail, file upload, session, error, exception, filter, PHP-ODBC.
Middleware Technologies : CORBA, COM, DCOM, E-commerce : Introduction, Types, Architectures, Applications.

References
1. Xavier, C, " Web Technology and Design" , New Age International
2. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication.
3. Ramesh Bangia, "Internet and Web Design" , New Age International
4. Bhave, "Programming with Java", Pearson Education
5. Ullman, "PHP for the Web: Visual QuickStart Guide", Pearson Education
6. Deitel, "Java for programmers", Pearson Education

CA34207: Web Technology Lab.	**L – T – P** 0 – 0 – 3

1. Creation of HTML pages with frames, links, tables and other tags
2. Usage of internal and external CSS along with HTML pages
3. Creation of XML document for a specific domain
4. Writing DTD or XML schema for the domain specific XML document
5. Parsing an XML document using DOM
6. Client side Programming
   # programs of Java script & VB script of statements, functions, objects; event and event handling
   # Form Validation including text field, radio buttons, check boxes, list box and other controls.
7. Usage of ASP/JSP objects response, Request, Application, Session, Server, ADO etc
   # Writing online applications such as shopping, railway/air/bus ticket reservation system with set of ASP/JSP pages
   # Using sessions and cookies as part of the web application
8. Writing Servlet Program using HTTP Servlet
9. PHP of simple program, if-else, loop, switch, array, function, form, mail, file upload, session, error, exception, filter, PHP-ODBC.
10. Any online application with database access
11. Sample web application development in the open source environment

CA34208: Elective Lab.	**L – T – P** 0 – 0 – 3

Project Distribution

At the beginning of semester a list of project topic should be provided by concerned faulty. A group of 9-10 Students must select a topic of his choice. The student group is required to conduct rigorous study/survey on the subject under the supervision of the faculty member of the department, prepare a report and PowerPoint presentation. The demonstration of the project will be in presence of all the students of his class at the end of semester. The comments & criticism of the topic/subject will be discussed for the benefit of all the students. The evaluation will be carried out by the department based on the presentation.

SEMESTER - V

GE35102: Organizational Behaviour and Management	**L – T – P**
	3 – 1 – 0

UNIT I :
Concept, Nature, Characteristics, Conceptual Foundations and Importance, Models of Organizational Behaviour, Management Challenge, A Paradigm Shift, Relationship with Other Fields, Organisational Behaviour: Cognitive Framework, Behaviouristic Framework and Social Cognitive Framework.
Perception and Attribution: Concept, Nature, Process, Importance. Management and Behavioural Applications of Perception.

UNIT II :
Attitude: Concept, Process and Importance, Attitude Measurement. Attitudes and Workforce Diversity.
Personality: Concept, Nature, Types and Theories of Personality Shaping, Personality Attitude and Job Satisfaction.
Learning: Concept and Theories of Learning.
Motivation: Concepts and Their Application, Principles, Theories, Employee Recognition, Involvement, Motivating a Diverse Workforce.

UNIT III:
Leadership: Concept, Function, Style and Theories of Leadership-Trait, Behavioural and Situational Theories.
Analysis of Interpersonal Relationship, Group Dynamics: Definition, Stages of Group Development, Group Cohesiveness, Formal and Informal Groups, Group Processes and Decision Making, Dysfunctional Groups.

UNIT IV:
Organizational Power and Politics: Concept, Sources of Power, Distinction Between Power, Authority and Influence, Approaches to Power, Political Implications of Power: Dysfunctional Uses of Power. Knowledge Management & Emotional Intelligence in Contemporary Business Organisation, Organisational Change : Concept, Nature, Resistance to change, Managing resistance to change, Implementing Change, Kurt Lewin Theory of Change.
Conflict: Concept, Sources, Types, Functionality and Dysfunctionality of Conflict, Classification of Conflict Intra, Individual, Interpersonal, Intergroup and Organisational, Resolution of Conflict, Meaning and Types of Grievance and Process of Grievance Handling. Stress: Understanding Stress and Its Consequences, Causes of Stress, Managing Stress.
Organisational Culture : Concept, Charactersitics, Elements of Culture, Implications of Organisation culture, Process of Organisational Culture.

UNIT – V:
Staffing: Concept, System Approach, Manpower Planning, Job Design, Recruitment & Selection, Training & Development, Performance Appraisal
Directing: Concept, Direction and Supervision

Communication: Communication Process, Importance of Communication, Communication Channels, Barriers to Communication.

References:
1. Newstrom John W. **-** Organizational Behaviour: Human Behavour at Work (Tata Mc Graw Hill, 12th Edition)
2. Luthans Fred - Organizational Behaviour (Tata Mc Graw Hill)
3. Robbins Stephen P**. -** Organizational Behaviour (Pearson Education, 12th Edition)

| **CA35117:** Network Programming | **L – T – P**
3 – 1 – 0 |

Unit I:
Communication Protocol, Internet protocols, IPv4, IP addressing, Sub-netting, TCP/IP, fragmentation, System Network Architecture, XNS, UUCP.IPX/SPX for LANs. Protocol comparisons.

Unit II:
Berkeley sockets: Overview. UNIX domain protocols, Socket addresses. Socket system calls, Reserved ports, Passing file descriptors, I/O asynchronous and Multiplexing, socket implementation.

Unit III:
Winsock programming: Using the windows socket. API Window sockets and blocking I/O. Other windows extensions. Network dependent DLL. Sending and receiving data over connections. Termination. TCP / IP, UDP Programming.

Unit IV:
Network Programming for Internet – Firewall, Router, Search engines, Crawlers, Indexing, Audio, Video, Data Transmission & storage.

Unit V:
Programming applications: Time and date routines. Ping. Trivial file transfer protocol. Remote login, Video conferencing, sharing – Desktop & applications.

Text Books:
1. Davis, R., "Windows Network Programming" Addison Wesley, Reading, M. A., 1993.
2. Steven, R., "Unix Network Programming", Prentice Hall of India, New Delhi, 1994.

