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**MCA 404 Elective:**
1. UID
2. Artificial Intelligence.
3. Computer System Performance and Evaluation
4. PPL

**MCA 504 Elective:**
1. ERP
2. DSS
3. Distributed Systems
4. Distributed Operating System
5. Mobile Computing

**MCA 405 Elective:**
1. E-Commerce
3. Advanced Computer architecture
4. Network Managements Systems

**MCA 505 Elective:**
1. Image Processing
2. Multimedia System
3. Real Time System
4. Software Testing
5. Software Project Management
MASTER OF COMPUTER APPLICATIONS (MCA)
SEMESTER I

MCA 101: DISCRETE MATHEMATICAL STRUCTURES

UNIT I: Logic and Proof, Sets and Functions – Logic Propositional equivalence, Predicates and Quantities, Nested quantifiers, Methods of Proof, sets, set operations, functions.

UNIT II: The Integers and Division, Integers and Algorithms, Applications of Number theory, Mathematical reasoning, Induction and Recursion–Proof strategy, Sequences and Summations, Mathematical induction. Recursive definitions and Structural induction, Recursive algorithms, Program correctness.

UNIT III: The basics of counting, the pigeonhole principle, Permutations and Combinations, Binomial coefficients, Generalized permutations and combinations, Generating permutations and combinations, Recurrence relations, Solving recurrence relations.

UNIT IV: Relations – Relations and their properties, n-ary Relations and their applications, Representing Relations, Closures of relations, Equivalence relations, Partial orderings. Languages and Grammers, Finite state machines with output, Finite state machines with no output, Language recognition, Turing machines.

UNIT V: Graphs – Introduction to Graphs, Graph terminology, Representing graphs and Graph isomorphism, Connectivity, Euler and Hamilton Paths, Shortest Path problems, Planar graphs, Graph coloring.


REFERENCE BOOKS:

MCA 102: PROBABILITY AND STATISTICS

UNIT I: Probability: Sample space and events – Probability – The axioms of probability – some elementary theorems – conditional probability – Bayes Theorem.


UNIT III: Sampling distribution: Population and samples – sampling distributions of mean (Known and unknown) proportions, sums and differences: Point estimation – interval estimation – Bayesian estimation.

UNIT IV: Test of hypothesis – mean and proportions – Hypothesis concerning one and two means – Type I and Type II errors. One tail, two-tail tests. Test of significance – students t-test, f-test, x²-test. Estimation of proportions.


TEXT BOOKS:

EDUCATION/PHI REFERENCE BOOKS:
MCA 103: INTRODUCTORY PROGRAMMING


UNIT III: Basic concepts of Object Oriented Programming – Objects, Classes, Data abstraction, Data encapsulation, Inheritance, Polymorphism, Dynamic binding, Message passing: Object oriented software development – Class diagram, Object diagram, Use case diagram, State chart diagram, Activity diagram.

UNIT VI: Classes, and Objects in C++, Constructors, and Destructors, Operator overloading. Type conversions, inheritance.

UNIT V: Pointers, Memory management – new, and delete operators, Dynamic objects: Binding, Polymorphism, Virtual functions, Templates, Exception handing.

Text Books:

References Books:
MCA 104: COMPUTER ORGANIZATION


Reference Books:
MCA 105: ORGANIZATION AND MANAGEMENT


UNIT III: Delegation and decentralization – Directing and problems in Human relations – Motivation

UNIT IV: Communication – Leadership –Coordination – Management control – Control techniques.

UNIT V: Dynamic Personnel Management – staffing policies and process – wage and salary administration.

Text Book:

Reference Books:
SEMESTER II

MCA 201: COMPUTER ORIENTED OPERATIONS RESEARCH

UNIT I: Overview of Operations Research Modeling Approach, Decision Analysis and Games
Decision environments, Decision making under Certainty, Decision making under Risk,
Decision under Uncertainly, Game Theory.

UNIT II: Linear Programming – Formulation, Graphical method, Simplex method, Duality,
Revised Simplex method. Transportation, Assignment and Transshipment models. Goal
Programming – Formulation, Weighting and Preemptive methods.

UNIT III: Nonlinear Programming – Sample applications, Graphical illustration of Nonlinear
Programming Problems, Types of Nonlinear Programming problems, One-variable Unconstrained Optimization, Multivariable Unconstrained Optimization, Karush-Kuhn-
Tucker Conditions for Constrained Optimization, Quadratic Programming, Separable
Programming, Convex Programming and Non-Convex Programming.

UNIT IV: Queuing Theory – Basic Structure of Queuing Models, Examples of Real queueing
Systems, Role of Exponential Distribution, Birth-and Death Process based on Queuing Models,
Models involving Non-Exponential Distributions, Priority – Discipline Queuing Models and
Queuing networks.

Applications of Queuing Theory – Examples, Decision Making, Formulation of Waiting
Cost Functions and Decision Models.

UNIT V: Introduction to Simulation, Simulation examples, Random – Number generation,
Random-Variate generation, Verification and Validation of Simulation Models, Output Analysis
for a Single Model, Comparison and evaluation of Alternative System designs, Simulation
Packages.

TEXT BOOKS:

   2003. (For Unit II, Chapters 2,3,4,5,7 and S: for part of Unit I Chapter 14)
2. Frederick H.S. and Lieberman G.J. Introduction to Operations Research, 7th edition,
   Tata McGraw-Hill, 2002. (For part of Unit I chapter 2, for Unit III Chapter 13, and for
   Unit IV Chapters 17 and 18).
   Simulation. Pearson Education Asia, 3rd edition, 2002. (for Unit V Chapters
   1,2,7,8,10,11 and 12; and Section 4.7).
MCA 202: DATA STRUCTURES

UNIT I: Concept of Abstract Data Types (ADTs), Data Types, Data Structures, Storage Structures, and File Structures, Primitive and Non-primitive Data structures. Linear and Non-linear Structures.


TEXT BOOKS:-

REFERENCES BOOKS:
MCA 203: OPERATING SYSTEMS


UNIT II: CPU Scheduling: Scheduling criteria, Scheduling Algorithms, Multiple processor Scheduling, Real-time scheduling.
Dead Locks: Deadlock characterization, Deadlock handling, Deadlock prevention, Deadlock avoidance, Deadlock detection, and Recovery.


UNIT IV: I/O Systems: overview, I/O hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O to Hardware operations, STREAMS, Performance of I/O.


TEXT BOOKS:

REFERENCE BOOKS:

Note: Operating System concepts are to be discussed using examples from Unix/Linux and Windows 2000 Operating Systems.
**MCA 204: FILE STRUCTURES**


**UNIT II:** Managing Files of Records, Organizing files for Performance, Indexing, Consequential Processing, Sorting of Large Files.

**UNIT III:** Multi-Level indexing, B-Trees, Indexed Sequential File access, Prefix B Trees, Hashing, Extendible Hasting.

**UNIT IV:** COBOL Fundamentals, Sequential File Processing, Sorting and Merging.

**UNIT V:** Indexed File Processing, Relative File Processing, Interactive Processing, Array Processing – Defining initializing, accessing, and searching of arrays, Report generation, Sub programs.

**Text Books:**

**MCA 205: ACCOUNTING AND FINANCIAL MANAGEMENT**


**Unit II:** Cost Accounting: Nature and significance – Cost classification and Analysis – Marginal Costing

**Unit III:** Budget – Budgetary control – standard costing – Finance Function


**Unit V:** Funds flow Analysis – Cash flow Analysis - Ratio Analysis-

**Text Books:**

Reference Books:
SEMESTER III
MCA 301: DATA BASE MANAGEMENT SYSTEMS


UNIT III: OBJECT- DATABASES AND XML: Complex Data Type-Structured Types and inheritance in SQL-Table Inheritance-Array and Multiset Types in SQL-Object-Identity and Reference Types in SQL-Implementing O-R Features-Persistent Programming Languages – Object-Oriented versus Object-Relational.


Text Book:

Reference Books:

UNIT – II: Data Link Layer: Error detection and correction, Data link control and Protocols – Stop and wait, Go-back-n, Selective repeat, HDLC, Point to point access, Channelization, LANS – Traditional Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN’s – IEEE 802.11, Bluetooth, Connecting LANs – Connecting devices, Backbone networks, Virtual LANS, Cellular telephony, Satellite networks, Virtual circuit switching, Frame relay, ATM.


UNIT – V: Application Layer: Client-Server model, Socket interface Introduction to DNS, Distribution of name space, DNS in the Internet, Resolution, DDNS, Electronic mail, SMTP, File Transfer, FTP, HTTP, World Wide web

Text Books:

Reference Books:
MCA 303: SOFTWARE ENGINEERING


UNIT –III: Design Engineering-Design process and quality, design concepts the design model, and pattern-used software design. Architectural design – Software architecture, data design, architectural styles and patterns, architectural design mapping data flow into a software architecture. Component-level design-component, designing class-based components, conducting component-level design, object-constraint language, and design conventional components. Interface design – Design steps, web apps design issues and architecture design.

UNIT –IV: Testing strategies – Strategies and issues, testing strategies for and object-oriented software. Validation testing and system testing. Software testing tactics – Fundamentals, black-box and white-box testing white-box testing basis path testing. Control structure testing, black-box testing, object-oriented testing methods. Testing methods applicable at the class level inter class testing case design. Testing for specialized environments, architectures and applications, web application testing – concepts, testing process, component level testing.

UNIT – V: Product metrics – Software quality, framework, metrics for analysis model design model, source case and testing. Managing software projects – The management spectrum, the W5 HH principle, metrics in process, software measurement, metrics for software quality integrating metrics within the software process. Estimation – observations, decomposition techniques, empirical models, estimation for object-oriented projects other estimation techniques, project scheduling, risk management, quality management, reengineering, change management, component-based development.

TEXT BOOK:

REFERENCE BOOKS:
1. James F Peters, Software Engineering, John Wiley
MCA 304: DESIGN AND ANALYSIS OF ALGORITHMS

UNIT I:  Divide – and-Conquer and Greedy Methods.

UNIT II:  Dynamic Programming; Basic Traversal and Search Technique.

UNIT III:  Backtracking; and Branch-and Bound Technique.

UNIT IV:  Lower bound Theory; NP-Hard and NP-Complete Problems

UNIT V:  Mesh and Hypercube Algorithms.

TEXT BOOKS:


REFERENCE BOOKS:

4. TH Coremen, CE Leiserson and RL Rivest, Introduction to Algorithms, PHI
MCA 305: TECHNICAL COMMUNICATION AND COMPUTER ETHICS


UNIT II: Introduction to Technical Writing – Objective of technical writing Audience Recognition and Involvement, Preparation of Resume, Techniques for writing effective E-mail. Writing User Manuals, Writing Technical Reports and Summaries.


Text Books:

References Books:
3. Division of Humanities and Social Sciences, Anna University, English for Engineer and Technologists, Vols, 1and 2nd edition, Orient Longman, 2002.
SEMESTER IV

MCA 401: PRODUCTION AND MARKETING MANAGEMENT

UNIT I: Production Management – Production Planning and control – Maintenance Management.

UNIT II: Quality Control – Inventory Control – Purchasing

UNIT III: Nature and Functions of Marketing – Marketing environment – Market Segmentation

UNIT IV: Product Strategy – Pricing objectives and policies

UNIT V: Promotion strategies – Advertising and sales promotion – Personal selling – Publicity – Marketing research – Place – Distribution channels.

TEXT BOOK:

REFERENCE BOOKS:
4.2 DATA WAREHOUSING AND MINING

**Unit – I:** Introduction to Data Warehouse. Data Warehouse Architecture: System Processes, Process Architecture, Hardware Architecture.

**UNIT – II:** Data Warehouse Design: Data Warehouse Schema, Partitioning strategy , Aggregations, Data Marting, Meta data, System & Process managers. Introduction to Data Mining and related topics.


**UNIT – IV:** Algorithms for Clustering:- Hierarchical Algorithms, Partitional Algorithms, Clustering large Databases, Clustering with categorical Attributes.

**UNIT – V:** Associate Rules:- Basic Algorithms, Parallel and Distributed algorithms, Comparative study, Incremental Rules, Advanced Association Rule Technique, Metrics for Quality of a Rule. Web Mining:- Web Content mining, Structure Mining, Usage Mining

**Text Books:**
1. Data Warehousing in the real world by Sam Anahory & Murray, Pearson Education publishers.
2. Data Mining – Introductory & Advanced topics by Margaret H. Dunham,. Pearson Education publishers.