CA35118: Decision Support Systems	**L – T – P** 3 – 1 – 0

Unit I

Decision Making Perspective: Information System and its classification, Managerial Decision Making and management Information Systems; Framework for Decision Support Systems; MIS-DSS-ES connection.

Unit II

DSS: The Basic Concepts: Components of DSS; data management, model management sub system; the user interface sub system; DSS hardware and software; classification of DSS and their support.

Unit III

Modelling and Model Management: Static and Dynamic Model; Optimization via mathematical programming; linear programming models; integer programming models; dynamic programming models; simulation; discrete event simulation; generation of random numbers; simulation process languages; heuristic programming; forecasting.

Unit IV

Decision support system construction: The system development life cycle; DSS development process and strategies; approaches to DSS construction; end user computing and user developed DSS; DSS generators; selection of a DSS generator and other software tools.
Implementation and Evaluation of DSS: Models of implementation; Implementation strategies; Evaluation.

Unit V

Group DSS: Fundamental of GDSS; the technology of GDSS; constructing of GDSS; commercial GDSS software.
DSS: Through internet/intranet.

Text book:

1. Decision Support and Data Warehouse Systems by Efrem G. Mallach, Tata McGraw Hill Publication.
2. Decision Support Systems and Intelligent Systems, 6/e by Turban & Aronson, PHI Pvt. Ltd.

Reference Books:

1. Ajoy K. Ray, Tinku Acharya, Information Technology: Principles and Applications, PHI Learning Pvt. Ltd., 01-Oct-2004
2. Waman Jawadekar, Management Information Systems : Text & Cases, Mc-Graw Hill publication
3. Gordon Davis, University of Minnesota, Management Information Systems, Mc-Graw Hill publication

CA35209: DSS and Network Programming Lab.	**L – T – P** 0 – 0 – 3

Program (using C/C++/Java/.Net Technology)
- Implementation of the different types of sockets calls, socket implementation
- Active connection, passive connections,
- Internet programming, firewall, router, search engines, crawlers, audio-video data transmission
- Program for ping, time and date routine
- Remote logging, video conferencing

CA35301: Seminar/Colloquium/Comprehensive Viva	**L – T – P** 0 – 0 – 3

Guidelines & General Instruction:

The aim of the subject is to develop ability of a student to carry out literature survey & independent study of advanced subject/topic/matters in the field of Computer Science and Information technology. At the beginning of semester a list of colloquium topic should be displayed on the notice board by the department and/or on the institution web site. Every Student must select a topic of his choice. The student is required to conduct rigorous study/survey on the subject under the supervision of the faculty member of the department, prepare a report and present (PPT presentation along with hardcopy of project work) this in presence of all the students of his class at the end of semester. The comments & criticism of the topic/subject will be discussed for the benefit of all the students. The evaluation will be carried out by the department based on the presentation.

Semester – VI

CA36401: Thesis/Project	**L – T – P** 0 – 0 – 20

Guidelines & General Instruction:

Every student is required to carry out project work under the supervision of a faculty member of the department. However, a student may also opt to pursue his project work in a reputed industry/institution with the consent of Department/Institute. In such cases, the department must look into the suitability of the projects and assign one internal guide/supervisor. The internal supervisor shall monitor progress of the student continuously. A candidate is required to present the progress of the project work (at least twice) during the semester at an appropriate time decided by the Department . There will a final presentation of the project work at the end of the semester.

SYLLABUS OF ELECTIVES

System Analysis & Design

Unit I

Overview of System Analysis and Design: System definition & concepts, System models, Role and attributes of system analyst, Systems development life cycle-Project selection, Analysis, Design, Implementation, Testing and Maintenance.

System Planning: Data and fact gathering techniques, Feasibility analysis, Project selection plan and proposal, Prototyping, Cost-benefit analysis.

Unit II

Information Requirement Analysis: Concept of structured analysis, Tools of structured analysis-Data flow diagrams, Data dictionaries, Structured English, Decision Trees and Decision Tables.

System Design: Process and stages of System Design, Logical and Physical Design, Process modelling with physical and logical DFD's, System flow charts and structured charts, Data modelling with ERD's.

Unit III

Modular and Structured Design: Modularization, Module specification, Module coupling and cohesion, Top-down and Bottom-up design.

Input / Output and Form design : File and Database Design, User-interface design, Prototyping, Use of CASE tools, System documentation and their importance.

Unit IV

System Implementation and Maintenance: Test planning, Implementation planning and performance evaluation, Testing and validation, Performance and acceptance criteria, System quality control and assurance, Reviews and walkthroughs, Maintenance activities and issues, Audit trails and system security.

Unit V

Analysis and Design in Object-oriented Platforms: Introduction object modeling, Object oriented analysis and design through object modeling techniques, Dynamic modeling and functional modeling, Process of Object oriented design, Object oriented programming systems for implementation, Object oriented databases.

Text Books:

1. System Analysis And Design by Samarjeet Kaur, Sandhir Sharma, Publisher: Deep & Deep Publications Pvt.ltd
2. Systems Analysis & Design, Elias M Award, Publisher: Galgotia (2010)
3. Structured System Analysis And Design, Isrd Group, ISBN: 9780070612044

Java Programming

Unit-1

Internet: Internet, Connecting to Internet: Telephone, Cable, Satellite connection, Choosing an ISP, Introduction to Internet services, E-Mail concepts, Sending and Receiving secure E-Mail, Voice and Video Conferencing.

Unit- II

Core Java: Introduction, Operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Networking, Event handling, Introduction to AWT, AWT controls, Layout managers, Menus, Images, Graphics.

Unit-III
Java Swing: Creating a Swing Applet and Application, Programming using Panes, Pluggable Look and feel, 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, Dialog Boxes, Inner frame.
JDBC: The connectivity Model, JDBC/ODBC Bridge, java.sql package, connectivity to remote database, navigating through multiple rows retrieved from a database.

Unit-IV
Java Beans: Application Builder tools, The bean developer kit(BDK), JAR files, Introspection, Developing a simple bean, using Bound properties, The Java Beans API, Session Beans, Entity Beans, Introduction to Enterprise Java beans (EJB), **Introduction to RMI (Remote Method Invocation):** A simple client-server application using RMI.

Unit-V
Java Servlets: Servlet basics, Servlet API basic, Life cycle of a Servlet, Running Servlet, Debugging Servlets, Thread-safe Servlets, HTTP Redirects, Cookies, Introduction to Java Server pages (JSP).

References:

1. Margaret Levine Young, "The Complete Reference Internet", TMH
2. Naughton, Schildt, "The Complete Reference JAVA2", TMH
3. Balagurusamy E, "Programming in JAVA", TMH
4. Dustin R. Callway, "Inside Servlets", Addison Wesley
5. Mark Wutica, "Java Enterprise Edition", QUE
6. Steven Holzner, "Java2 Black book", dreamtech

Java Programming Lab.

Write Programs on

Illustrating, overloading, over riding and various forms of inheritance. To create packages and multiple threads in Java. Event handling Mouse and Keyboard events. Using Layout Manager create different applications. Create and manipulate Text Area, Canvas, Scroll Bars, Frames and Menus using swing/AWT. Using Java create Applets. Programs or Client Server Interaction with stream socket connections. In java to read data from disk file.

Windows Applications Programming

UNIT – I :
Introduction of .NET Framework, Visual C#.NET, Fundamental programming concepts, including event-driven programming, classes, objects, properties, methods, and events.

UNIT – II:
Object-Oriented Programming in Visual C#.NET: Concepts of abstraction, encapsulation, instantiation, initialization, constructors, and destructors, Inheritance, polymorphism, and namespaces, Handling Errors and Exceptions, Forms and controls to create a user interface, Variables, Constants, Functions, Procedures, Arrays. Create and use classes,

UNIT – III :
Decision Structures and Loops, Events, Delegates: Forms Controls, Switch, If-else, Loops, Validating User Input, Delegates and Events

UNIT – IV :
Using ADO.NET: Use ADO.NET with a Windows Forms application to create, read, update, and delete records in Access and SQL Server databases.

UNIT – V :
Reports Generations: Visual Studio Reports, Crystal Reports, Deploying Applications

Text Book:
1. Mastering C# Database Programming, Jason Price
2. Beginning Visual C# 2005, Karli Watson, C. Nagel, Eric White

Reference book:
1. C# 2005 Programming, Black Book, Dreamtech Press

Information Security

UNIT-I:
History of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing-Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security Concepts in Internet and World Wide Web: Brief review of Internet Protocols-TCP/IP, IPV4, IPV6. Functions of various networking components-routers, bridges, switches, hub, gateway and Modulation Techniques

UNIT-II:
Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles. Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E-Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards.

UNIT-III:
Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges Framework for Information Security, ISO 27001, SEE-CMM, Security Metrics, Information Security Vs Privacy

UNIT-IV:
Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues, Policies Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN

UNIT-V:

Laws, Investigation and Ethics: Cyber Crime, Information Security and Law, Types & overview of Cyber Crimes, Cyber Law Issues in E-Business Management Overview of Indian IT Act, Ethical Issues in Intellectual property rights, Copy Right, Patents, Data privacy and protection, Domain Name, Software piracy, Plagiarism, Issues in ethical hacking.

References :

1. Godbole," Information Systems Security", Willey
2. Merkov, Breithaupt," Information Security", Pearson Education
3. Yadav, "Foundations of Information Technology", New Age, Delhi
4. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill
5. Sood,"Cyber Laws Simplified", Mc Graw Hill
6. Furnell, "Computer Insecurity", Springer
7. IT Act 2000

Data Warehousing & Data Mining

Unit – I
Dss-Uses, definition, Operational Database. Introduction to DATA Warehousing. Data-Mart, Concept of Data-Warehousing, Multi Dimensional Database Structures. Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems. Distributed DBMS implementations.

Unit – II
DATA Warehousing. Data Warehousing Components. Building a Data Warehouse. Warehouse Database. Mapping the Data Warehouse to a Multiprocessor Architecture. DBMS Schemas for Decision Support. Data Extraction, Cleanup & Transformation Tools. Metadata.

Unit – III
Business Analysis. Reporting & Query Tools & Applications. On line Analytical Processing(OLAP). Patterns & Models. Statistics. Artificial Intelligence.

Unit – IV
Knowledge Discovery, Data Mining. Introduction to Data-Mining. Techniques of Data-Mining. Decision Trees. Neural Networks. Nearest Neighbor & Clustering. Genetic Algorithms. Rule Introduction. Selecting & Using the Right Technique.

Unit – V
Multimedia Data-Mining, Multimedia-Databases, Mining Multimedia Data, Data-Mining and the World Wide Web, Web Data-Mining, Mining and Meta-Data. Data Visualization & Overall Perspective. Data Visualization. Applications of Data-Mining.

References:
1. Berson, "Data Warehousing, Data-Mining & OLAP", TMH
2. Mallach, "Decision Support and Data Warehousing System", TMH
3. Bhavani Thura-is-ingham, "Data-Mining Technologies, Techniques Tools & Trends", CRC Press

Graph Theory and Network flows

Unit I

Introduction and Basic Concepts : Definition, Representation of graphs, Finite and infinite graphs, Directed graphs, Incidence and degree, Bipartite graph, Planar graphs, Matrix representation of graphs, Applications of graph in computer science.

Unit II

Paths and Circuits : Isomorphism, Subgraphs, Walks, Paths and Circuits, Connected and disconnected graphs, Euler graphs, Operations on graphs, Hamiltonian graphs, Travelling salesman problem.
Trees and Fundamental Circuits : Definition, Properties of trees, Spanning trees, Fundamental circuits and cut-sets, Connectivity and separability, Minimal spanning tree and connected algorithms, Rooted and Binary trees, Applications of trees.

Unit III

Shortest Path Problems : Shortest path algorithms, Generalized shortest path algorithms, Applications of shortest path problems.
Network Flow Problems : Flows in network, formulation, Max-flow min-cut theorem, Minimum cost flow problems, Multicommodity network flow problem, Decomposition of multi-commodity network flow problems.