**REFERENCE BOOKS:**
2. Oracle 8i – Data Warehousing by Cohen, Abbey, Taub, Tata McGraw Hill
UNIT – I: Introduction to Internet – Microsoft Internet Explorer – Introduction XHTML Part I and Part II (Chapters 1, 2, 4, 5)

UNIT – II: Java Script: Introduction to Scripting - Control Structures - Functions – Arrays Objects - Object model collections – Events (Chapters 7 to 10, 11, 14)


UNIT – IV: Introduction to PHP – Control Structures – Arrays – Functions – Database Connectivity - Web Servers (IIS, and Apache) (Chapters 15, 16, 20, 21)

UNIT – V: Advanced Java – Java Database Connectivity (JDBC) – Swing Framework – Servlets Technology (Chapters 8, 9, 10, 14, of Ivan Bayross)

TEXT BOOK:

1. Deitel, Deitel and Goldberg Internet & World Wide Wide how to program”by End. Pearson Education
2. Ivan Bayross, Webenavled commercial Application Development in Java 2.0 BPB.

REFERENCE BOOKS:

**Unit – I:** Human factors of interactive software goals of system engineering and user-interface design, motivations, accommodation of human diversity goal for our profession. Theories, principles, and guidelines – High-level theories, object-action interface model, Principle 1.2 and 3, guide links for data display and data entry, balance of automation and human control. Managing design processes – Usability, design pillars, development methodologies, ethnographic observation, usability testing, surveys, and continuing assessments – expert reviews, usability testing and laboratories, surveys acceptance tests, evaluation during active use, and controlled psychologically oriented experiments.

**Unit – II:** Software tools – Specification methods, interface-building tools and evaluation and critiquing tools. Direct manipulation and virtual environments – examples, explanations, programming, visual, thinking and icons Home automation, remote direct manipulation, visual environments. Menu selection, form fillin, and dialog boxes – Task-related organizations, item presentation sequence, response time and display rate, fact movement through menus, menu layout, form fill in, and dialog boxes. Command and natural languages – Functionality to support users tasks, command – organization strategies, the benefits of structure, naming and abbreviations, command menus, natural language in computing.

**Unit – III:** Interaction Devices – Keyboards and function keys, pointing devices, speech recognition digitization and generation. Image and video displays, printers. Response time and display rate-Theoretical foundations, expectations and attitudes, user productivity, variability. Presentation styles: Balancing function and fashion – error messages, No anthropomorphic design, display design, color, Printed manuals, Online Help and tutorials – Reading from paper versus form displays, preparation of printed manuals, and preparation of online facilities.


**Unit – V:** Introduction to Dot Net technology VB.Net Language – Control structures – GUI controls – Database GUI Controls and its connectivity to databases – ASP.Net Fundamentals and Web pages Interface designing.

**Text Book:**
2. Beginning .NET 2.0 by wrox publications (For Unit V).

**Reference Books:**
3. ASP.NET 2.0 Black Book, Dreamtech publications.
4. VB.NET 2.0 Black Book, Dreamtech publications.
MCA 404 B: PRINCIPLES OF PROGRAMMING LANGUAGES


UNIT II: Basic Semantics: Attributes, Binding, and semantic functions, Declarations. Blocks, and Scope, Symbol table, Name resolution and Overloading allocation. Life times and Environment, Variables and Constants, Aliases, Dangling references, Garbage Collection. Data Types: Simple types: Simple types, Type checking, Type conversion, Polymorphic type checking, Explicit polymorphism.


UNIT V: Logic Programming: Logic and logic programs, Horn classes, Resolution and Unification. Introduction to PROLOG, problems with logic programming, Constraint logic programming. Parallelism in Non-imperative languages. Introduction to Operational, Denotational and Axiomatic semantics.

Text Books:

Reference Books:
MCA 404C: ARTIFICIAL INTELLIGENCE


UNIT – IV: Natural language processing – Overview of linguistics. Grammars and languages, Basic parsing techniques, Transitional networks, Semantic analysis and representation structures, Natural language generation, Natural language systems; General concepts in knowledge acquisition - Types of learning, General learning model, Performance measures; Early work in machine learning – Perceptions, Genetic algorithms, Intelligent editors.

UNIT – V: Expert system architecture – Characteristic features of expert systems, history, Applications, Rule based system architecture, Expert system shells; Pattern recognition – The recognition and classification process, Learning classification patterns, Recognizing and understanding speech; Perception and Action; Features of AI Programming language PROLOG.

Text Books:

Reference Books:
MCA 404 D: COMPUTER SYSTEMS PERFORMANCE EVALUATION


UNIT III: Hardware Test beds Instrumentation, Measurement, Data Extraction, and Analysis – System Performance Evaluation Tool Selection and Use – Analysis of Computer Architectures.

UNIT IV: Analysis of Operating System Components – Database system performance Analysis

UNIT V: Analysis of Computer New works Components.

TEXT BOOK

REFERENCE BOOKS

UNIT – II: The Internet as a Network Infrastructure: The Internet Terminology; Chronological History of the Internet NSFNET: Architecture and Components: Globalization of the Academic Internet; Internet Governance: The Internet Society –An Overview of Internet Applications – Electronic Commerce; World Wide Web(WWW) as the Architecture: Web Background: Hypertext Publishing; Technology behind the Web: Security and the Web- Consumer-Oriented Electronic Commerce: Oriented Applications; Mercantile Process Models Mercantile Models from the Consumer’s Perspective; Mercantile Models from the Merchant’s Perspective.

UNIT – III: Electronic Payment Systems: Types of Electronic Payment Systems; Smart Cards and Electronic Payment Systems; Credit Card-Based Electronic Payment systems: Risk and Electronic Payment Systems Designing Electronic Payment systems – Inter organizational Commerce and EDI: Legal, security, and Privacy Issues:EDI and Electronic Commerce – EDI Implementation, MIME, and Value- Added Networks : Standardization and EDI;EDI Software Implementation: EDI Envelope for Message Transport: Value- Added Networks (VANs); Internet – Based EDI.

UNIT – IV: Intraorganization Electronic Commerce: Internal Information System: Macro forces and Internal Commerce; Work-Flow Automation and Coordination; Customization and Internal Commerce; Supply Chain Management (SCM) – The Corporate Digital Library: Dimensions of Internal Electronic Commerce Systems; Making a Business Case for a Document Library; Types of Digital Document Library; Types of Digital Documents; Issues behind Document Infrastructure; Corporate Data Warehouses.