Unit IV

Tours in Networks : Euler tours, Postman and Travelling salesman tours in networks, Algorithms for tours in networks with applications, Vehicle routing and Scheduling problems.

Unit V

Flow Graphs : Definition, Methods of solution, Path inversion, Application of flow graphs for system modeling.
Project management by network (PERT & CPM) techniques, Graphical evaluation and review techniques (GERT).

Text Books:

1. Narsingh Deo, " Graph Theory", Prentice Hall of India Pvt. Ltd.
2. V. K. Balakrishnan, " Graph Theory{", Tata McGraw-Hill Pub.
3. C. Vasudev, "Graph Theory with Applications", New Age International Publishers.

Reference Books:

1. K. Patrai, "Graph Theory", S. K. Kataria & Sons.
2. Agnarsson, "Graph Theory, Modeling, Applications and Algorithms", Pearson Education Pvt. Ltd.

Parallel and Distributed Processing

Unit I

Trends towards Parallel Processing, Type of Parallel Processing, Difference between Temporal and Data Parallelism.
Parallel Processing Mechanism : Multiplicity ;of functional units, Parallelism and pipelining within CPU, Overlapped CPU & I/O operation, Use of hierarchical memory; system, Balancing of subsystem bandwidths, Multiprogramming and Time sharing.
Parallel Processing Applications : Remote sensing Application, Numerical Weather forecasting.

Unit II

Pipelining : An overlapped parallelism, Instruction and Arithmetic pipelines, Principles of Designing Pipeline Processors, Vector Processing requirements, Architecture of Vector Computers.

Unit III

Array Processor : SIMD Array ;Processor, SIMD Interconnection Networks, Parallel Algorithms for Array Processors.

Unit IV

Multiprocessor : Functional Structures, Loosely coupled Multiprocessor, Tightly coupled Multiprocessor, Interconnection Networks, Time shared of Common Buses, Crossbar switch & Multiport Memories, Multistage Networks for Multiprocessor.

Unit V

Data Flow Computer : Data-Driven Computer & language, Control flow versus Data Flow computer, Data Flow Graphs and Languages, Data flow Computer Architecture, Static Data Flow Computer, Dynamic Data Flow Computer, Advantage and Potential Problems of Data Flow Computers.

Text Books :
1.   Computer Architecture & Parallel Processing – By K. W. & Briggs.

Reference Books:
1.   Quinn M. J. "Parallel Processing: Theory and Practice," McGraw-Hill , (1994).
2.   Hwang, K., "Advanced Computer Architecture : Parallelism, Scalability & Programmability", McGraw Hill Inc. (1993).

Soft Computing

Unit I

Introduction to Soft Computing, Overview of Crisp Sets, Fuzzy sets, Linguistic variables, Membership Functions, Operation on Fuzzy sets, Fuzzy Relation, Fuzzy compositions, Hedges.

Unit II

Elements of Fuzzy logic system : Rules, Fuzzifier, Inference, Defuzzifier

Unit III

Mamdani Fuzzy Models, Sugeno Fuzzy Models, Applications of Fuzzy logic, Designing Fuzzy logic system.
 Biological Neural Network.

Unit IV

Models of Neuron – McCulloch-Pitts Models, Perceptron, Adaline
Architecture-Single layer Feed Forward Network, Multilayer Feed forward Network, Recurrent Networks, Back Propagation Network, Associative Memory, Applications.
Unsupervised Learning: Competitive Learning Networks, Kohonen Self-organising networks, Hebbian Learning, The Hopfield Network.

Unit V

Fundamentals of Genetic Algorithms : Basic Concepts, Creation, Offsprings Encoding, Fitness functions, Reproduction, Genetic Modelling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators, Applications.

Text Books:

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1. J.S.R.Jang, C.T.Sun and E. Mizutani, "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi 2004.
2. S. Rajasekaran & G.A. Vijayalakshmi Pai, PHI, New Delhi 2003.

Reference Book :

1. T. J. Ross, "Fuzzy Logic with Engineering Applications." TMH, New York, 1997.

Supply Chain Management

Unit I
Understanding the Supply Chain : Definition of SCM, Types of SCM, Decision Phases in a Supply Chain, Process View of a Supply Chain, Examples of Supply Chains, IT applications in SCM, Importance of SCM for businesses.

Supply Chain Design : Distribution Network Design in a Supply Chain : Role of Distribution Network in the Supply Chain, Factors Influencing Distribution Network Design, The Value of Distributors in the Supply Chain, Network Design in the Supply Chain : Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions, A Framework for Network Design Decisions, Network Design in an Uncertain Environment.

Unit II
Demand Forecasting in a Supply Chain : Role of Forecasting in a Supply Chain, Characteristics of Forecasts, Components of a Forecast and Forecasting Methods, Basic Approach to Demand Forecasting, Time Series Forecasting Methods.

Unit III
Planning and Managing Inventories in a Supply Chain : Managing Economies of Scale in the Supply Chain (Cycle Inventory), Managing Uncertainty in the Supply Chain (Safety Inventory), Determining Optimal Level of Product Availability.

Unit IV
Transportation in the Supply Chain : Role of Transportation in the Supply Chain, Factors Affecting Transportation Decisions, Modes of Transportation and their Performance Characteristics, Routing and Scheduling in Transportation.
Performance Measurement in SCM : Advantages and benefits of Performance Measurement, Measuring SCM, Supply Performance Measurement, Various Parameters for Measurement.

Unit V
Information Technology and the Supply Chain : Role of IT in the Supply Chain, Customer Relationship Management, Future of IT in the Supply Chain.
E-Business and the Supply Chain : Role of E-Business in the Supply Chain, The E-Business Framework.
Logistic Management : History and Evolution of Logistic Management, Definition, Role of Logistic Management, Framework of Logistic Management, Elements of Logistic Management, Modes of Transportation in Logistic Management, IT in Logistic Management.