UNIT – V: Advertising and Marketing on the Internet: The New Age of Information–Based Marketing; Advertising on the Internet; Charting the On-Line Marketing Process; Market Research – Consumer Search and Resource Discovery; Search and Resource Discovery Paradigms; Information Search and Retrieval; Electronic Commerce Catalogs or Directories ; Information Filtering; Consumer – Data Interface; Emerging Tools – On Demand Education and Digital Copyrights; Computer- Based Education and Training; Technological Components of Education ON-Demand; digital Copyrights and Electronic Commerce.

TEXT BOOK:

REFERENCE BOOKS:
MCA 405 B: NETWORK SECURITY


UNIT – III: Public-Key Cryptography, Introduction to Number Theory: Prime Numbers, Modular Arithmetic, Euler’s Theorem, Primary and Factorization, Discrete Logarithms; Message Authentication and Hash Functions – Hash and MAC algorithms.


TEXT BOOK

REFERENCE BOOK:
2. Charke Kaufman, Rodia Perlman and Mike Speciner, Network Security
MCA 405 C: ADVANCED COMPUTER ARCHITECTURE


TEXT BOOK:

Reference Books:
UNIT I: Data communications and Network Management overview: Analogy of Telephone Network Management: Communications protocol and standards, case Histories of Networking, and Management, Challenges of Information technology Managers, Network Management Goals, organization and functions, network and system Management, Network Management system Platform, current status and future of Network management, SNMPV1 Network Management: Organization and information and Information Models

UNIT II: Managed Network: case Histories and examples, the History of SNMP management SNMP Model. The Organization Models system Overview, The Information Model SNMPv1 Management: Communication and Functional Models, the SNMP Communication Model, Functional Model

UNIT III: SNMP Management SNMPv2: major changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, the SNMPv2 Network Management base, SNMPv2 protocol, Compatibility with SNMPv1. SNMP Management RMON what is remote Monitoring / RMON SMI and MIB, RMON1, RMON2 ATM remote monitoring. A case study of internet traffic using RMON.


TEXT BOOK:
1. Mani Subramanian, Network Management, Principles and practice, Pearson Education

REFERENCES:
2. Mark Burges, principles of network systems administration, Wiley dreamtech.
SEMESTER V

MCA 501: COMPUTER GRAPHICS

UNIT I: A survey of computer graphics, overview of graphics systems, output primitives

UNIT II: Attributes of output primitives, 2-d geometric transformations, 2-d viewing.

UNIT III: Structures and hierarchical modeling, graphical user interfaces and interactive input methods, 3-d concepts, 3-d object representations.

UNIT IV: 3-D Geometric and modeling transformations, 3d viewing, visible-surface detection methods.

UNIT V: Illumination models and surface – rendering methods, color models and color applications, computer animation.

Text Book:

Reference Books:
4. J.D.Foley Wesley,199, second Edition in C.
MCA 502: OBJECT ORIENTED SYSTEMS DEVELOPMENT


Unit II: Methodology, Modeling, OO analysis and unified modeling language – oo methodologies; rum Baugh, the booch and Jacobson methodologies patterns, frameworks, and unified approach.

Unified modeling language : introduction to UML, UML diagrams and class diagram. Use –case diagram, UML dynamic modifying, model management and uml extensibility oo analysis : use – case drivers – object – oriented analysis process – identifying use cases : difficulty of oo analysis understanding the business, use case drivers oo analysis : the unifier approach, use case model and documentation. Object analysis : classification : theory, approaches for identifying classes, noun phrase, common class pattern, use case driver and classes, responsibility and collaborations. Identifying objects relationships, attributes and methods-super – sub class relationships, a – part – of relationships- aggregation, class responsibility : identifying attributes and methods, defining attributes by analysis use cases and other uml diagrams, object responsibility: methods and messages.

UNIT III: Philosophy, uml, the purpose, class visibility, refining attributor, designing methods and protocol, access layer: object storage and object interoperability : object store and persistence, review of dbms, database organization : access distributed data base and distribution object complexity, oo dbms, object-relation system, multimedia system. Designing access layerclasses. View layer : designing interfacing objects- and, designing view layer classes, macro and micro – level process, purpose, and prototyping.

UNIT IV : Software quality: squaquality assurance tests , strategies, impact & object orientation on testing text courses, text plan, continnous testing , users debugging principle, (case studies may be considered for better understanding).

UNIT V: Design patters introduction – definition, move, describing design pattern, the catalog and its organization. Solving design problem, select and use a design pattern, designn pattern catalog internet, motivation, applicability, structure, participants, collaborations, consequences, implementation, sample code, known use and related panerns of abstract factory, builder, factory method, prototype singleton, adapter, composite, decorator, observer, strategy and template method.

Text Books:

Reference Books:
1. Simon Bennett, steve Mcrobb and Ray farmer object- oriented system analysis and design using uml, second edition, tata mcgraw-hill.
4. Cay horseman, object oriented design and patterns, wiley.
MCA 503: SYSTEMS PROGRAMMING

UNIT I: background introduction, system software and machine architecture, sic, cisa, and rise architecture. Assembler: basic assembler functions, machine dependent and independent assembler features, assembler design options, and implementation examples.

UNIT II: loading and linkers basic loader junction, machine dependent and independent loader features, loader design options and implementation examples.

UNIT III: types of os , os design options, environment of unix process. Device drivers; grand design, details, types of device drivers, gross anatomy of a device driver, general programming considerations.


Text Books:

Reference Books:
MCA 504 A: ENTERPRISE RESOURCE PLANNING

UNIT–1: Business Functions, process and Data Requirements, Development of Enterprise Resource planning.

UNIT - II: Marketing Information system and the Sales order process.


UNIT – IV: Accounting and Finance.


TEXT BOOK:

REFERENCE BOOK:

MCA 504 B: DECISION SUPPORT SYSTEMS

UNIT I: Introduction to decision support systems-human decision-making processes-Systems, information quality and models-types of decision support systems.

UNIT II: DSS architecture, Hardware and operating system platforms-DSS software tools – Building and implementing decision support systems.

UNIT III: Models in decision support systems-Mathematical models and optimization.

UNIT IV: Group decision support systems-export systems.

UNIT V: Data warehousing and executive information system fundamentals-data warehouse Database analyzing the contents of the data warehouse

TEXT BOOK:

REFERENCE BOOKS:
2. Sam Aaahory and Dennis Murray, Data warehousing in the real world-A practical guide for Building Decision support Systems, Addison-Wesley
MCA 504 C: DISTRIBUTED SYSTEMS

UNIT-I: Introduction: Definition, goal, hard work, software concepts and the client-server model Communication: layered protocols, RPC, ROC, message – oriented communication, stream-oriented communication.

UNIT-II: Processes: Threads, clients, servers, code migration, software agents. Naming: Naming entities, locating mobile entities, rom array, unreformed entities. Synchronization: Clock synchronization, logical clocks, global state, election algorithms, Mutual exclusion, distributed Transactions.


UNIT-IV: Security: Introduction, Secure channels, access control, security management, KERBEROS, SESAME, payment system. Distributed object-Based systems: CORBA, DECOM, GLOBE comparisons

UNIT-V: Distributed File systems: Sun network file system, the code file system, other distributed files, status, comparison of distributed file systems. Distributed document-Based systems: The www.LOTUSNOTES, and comparison. Distributed coordination- Based systems: Introduction to coordination model, TIB/RENDEZVOUS, JINI and comparision of TIB\RENDEZVOUS AND JINI.

TEXT BOOK:

REFERENCE BOOK:
1. George coulouries, Jean Dollimore and Tim Kindberg, Distributed systems, Pearson Education

MCA 504 D: DISTRIBUTED OPERATING SYSTEMS

UNIT I: Architectures of Distributed Systems-Theoretical Foundations

UNIT II: Distributed Mutual Exclusion – Distributed Deadlock Detection.


UNIT IV: Distributed Shared memory-Distributed Scheduling.

UNIT V: Recovery-Fault Tolerance.


REFERENCES:
Elective 504E: MOBILE COMPUTING

Unit I: Wireless Communication Fundamentals

Unit II: TELECOMMUNICATION SYSTEMS

Unit III: Wireless Networks

Unit IV: Network Layer

Unit V: Transport and Application Layers

Text Books:

References:
MCA 505 A: IMAGE PROCESSING


UNIT-IV: Detection of Discontinuities – Edge Linking and Boundary Detection – Threshold-Regarding based Segmentation- Segmentation by morphological watersheds-the Use of Motion Segmentation.


TEXT BOOK:

REFERENCE BOOKS:
1. Introductory Computer Vision & Image Processing, Mc Graw Hill.
3. B.Chandra, D.Dutta Majmlar, Digital Image Processing PHL
MCA 505 B: MULTIMEDIA SYSTEMS


UNIT-II: Video and Animation: Basic Concepts-Television-Computer based Animation-Data Compression: Storage Space-Coding Requirements-Source, Entropy and Hybrid coding-some Basic Compression Techniques-JPEG.261-MPEG_DVI.


REFERENCE BOOKS:
.... Jeffcoate, Multimedia in practice Technology and Application, Prentice Hall, 1995
MCA 505 C: REAL-TIME SYSTEMS


TEXT BOOK:

REFERENCE BOOKS:
- phillip A Laplante, Real-Time systems Design and Analysis, PHI.
MCA 505 D: SOFTWARE TESTING

UNIT I: Building a software Testing strategy, software Test Design Techniques, software Testing tools and selection of Test Automation products.

UNIT II: Software Testing Life cycle and software testing process, testing Effort estimation and test planning, software test effort estimation technique.

UNIT III: Pre-Development testing: requirements and Design phase, Best practices in program phase: Unit Testing, System Testing and integration testing, case study on acceptance testing.


UNIT V: Testing of web Based Applications, Testing of Embedded software systems, testing Applications for security, testing Metrics and Bench Marks.

TEXT BOOK: Renu Rajani and pradeep Oak,, software testing, tata Mc Graw Hill.

Elective 505 E : SOFTWARE PROJECT MANAGEMENT

Unit I:

Unit II:
Project Management concept: People – Product-Process-Project Software process and project metrics: Measures – Metrics and indicators-Software measurements-metrics for software quality-integrating metrics within the software process.

Unit III:

Unit IV:
Project scheduling and tracking: Basic concepts-relation between people and effort defining task set for the software project-selecting software engineering task-refinement of major task-defining a task network-scheduling –project plan software quality assurance-quality concepts-software concepts -software reviews-formal technical review –Formal approaches to SQA-software reliability –SQA plan –the ISO 9000 quality standards.

Unit V:

Text Book:
1. Walker Royce, Software Project management: A unified framework, Pearson Education
2. Pankaj Jalote., Software Project management in practice, Pearson Education
3. Kelkar, S.A., Software Project management: A concise study, PHI
4. Mike Cottorell and Bob Hughes, Software Project management –
5. Sommerville I, Software engineering - , Addison Wesley
6. Robert Futrell, Donald Shafer and Linda I Quality software project management, Person Education

Pressman, R.S., Software Engineering, McGraw Hill International
MCA 508: MINOR PROJECT WORK

Students shall be grouped into teams not exceeding three per team for pursuing Minor Project work. Each team shall identify a real-life problem pertaining to a Manufacturing / Service / Trading System and offer a solution in the form of a Computer – Based system.

The team should put m a combined effort of 360 student-hours (i.e, 3 students x 120 hours per student) and submit their combined report. However, the reports should reflect the contributions or individuals.

The students shall select appropriate:
- Analysis and Design Methodologies for the development of Computer Based System.
- Operating system platform, programming Languages/ Front-End and Back-End Tools/ Packages for implementation.

The team shall follow the guidelines given below while preparing their project Report:
- The report should be given a title and it should have correlation with the contents of the report.
- Good quality A4 size papers shall be used of preparing the report and it shall be in the bound form.
- There shall be a front page depicting the Title of the Project Report, Authors Names and other information in the suggested format.
- The duly signed Certificate in the suggested format must be there and it shall follow the front page.
- Acknowledgements, if any, shall follow the Certificate.
- A list of contents shall be prepared denoting each chapter / section/sub-section with its number, caption and the beginning page number and of that chapter/ section/ subsection.
- The report shall be divided into chapters and each chapter shall be assigned with a number and title.
- Each chapter shall be further divided into sections and each section shall be assigned with a numbe and heading. For example, 3.1 refers to section 1 of chapter3.
- Each section may be divided further into sub-sections and a number and sub-heading shall be given to each sub-section. For example, 3.2.1 refers to sub-section 1 of section 2 of chapter 3.
- Each Figure shall be given a number and caption and it must be referred to in the text of the chapter. For example, figure 2.1 refers to figure 1 of chapter 2.
- Each table shall be given a number and caption and it must be referred to in the text of the chapter. For example, Table 3.1 refers to table 1 of chapter3.
- I any material, namely, text, figures, graphs, data or tables; is incorporated taking from the reported literature, namely, books monographs, articles published in Journal/ Magazines, or from any other source, the same shall be referre d to following a style of reference. One style of reference may be as follows.

prepare the list of such references and sort the same on ascending order of the Author (s) and assign numbers. For example.