Text Books:

1. Supply Chain Management, 2/e, S. Chopra & P. Meindl, PHI/Pearson Education Pvt. Ltd.
2. Logistic & Supply Chain Management, 2/e, M. Christopher, Pearson Education Pvt. Ltd.
3. Supply Chain Management: Theory and Practices, Mohanty and Deshmukh, Dreamtech Pub.
4. Supply Chain management, 5/e, Ballou, Pearson Education Pvt. Ltd.

Reference Books:

1. Introduction to Supply Chain Management, Handfield & Nichols, Jr., PHI Pvt. Ltd.
2. Supply Chain Management: Concepts & Cases, Altekar, PHI Pvt. Ltd.
3. Logistic Management: The Integrated Supply Chain Process, Bowersox, Tata McGraw Hill Publication.
4. Supply Chain Management: Concepts & Cases, Kulkarni & Sharma, TMH Publishing Co. Ltd.

Compiler Design

Unit I
Introduction to Compiling and one pass compiler
Finite Automata & Lexical Analysis

Unit II
Syntax Analysis & Parsing Techniques
Automatic Construction of Efficient Parsers

Unit III
Syntax Directed Translation
Run Time Environment

Unit IV
Intermediate Code generation
Error Detection and Recovery

Unit V
Code Optimization
Code Generation
Compiler Design & Implementation Using UML

Image Processing

Unit I
Image digital representation, Elements of visual perception. Sampling and quantisation. Image processing system elements.

Unit II
Fourier transforms. Extension to S-D, DCT, Walsh, Hadamard transforms.

Unit III
Enhancement and segmentation: Histogram modification, Smoothing, sharpening, Thresholding, Edge detection, Segmentation, Point and region dependent techniques.

Unit IV
Image encoding: Fidelity criteria, Transform compression, KL, Fourier, DCT, Spatial compression, Run length coding, Huffman and contour coding.

Unit V
Restoration : Models, Invrse filtering, Least squares filtering, Recursive filtering.

UNIX & Shell Programming

Unit I

Overview of UNIX Architecture: Kernel: Processes; Time sharing, Shell, Files and directories, Creation of a file, Inode numbers and filenames, File security, file systems, Peripheral devices as files.

UNIX Editors and Basic UNIX commands: ed editor, vi editor, Redirections, piping, tees, filters, UNIX utilities; grep, sed, awk, tr etc.

Unit II

Introduction to Shell Scripts: Bourne shell, C Shell, Shell variables, scripts, metacharacters and environment, 'if' and 'case' statements, For, while and until loops.

Awk Programming: Awk: pattern scanning and processing language, BEGIN and END patterns, Awk arithmetics and variables, Awk Built-in variable names and operators.

Unit III

Introduction to UNIX Internals: Process management, Memory management, File and directory structure, Security.

Introduction to Systems Administration: The System Administration: the need and the role, Function of a System Administrator.

Unit IV

System Calls and C Function Library: UNIX system calls, C library function and math library, Standard I/O package, File handling, Command line parameters, UNIX-C interface, C files, Graphics.

Unit V

Local Networking: General concepts - NIFS, NIS - their functionalities, Berkeley and Arpa services - their functionalities and services, X terminals - windows Manager, XDM, Safety aspects in local networking.

Global Networking: Electronic Mail - domain concept mail feed configuration, uucp - configuration versions protocols - uucp front ends, uucp and electronic mail, News services.

Client / Server Technology

Unit I

Introduction to Client/Server Computing.

Unit II

Client/Server Management issues. Building and Managing Client/Server Systems.

Unit III

Network Operating Systems (Nos). Client/Server Architecture. What is Middleware?

Unit IV

Implementing a Client/Server System. Client/Server Databases. Distributed Databases.

Unit V

Internet, Intranet, and Extranet. Organizational Support and Management. Client/Server Security.

Microprocessors & their Interfacing

Unit I
Microprocessor Architecture, Instruction Set, Assembly Language Programming.

Unit II
Interrupts and Timing Diagrams.

Unit III
Data Transfer Schemes.

Unit IV
General and Special Purpose I/O Interface Chips, Memory and I/O Interfacing.

Unit V
Typical Applications in Electric Drives, Instrumentation, Control and Power Systems.
Introduction to PLC.

Computer Aided Design

Unit I
Fundamental of CAD : Design Process, Application of Computers for Design, Creating the Manufacturing Data Base, Benefits of CAD.

Unit II
Hardware in CAD: Introduction, Design work station, Graphics Terminal, Operator input devices, plotters and other output devices, CPU, Secondary storage.

Unit III
Computer Graphics Software and Data Base: Software configuration of graphics system, Functions of a Graphics Package.

Unit IV
Constructing the Geometry, Transformations, Wire frame and Solid Modeling, CAD/CAM integration.

Unit V
CAD/CAM Implementation: Turnkey CAD/CAM Systems, Selection criteria, Evaluation of alternative systems, Future of CAD/CAM.

ERP Systems

UNIT - I
ERP Introduction, Benefits, Origin, Evolution and Structure**:** Conceptual Model of ERP, The Evolution of ERP, The Structure of ERP.

UNIT - II
Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing(OLAP), Product Life Cycle Management(PLM),LAP, Supply chain Management.

UNIT - III

ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, The Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications.

UNIT - IV
ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees,

UNIT - V
ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture. Using ERP tool: either SAP or ORACLE format to case study

References:
1. Alexis Leon, "ERP Demystified", Tata McGraw Hill
2. Rahul V. Altekar "Enterprisewide Resource Planning", Tata McGraw Hill,
3. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI
4. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology
5. Mary Summer, "Enterprise Resource Planning"- Pearson Education

E- Commerce & E- Business

Unit I
E-Business: E-business fundamentals, application development technology, internet business skills, gaining market intelligence using www, internet security for business application.

Unit II
Electronic Commerce: Introduction, Impact of EC, Strategies for adopting EC, Tools and technologies for EDI and EC, Work flow systems, Bar coding, Article numbering etc., EC over internet, EC resources, Fundamental processes.

Unit III
Price making methods, Applications.
Architectured Framework of EC, Consumer to Business electronic commerce, consumer oriented application, models from the consumers and merchant's perspective, STOREFRONT TECHNOLOGY , Virtual MALL except.

Unit IV
Business to Business EC
Virtual private networks, extranets, EDI,.
Electronic Payment systems, concerns for E-commerce growth, Methods and mechanism.

Unit V
Security Issue in Electronic commerce.
Legal Issue in Electronic Commerce.
Trackmarks, cyberspace and the Internet.
Digital signature law.
Current Research and future direction.

Industrial Robotics and Automation

Unit I
Industrial Robotics:
Robot Technology
Robot Anatomy, control systems, accuracy and repeatability, end effectors, sensors in Robotics.

Unit II
Robot Programming:
Types of programming, Lead through programming, Robot languages, off-line programming, workcell control.

Unit III
Robot Applications:
Characteristics of Robot applications, Robot cell Design, types at robot applications, Material handling application, processing operation Assembly and Inspection.

Unit IV
Automation:
Introduction, Hard automaton, Flexible automaton, Quality and automation.
Sensors: Manual Switches, limit switches, proximity switches, photoelectric Sensors, Infra-red Sensors.
Analyzers: Counters, Timers, Bar Code readers, Optical encoders.

Unit V
Actuators: Cylinders, Solenoids, Relays,
Drives: Motors, kinematic linkages, Genevas, Walking Beams.
Machine Vision Systems: Image Scanning, lighting; digitization, windowing, thresholding, shape identification, Template matching, Edge detection, Roberts cross-operators.

Pattern Recognition

Unit I
What is Pattern Recognition? Applications ad Relation with other fields like Data Mining, Information Retrieval, etc.

Unit II
Linear Discriminant Functions and its Applications. Bayesian Decision Theory, Maximum-Likehood and Bayesian Parameter Estimation.

Unit III
Component Analysis, E-M technique, Hidden Markov Model, Non-Parametric Techniques: Nearest Neighbour, K-NN.

Unit IV
Non-metric Methods: Decision Trees, ID3, Grammar based Methods.

Unit V
Neural Network Based Approaches, Fuzzy Logic Based Techniques, Support Vector Machine, Applications.

Advanced Computer Architecture

Unit I

Basic concepts: Introduction to Parallel processing, Parallel Processing terminology, Decomposition, Complexity, Throughout, Speedup, Measures, Data Dependence, Resource Dependence, Bernstein's conditions, Levels of parallelism programs. Program flow-control Flow, Data Flow.

Distributed Systems : Introduction, Advantages, Tightly-coupled, Loosely-coupled systems. Hardware and Software requirements, Design issues.

Unit II

Parallel Processing-Structure & Organization: Taxonomy of parallel processes; granularity, Basic Architectures, Multiprocessors, Vector processors, Pipeline, Array, Systolic, Wavefront array, Cube Architecture, Hypercube, CCC, Pyramid, Prism. Network architecture-Binarytree, Hypertree Butterfly, Shufflle exchange, Dataflow Architecture, Connection Machine.

Unit III

Distributed Systems: Review of Networks, Layered Protocols-Physical, Data Link Network, Transport, Application.
Network Operating System. Distributed Operating system. Resource sharing. Message Passing. Example system.
Synchronization aspects, Clocks, Algorithms, Mutual Exclusion, Coroutines, CSP, DP, Deadlocks, Distributed deadlock detection. Modelling-Petri Nets.

Unit IV

Parallel Algorithms: PRAM Model of computation, Elementary Parallel Algorithms-Broadcast, Prefix sums, Permutation, Parallel Selection, Merging, Sorting, Odd-Even, Bitonic Merge, Dictionary Operations, Elliss Algorithm, Graph Algorithms, Matrix-Transportation, Multiplication, Solving linear systems.

Unit V

Parallel & Distributed Programming: Parallel Programming Environments, Models, Synchronous Asynchronous Programming, Modula-2, Occam, FORTRAN, DAP FORTRAN, Actus, Data Flow Programming, VAL.

System Simulation and Modeling

Unit-1

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

Unit-II

System simulation, why & when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag models, Cobweb model.

Unit-III

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

Unit-IV
System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams Introduction to SIMSCRIPT: Program, system concepts, origination, and statements, defining the telephone system model.

Unit-V
Simulation of PERT Networks, critical path computation, uncertainties in activity duration , resource allocation and consideration. Simulation languages and software, continuous and discrete simulation languages, expression based languages, object oriented simulation, general purpose vs. application - oriented simulation packages, CSMP-III, MODSIM-III.

References
1. Geoffrey Gordon, " System Simulation", PHI
2. Jerry Banks, John S. C Barry L. Nelson David M. Nicol, "Discrete Event System Simulation", Pearson Education
3. V P Singh, "System Modeling and simulation", New Age International.
4. Averill M. Law, W. David Kelton, "System Modeling and simulation and Analysis", TMH

Advanced Database Management Systems

UNIT-I
Transaction and schedules, Concurrent Execution of transaction, Conflict and View Serializability, Testing for Serializability, Concepts in Recoverable and Cascadeless schedules.

UNIT –II
Lock based protocols, time stamp based protocols, Multiple Granularity and Multiversion Techniques, Enforcing serializablity by Locks, Locking system with multiple lock modes, architecture for Locking scheduler

UNIT III
Distributed Transactions Management, Data Distribution, Fragmentation and Replication Techniques, Distributed Commit, Distributed Locking schemes, Long duration transactions, Moss Concurrency protocol.

UNIT –IV
Issues of Recovery and atomicity in Distributed Databases, Traditional recovery techniques, Log based recovery, Recovery with Concurrent Transactions, Recovery in Message passing systems, Checkpoints, Algorithms for recovery line, Concepts in Orphan and Inconsistent Messages.

UNIT V
Distributed Query Processing, Multiway Joins, Semi joins, Cost based query optimization for distributed database, Updating replicated data, protocols for Distributed Deadlock Detection, Eager and Lazy Replication Techniques

References
1. Silberschatz, Korth and Sudershan, Database System Concept', Mc Graw Hill
2. Ramakrishna and Gehrke,' Database Management System, Mc Graw Hill
3. Garcia-Molina, Ullman,Widom,' Database System Implementation' Pearson Education
4. Ceei and Pelagatti,'Distributed Database', TMH
5. Singhal and Shivratri, 'Advance Concepts in Operating Systems' MC Graw Hill

Artificial Intelligence

Unit-I
Introduction : Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.