At the end of the material taken from the repoted literatue, the appropriate number shall be given in a pair of brackets. For example, Commerce is the interchange of goods of services, especially on a large scale (1)

The list of references shall immediately succeed the last chapter.

The appendices, if any, shall follow the list of references.

MCA 509 : SEMINAR

1. Every student shall give two seminars of 30 minutes of duration each. The seminar topics should be outside the syllabus and from the emerging areas of computer Applications.
2. The student shall submit the seminar material in type written form to the teacher concerned at least two days in advance of seminar presentation date.
3. The student shall use LCD Projector for seminar presentation. He shall not use Black Board except for answering the questions after the seminar presentation, if any.
Decision Support Systems and Data Warehouse

1. Given the following list of employees in a manufacturing company, develop a software to find solutions to the following queries
   a. Sort the employees by department.
   b. Sort the employees by salary in an ascending order.
   c. Sort the employees by department and sort the employees of each department by age in an ascending order.
   d. Calculate the average salary.
   e. Calculate the average salary of female employees.
   f. Calculate the average salary in Department A.
   g. List the names of females who were hired after December 31, 1995.
   h. Show the age distribution graphically (use a 5-year grouping) as a pie chart.
   i. Compute the linear regression relationship for salary versus age for all employees.
   j. Compute the relationship for females and independently. Is there a significant difference?

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender</th>
<th>Age</th>
<th>Date Hired</th>
<th>Dept.</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martin Dean</td>
<td>M</td>
<td>28</td>
<td>06.Jan.88</td>
<td>A</td>
<td>$22,000</td>
</tr>
<tr>
<td>Jane Hanson</td>
<td>F</td>
<td>35</td>
<td>15.Mar.96</td>
<td>D</td>
<td>$33,200</td>
</tr>
<tr>
<td>Daniel Smith</td>
<td>M</td>
<td>19</td>
<td>06.Dec.90</td>
<td>C</td>
<td>$18,500</td>
</tr>
<tr>
<td>Emily Brosmer</td>
<td>F</td>
<td>26</td>
<td>10.Jan.88</td>
<td>B</td>
<td>$27,000</td>
</tr>
<tr>
<td>Jessica Stone</td>
<td>F</td>
<td>45</td>
<td>26.May.83</td>
<td>A</td>
<td>$38,900</td>
</tr>
<tr>
<td>Tom Obudzinski</td>
<td>M</td>
<td>38</td>
<td>01.Dec.98</td>
<td>B</td>
<td>$29,800</td>
</tr>
<tr>
<td>Kathleen Brosmer</td>
<td>F</td>
<td>32</td>
<td>18.Apr.92</td>
<td>B</td>
<td>$35,600</td>
</tr>
<tr>
<td>Lisa Gregory</td>
<td>F</td>
<td>48</td>
<td>03.Sept.91</td>
<td>C</td>
<td>$32,400</td>
</tr>
<tr>
<td>Timothy Parker</td>
<td>M</td>
<td>29</td>
<td>03.Aug.93</td>
<td>A</td>
<td>$21,200</td>
</tr>
<tr>
<td>Jessica Hibschers</td>
<td>F</td>
<td>53</td>
<td>30.July.94</td>
<td>D</td>
<td>$38,900</td>
</tr>
<tr>
<td>Adam Handel</td>
<td>M</td>
<td>62</td>
<td>29.Nov.97</td>
<td>A</td>
<td>$40,250</td>
</tr>
<tr>
<td>Melissa Black</td>
<td>F</td>
<td>42</td>
<td>01.Dec.89</td>
<td>B</td>
<td>$26,400</td>
</tr>
<tr>
<td>Ray Ernster</td>
<td>M</td>
<td>29</td>
<td>02.Dec.89</td>
<td>C</td>
<td>$23,200</td>
</tr>
<tr>
<td>Daniel Baim</td>
<td>M</td>
<td>38</td>
<td>26.Feb.88</td>
<td>C</td>
<td>$31,000</td>
</tr>
<tr>
<td>Amy Melnikov</td>
<td>F</td>
<td>45</td>
<td>30.Apr.86</td>
<td>A</td>
<td>$36,400</td>
</tr>
<tr>
<td>Adrienne Cam</td>
<td>F</td>
<td>30</td>
<td>15.June.86</td>
<td>A</td>
<td>$25,400</td>
</tr>
<tr>
<td>Steven Knowless</td>
<td>M</td>
<td>48</td>
<td>22.Oct.85</td>
<td>D</td>
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</tr>
<tr>
<td>Patricia Salisbury</td>
<td>F</td>
<td>56</td>
<td>26.Oct.85</td>
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<tr>
<td>Matthew BroekhuizenM</td>
<td>M</td>
<td>44</td>
<td>01.Jan.88</td>
<td>C</td>
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</tr>
<tr>
<td>Sarah Parent</td>
<td>F</td>
<td>64</td>
<td>01.Jan.99</td>
<td>A</td>
<td>$38,200</td>
</tr>
</tbody>
</table>

2. Design a DSS that helps in solving following queries. The demographics indicate family and gender makeup, income, education level, and other information for states, metropolitan statistical areas (MSAs), and counties. Such as data are available from various sources including books, disks, CD, ROMs, and the World Wide Web (see Internet Exercise). Take a real-world view of external but readily available data.
   a. Load the state P1 data population table into a spreadsheet files (Excel if possible) and into a database file. How difficult was this? How could this have been made easier? Don't forget to delete the comments and president (if Present) at the top. Print the table.
b. Using the state P1 population data, sort the data based on population size. What are the five most populated states and the five least populated states? Which five states have largest and smallest population densities? Which three states have the most people living on farms, and which state has the fewest lonely people? Which file type (spreadsheet or database) did you use and why? What features made it easy to do these analyses? Generate reports.

c. Load the state basic Table P6 (household income) into a spreadsheet or database file. Which five states have the most people earning $100,000 or more per year? Which five states have the highest percentages of people earning $100,000 or more per year? Combine these data with data from table P1 to determine which five states have the most people per Square mile earning $100,000 or more per year? Which file type (spreadsheet or database) did you use and why? What features made it easy to do these analyses?