Unit-II
Introduction to Search : Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.

Unit-III
Knowledge Representation & Reasoning: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

Unit-IV
Machine Learning : Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data – EM algorithm, Reinforcement learning,

Unit-V
Pattern Recognition : Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.

References:
1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education
4. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India

Information Storage & Management

Unit-I:
Introduction to Storage Technology: Data proliferation and the varying value of data with time & usage, Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, The five pillars of technology, Overview of storage infrastructure components, Evolution of storage, Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.

Unit-II:
Storage Systems Architecture: Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols.

Unit-III:
Introduction to Networked Storage: JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN): elements & connectivity, Fibre Channel principles, standards, & network management principles, SAN management principles, Network Attached Storage (NAS): elements, connectivity options, connectivity protocols (NFS, CIFS, ftp), & management principles, IP SAN elements, standards (SCSI, FCIP, FCP), connectivity principles, security, and management principles, Content Addressable Storage (CAS): elements, connectivity options, standards, and management principles, Hybrid Storage solutions overview including technologies like virtualization & appliances.

U nit-IV: Introduction to Information Availability
Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques.

Unit-V: Managing & Monitoring
Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and pro-active management best practices, Provisioning & configuration change planning, Problem reporting, prioritization, and handling techniques, Management tools overview.

References
1. Information Storage and Management Storing, Managing, and Protecting Digital Information , by EMC, Hopkinton and Massachusetts, Wiley, **ISBN:** 9788126521470

Software Project Management

UNIT-I:
Introduction and Software Project Planning: Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.

UNIT-II:
Project Organization and Scheduling: Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.

UNIT-III:
Project Monitoring and Control : Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming.

UNIT-IV:
Software Quality Assurance and Testing : Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality

Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Cleanroom process.

UNIT-V:
Project Management and Project Management Tools: Software Configuration Management: Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

References:
1. M. Cotterell, Software Project Management, Tata McGraw-Hill Publication.
2. Royce, Software Project Management, Pearson Education
3. Kieron Conway, Software Project Management, Dreamtech Press
4. S. A. Kelkar, Software Project Management, PHI Publication.

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Real Time Systems

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UNIT-I:
Introduction: Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT-II:
Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT-III:
Resources Sharing: Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

UNIT-IV:
Real Time Communication: Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols

UNIT-V:
Real Time Operating Systems and Databases: Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Charecteristic of Temporal data, Temporal Consistencey, Concurrency Control, Overview of Commercial Real Time databases

References:
1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
2. Mall Rajib, "Real Time Systems", Pearson Education

3. Albert M. K. Cheng , "Real-Time Systems: Scheduling, Analysis, and Verification", Wiley.

Mobile Computing

Unit – I
Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Unit - II
Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Unit – III
Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

Unit - IV
Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Unit – V
Adhoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

References:
1. J. Schiller, Mobile Communications, Addison Wesley.
2. Charles Perkins, Mobile IP, Addison Wesley.
3. Charles Perkins, Ad hoc Networks, Addison Wesley**.**
4. Upadhyaya, "Mobile Computing", Springer

Neural Networks

Unit-I:
Neurocomputing and Neuroscience Historical notes, human Brain, neuron Mode l, Knowledge representation, Al and NN. Learning process: Supervised and unsuperv ised learning, Error correction learning,competitive learning, adaptation, statistical nature of the learning process.

Unit-II:
Data processing Scaling, normalization, Transformation (FT/FFT), principal component analysis, regression, covariance matrix, eigen values & eigen vectors. Basic Models of Artificial neurons, activation Functions, aggregation function, single neuron computation, multilayer perceptron, least mean square algorithm, gradient descent rule, nonlinearly separable problems and bench mark problems in NN.

Unit-III
Multilayered network architecture, back propagation algorithm, heuristics for making BPalgorithm performs better. Accelerated learning BP (like recursive least square, quick prop, RPROP algorithm), approximation properties of RBF networks and comparison with multilayer perceptran.

Unit-IV
Recurrent network and temporal feed-forward network, implementation with BP, self organizing map and SOM algorithm, properties of feature map and computer simulation. Principal component and Independent component analysis, application to image and signal processing.

Unit-V
Complex valued NN and complex valued BP, analyticity of activation function, application in 2D information processing. Complexity analysis of network models. Soft computing. Neuro-Fuzzy-genetic algorithm Integration.

References:
1. J.A. Anderson, An Intoduction to Neural Networks, MIT
2. Hagen Demuth Beale, Neural Network Design, Cengage Learning
3. R.L. Harvey, Neural Network Principles, PHI
4. Kosko, Neural Network and Fuzzy Sets, PHI

Managerial Economics

Unit I
The theory of Consumer behaviour : The concept of utility, indifference curve analysis, demand analysis, the concept of elasticity.
Supply analysis: The law of supply, derivation of supply curve, the concept of reservation price.

Unit II
The theory of production : The production function (cobb-Douglas) law of production (laws of returns of scale, the law of variable proportions, equilibrium of the firm, choice of optimal combination of factors, choice of optimal expansion path).

Unit III
The theory of costs: Analysis of the concepts of costs, the traditional theory of cost (short-run costs, long-run cost- the envelope curve), modern theory of costs (short-run and long run costs, the L shaped scale curve), the analysis of economies of scale (real economies of scale, pecuniary economies of scale).

Unit IV
Theory of the firm and market analysis: Perfect competition (Assumptions, short-run and long-run equilibrium, dynamics changes and industry equilibrium), monopoly (definition, demand and revenue, costs, equilibrium of the monopolist, predictions in dynamic changes, the multiplant firm), price discrimination (assumptions, types of price discrimination, price discrimination and elasticity of demand),monopolistic competition (assumptions, product differentiation and the demand curve, equilibrium of the firm), classical oligopoly (assumptions, the 'kinked demand model' price leadership (collusive oligopoly).