3. Design an expert system that helps in suggesting to select a good job when you are having more than one offer. Think that you are in job market. List the names of four or five companies that had offered you a job. Write down all the factors that may influence your decision as to which job offer you will accept. Such factors may include geographic locations, salary, benefits, taxes, school system and potential for carrier advancement. Some of these factors may have sub criteria. For instance location may be subdivided into climate, urban concentration, cost of living and soon.

4. Design an expert choice software that suggest you in buying a new car.

5. Design a software to solve the traveling salesman problem.

6. Build an expert choice software to select next prime minister of India. Whom did you choose, did your solution match your expectation.

7. Design a DSS that helps you to invest 1 lakh rupees in share market. Analyze data of stocks for duration of minimum of 10 days in Daily News Papers (opening price, closing price on each day).

8. Data on a university campus or college campus are stored in different locations for different purpose (the registrars office, the housing office or the individual departmental offices etc.
   a. Design a Dataware house for above problem.

9. Design a DSS for a multinational Bank that helps the managers to view the reports regarding the performance of each branch and also helps them in making decisions.

10. Design a DSS for comparing organizations and to give ranks for those organizations.

Multimedia

11. Design and develop a software for Photo slideshow using Macromedia Flash.
12. Design and develop a software to show boat sailing in water using any Multimedia S/W.
13. Design and develop a software for creating an advertisement using Layers, Motion Tween & Shape, tween in Macromedia flash.
14. Design and develop a software for importing an object from the library apply the zoom in effect and zoom out effect using Macromedia flash.
15. Design and develop a software for creating a Publishing Banner ads using Macromedia Flash.
16. Design and develop a software for creating a Quiz on C or Java objective questions.
17. Design and develop a software E- Harathi using Macromedia Flash.
18. Design and develop a software to design an Logo with audio effects using Macromedia Flash.
19. Design and develop a software an Interactive greeting card using Macromedia Flash.
20. Design and develop a software for a Website using Macromedia Flash. (Minimum of 6 pages).
Image Processing (use Java)

1. Design an image processing package allows the user to design 3 convolution filters. Design 3 filters to perform the following tasks:
   (a) Blurring
   (b) Edge detection of vertical edges
Choose one of the two filters (a) or (b) from the previous part. Explain how it works, using the following image as an example (you may round off any calculated values to the nearest integer).

2. Design a software to store the image in the Haar or Walsh-Hadamard encoded version

3. Design a software to implement Stegnography

4. Design a software to implement any 5 filters.

5. Design a software to implement JPEG encoder.

6. Design a software to show Image Morphing

7. Design a software to show Fourier transform of a wave in Java

8. Design a software to show Pyramid Blending for a sample Image.

9. Develop a software to display Histogram for a given sample data

10. Design and develop a software to show Image using Gaussian Pyramid in Java.

ERP

Any 5 Case studies and its implementation in ERP Package.
System Programming
1. Design and develop a software in Java to simulate ls command in Unix with options like –l,-t,-P,-R your program should be interactive to prompt options (use command line arguments.)

2. Design and develop a Software in Java to Simulate grep Command in Unix with options
   a) to print lines matching patterns in file  b) Line number in file matching the pattern
   c) no. of times the pattern is present in file.
3. Design and develop a Software in Java Program to simulate menu driven program for commands
   a) Head    b) Tail    c) diff    d) comm.

4. Design and develop a Software in Java to simulate a Pass-1 of an Assembler for sample ALP code.

5 Design and develop a Macro Preprocessor for a C Language in Java

6. Design and develop a Software in Java to perform Syntax and semantics checking in Compiler for Loop and If statements in C Program

7. Write Unix Shell script for a) Pipe your /etc/passwd file to awk, and print out the home directory of each user. 
   b) Develop an interactive script for grep that asks for a word and a file name and then tells how many lines contain that word.

8. a) Write a Unix shell script that takes a command –line argument and reports on whether it is directory, a file, or something else. 
   b) Write a Unix shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.
   c) Write a Unix shell script that determines the period for which a specified user is working on the system.

9. a) Write a Unix shell script that accepts a file name starting and ending line numbers as arguments and displays all the lines between the given line numbers.

   b) Write a Unix shell script that deletes all lines containing a specified word in one or more files supplied as arguments to

   c) Write a Unix shell script to perform the following string operations:

      i) To extract a sub-string from a given string. ii) To find the length of a given string.

10. Design a C program that takes one or more file or directory names as command line input and reports the following information on the file: (Note : Use stat/fstat system calls)
    i) File type ii) Number of links iii) Read, write and execute permissions iv) Time of last access
Computer Graphics

11. Design and develop software in Java to draw Ellipse using different algorithms
12. Design and develop software in Java to show 3 D Translations on Applet.
13. Design and develop software in Java to implement Cohen Sutherland Clipping Algorithm
14. Design and develop software in Java to show image in various Shading or blur using filters.
15. Design and develop software in Java to show Bezier curves.
16. Design and develop software in Java to display bar chart for a given student data in Array fill bars in chart using various filling algorithms.

17. Design and develop software in Java to Rotate the text by a given angle from a keyboard.
18. Design and develop software in Java to display a Wall Clock
19. Design and develop software in Java to display the text for given Font and Size from keyboard
20. Design and develop software in Java to graphically view the Solution for travelling salesman problem for a given data using Java 2D API

MCA 508 P
Minor Project

Note: - Students are instructed to develop the System by using any Object Oriented Programming Language with Oracle, MySQL, SqlServer as backend. Student should use Rational Rose Tool or any UML tools for OOA and OOD

Object Oriented Analysis (Design SRS)
  Class Modeling
  Purpose: Determine the classes, their attributes and their interrelationships.
  Tool: Entity-Relationship Diagram
  End Product: Class Model Diagram

Dynamic Modeling
  Purpose: Determine the actions performed by/to each class or subclass.
  Tool: Finite-State Diagram, Activity Diagrams
  End Product: Dynamic Model Diagram

Functional Modeling
  Purpose: Determine how the various parts of the product interact.
  Tool: Data Flow Diagram
  End Product: Functional Model Diagram

Object Oriented Design
  System Design specification
  Class Design
  Component Design
  Database Design
  Interface Design
  Test case Design

Object Oriented Implementation
  Deployment Environment specification
  Testing done on each module with sample input test data

Conclusions and Future Enhancements

Annexure
  User Manual
  Screens
  Bibliography and References used
1. Each student shall pursue Major project work individually. Under no circumstances students shall be grouped into teams for pursuing Major Project work.
2. Each student shall identify a real-life problem pertaining to a Manufacturing / Service / Trading System and offer a solution in the form of a Computer-Based system.
3. The students shall select appropriate:
   i. Analysis and Design Methodologies for the development of Computer Based system.
   ii. Operating system platform, programming languages/Front – End and back – End Tools/ Packages for implementation.
   iii. Software Testing strategies and Technique for testing the software.
4. The student shall follow the guidelines given below while preparing the major project Report: their project Report:
   i. The report should be given a title and it should have correlation with the contents of the report.
   ii. Good quality A4 size papers shall be used for preparing the report and it shall be in the bound form.
   iii. There shall be a front page depicting the Title of the project Report, authors Names and other information in the suggested format.
   iv. The duly signed Certificate in the suggested format must be there and it shall follow the front page.
   v. Acknowledgements, if any, shall follow the Certificate.
   vi. A list of contents shall be prepared denoting each chapter/ section/ sub-section with its number, caption and the beginning page number and of that chapter/ section/ subsection.
   vii. The report shall be divided into chapters and each chapter shall be assigned with a number and title.
   viii. Each chapter shall be further divided into sections and each section shall be assigned with a number and heading. For example, 3.1 refers to section 1 of chapter 3.
   ix. Each section may be divided further into sub-sections and a number and sub-heading shall be given to each sub-section. For example, 3.2.1 refers to sub-section 1 of section 2 of chapter 3
   x. Each Figure shall be given a number and caption and it must be referred to in the text of the chapter. For example, Figure 2.1 refers to figure 1 of chapter 2.
   xi. Each Table shall be given a number and caption and it must be referred to in the text of the chapter. For example, Table 3.1 refers to table 1 of chapter 3.
   xii. If any material, namely, text, figures, graphs, data, or tables; is incorporated taking from the reported literature, namely, books, monographs, articles published in style of reference. One style of reference may be as follows.
   i. Prepare the list of such references and sort the same on ascending order of the Author(s) and assign numbers. For example,
   ii. At the end of the material taken from the reported literature, the appropriate number shall be given in a pair of brackets. For example, commerce is the interchange of goods of services, especially on a large scale (1).
   xiii. The list of references shall immediately succeed the last chapter.
   xiv. The appendices. If any, shall follow the list of references.
<table>
<thead>
<tr>
<th>FIRST Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turboc3, Borland C++</td>
</tr>
<tr>
<td>MS-OFFICE 2003/2007, Open Office</td>
</tr>
<tr>
<td>Operating Systems (Windows-XP, NT, Linux)</td>
</tr>
<tr>
<td>PC-Hardware Tools</td>
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<tr>
<td>TASM and MASAM Compilers for Assembly Level Programming</td>
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<table>
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<tr>
<th>SECOND Semester</th>
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<tbody>
<tr>
<td>Data Structures – Turboc3/JAVA</td>
</tr>
<tr>
<td>COBOL</td>
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<tr>
<td>TALLY 9.0</td>
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<tr>
<th>THIRD Semester</th>
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<tbody>
<tr>
<td>Oracle 11g</td>
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<tr>
<td>Rational Rose/UML Tools</td>
</tr>
<tr>
<td>JAVA for DAA</td>
</tr>
<tr>
<td>English Lab tools and software’s</td>
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<th>FOURTH Semester</th>
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<tbody>
<tr>
<td>Dot Net software – Visual Studio 2008</td>
</tr>
<tr>
<td>J2EE</td>
</tr>
<tr>
<td>Informatics 8.0</td>
</tr>
<tr>
<td>Java script/vbScript/PHP/Shell/Perl</td>
</tr>
<tr>
<td>Tomcat / Web Logic/ JRun/Web Sphere/IIS Servers</td>
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<tr>
<td>Visual C++/Visual Basic/Dream Weaver</td>
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<td>ERP software’s</td>
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<tr>
<th>FIFTH Semester</th>
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<tbody>
<tr>
<td>Java, C++, Visual Studio 2005</td>
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<tr>
<td>J2EE, Visual Studio 2005, J2ME</td>
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<tr>
<td>Dream viewer / Abode Photoshop</td>
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<tr>
<td>Software Testing Tools :- Junit, Mercury, Jmeter, Cunit</td>
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<tr>
<td>Abode Flash software</td>
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<tr>
<td>Tomcat / Web Logic/ JRun/Web Sphere/IIS Servers</td>
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<table>
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<tr>
<th>SIXTH Semester</th>
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<tbody>
<tr>
<td>Front-end tools</td>
</tr>
<tr>
<td>Visual Basics</td>
</tr>
<tr>
<td>Java, Siwngs, JFrames</td>
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<tr>
<td>Dream viewer</td>
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<tr>
<td>Visual C++</td>
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<tr>
<td>J2ME, Servlets, JSP, JSF</td>
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<tr>
<td>Turbo c, Turbo c++, Pascal, C# J#</td>
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<tr>
<td>Back-end tools</td>
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<td>MS-ACCESS</td>
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<td>ORACLE</td>
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<td>MYSQL</td>
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<td>DBASE</td>
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<tr>
<td>INFORMATICS</td>
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<tr>
<td>WEB-SERVERS:</td>
</tr>
<tr>
<td>Tomcat / Web Logic/ JRun/Web Sphere/IIS Servers</td>
</tr>
</tbody>
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## Systems List

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servers –Systems</td>
<td>6 (Windows)</td>
</tr>
<tr>
<td></td>
<td>2 (Linux)</td>
</tr>
<tr>
<td>Clients - Systems</td>
<td>180</td>
</tr>
<tr>
<td>Printers</td>
<td>18 (Dot Matrixes Printers)</td>
</tr>
<tr>
<td></td>
<td>2 (HP Inkjet Printer)</td>
</tr>
<tr>
<td></td>
<td>1 (Laser Printer)</td>
</tr>
<tr>
<td></td>
<td>1 (Xerox)</td>
</tr>
<tr>
<td>LCD’S</td>
<td>3</td>
</tr>
<tr>
<td>Internet Connections</td>
<td>5 Systems (100 Mbps)</td>
</tr>
<tr>
<td></td>
<td>1 Server : 30 Clients</td>
</tr>
<tr>
<td></td>
<td>10 Systems : 1 printer</td>
</tr>
</tbody>
</table>