Unit V
Theory of pricing : Full-cost pricing principle, average cost pricing principle.
Theory of Distribution: The marginal productivity theory, Rent-modern theory of rent, wages- meaning, determination of wages in competitive market, Monopsony in labour market, unions and wages, interest-time preference, the classical theory, the loanable funds theory, keynes liquidity preference theory, profits-meaning, different theories of profit.

Embedded Systems

Unit I
Introduction to embedded systems, architecture of embedded systems, specifications of embedded systems.

Unit II
Design methodologies, real time issues: modeling, specification, communication, scheduling, protocols etc.

Unit III
hardware software partitioning, approaches to software and code generation.

Unit IV
Operating system issues, memory and low power issues.

Unit V
Validation approaches, distributed embedded systems.

Formal Language and Automata Theory

Unit I
Introduction to automata : Alphabet, Language, Grammar, Concepts of automata theory, Some applications.
Finite automata: An informal picture of finite automata, Deterministic and non-deterministic finite automatas, Language recognized by finite automata, Equivalence of deterministic and non-deterministic finite automata, Finite automata with epsilon-transitions.

Unit II
Regular expression and languages: Regular expressions, Language associated with regular expressions, Connection between regular expression and regular languages, Finite automata and regular expressions, Regular grammars, Equivalence between regular languages and regular grammars, Chomsky classification of languages, Proving languages not to be regular, Pumping lemma and its applications, Properties of regular languages, Minimization of automata.

Unit III
Context free grammars and languages: Context free grammars, Context free languages and derivation trees, Ambiguity in grammars and languages, Properties of context free languages, Normal forms of context free grammars, Pumping lemma for context free languages.

Unit IV
Pushdown automata : Basic definition, Language recognized by pushdown automaton, Pushdown automata and context free languages, Context free grammars for pushdown automata, Deterministic pushdown automata.

Unit V
Turing machines: Definition, Turing machine model, Representation of Turing machines, Design of Turing machines, Turing thesis, Non-deterministic Turing machines, Universal Turing machine, Turing machine and Type 0 grammars, Halting problems of Turing machine, Turing computability, The Chomsky hierarchy, Primitive recursive functions, Linear bounded automata and context sensitive languages, Decidable and undecidable problems, Post correspondence problem.

Fault Tolerant Computing

Unit I
Introduction to redundancy theory, limit theorems, decision theory in redundant systems.

Unit II
Hardware fault tolerance : Computer redundancy techniques – detection of faults – replication and compression techniques – self repairing techniques – concentrated and distributed voters.

Unit III
Models of fault tolerant computer – case study of existing systems.

Unit IV
Software fault-tolerance : Fault tolerance versus fault intolerance, fault tolerance objectives; errors and their management strategies, implementation of error management strategies.

Unit V
Software fault tolerance techniques – Software defence, protective redundancy. Architectural support of fault-tolerance software protection mechanisms, recovery mechanisms.

Bluetooth Technology

Unit I
Introduction to wireless technologies: WAP services, Serial and Parallel Communication, Asynchronous and synchronous Communication, FDM, TDM, TFM, Spread Spectrum technology.
Introduction to Bluetooth: Specification, Core protocols, Cable replacement protocol

Unit II
Bluetooth Radio: Type of Antenna, Antenna Parameters, Frequency hoping.
Bluetooth Networking: Wireless networking, wireless network types, devices roles and states, adhoc network, scatternet.

Unit III
Connection establishment procedure, notable aspects of connection establishment, Mode of connection, Bluetooth security, Security architecture, Security level of services, Profile and usage model: Generic access profile (GAP), SDA, Serial port profile, Secondary Bluetooth profile.

Unit IV
Hardware: Bluetooth Implementation, Baseband overview, packet format, Transmission buffers, Protocol Implementation: Link Manager Protocol, Logical Link Control Adaptation Protocol, Host control Interface, Protocol Interaction with layers.

Unit V
Programming with Java: Java Programming, J2ME architecture, Javax.bluetooth package Interface, classes, exceptions, Javax.obex Package: Interfaces, classes.

Text Book:
1. Bluetooth Technology by C. S. R. Prabhu and A. P. Reddi; PHI.

Multimedia Technology

Unit I

Introduction : Concept of Multimedia, Multimedia Applications, Hardware Software requirements, Multimedia products & its evaluation.

Unit II

Components of multimedia: Text, Graphics, Audio, Video. Design & Authoring Tools, Categories of Authority Tools, Types of products.

Unit III

Animation. Introduction, Basic Terminology techniques, Motion Graphics 2D & 3D animation.

Unit IV

Introduction to MAYA(Animating Tool): Fundamentals, Modeling: NURBS, Polygon, Organic, animation, Paths & boxes, deformers.

Unit V

Working with MEL: Basics & Programming. Rendering & Special Effects: Shading & Texturing Surfaces, Lighting, Special effects.

Text Books:
1. David Hillman, "Multimedia Technology & Applications", Galgotia Publications.
2. Rajneesh Agrawal, "Multimedia Systems", Excel Books.
3. Nigel Chapman & Jenny Chapman, " Digital Multimedia", Wiley Publications.
4. D. P. Mukherjee, "Fundamentals of Computer Graphics and Multimedia", PHI.

Cluster & Grid Computing

Unit I

Cluster Computing: Parallel systems, Cluster Architecture, Parallel Paradigms, Parallel, Programming with MPI, Resource Management and scheduling.

Unit II

Grids and Grid Technologies, Programming models and Parallelization Techniques.

Unit III

Standard application development tools and paradigms such as message-passing and parameter parallel programming.

Unit IV

Grid Security Infrastructure, Data Management.

Unit V

Applications Case Study: Molecular Modelling for Drug Design and Brain Activity Analysis, Resource management and scheduling, Setting up Grid, deployment of Grid software and tools, and application execution.

Text Books:
1. Buyya (editor), High Performance Cluster Computing, Vo11. And Vol.2, Prentice Hall, Usa, 1999.
2. I. Foster and C. Kesselman (editors), The Grid : Blueprint for a New Computing Infrastructure, Morgan Kaufmann Publishers, 1999.