

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA**  
**(University of Technology of Madhya Pradesh)**  
*Air Port Bypass Road*  
*Gandhi Nagar, Bhopal-462 036*

***COURSE OF STUDY AND SCHEME OF EXAMINATION***  
***MASTER OF COMPUTER APPLICATIONS (MCA)***

W.E.F. 2005-2006

**(New Scheme)**

**To be implemented for student admitted in I Year MCA in July-Aug 2005**

**MCA FIRST SEMESTER**

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-101	Information Technology	3	1	-	100	40	50	30	-	-	150
MCA-102	Mathematical Foundation of Computer Science	3	1	-	100	40	50	30	-	-	150
MCA-103	Programming and Problem Solving in C	3	1	-	100	40	50	30	-	-	150
MCA-104	Computer organization and Assembly Language Programming	3	1	4	100	40	50	30	50	25	200
MCA-105	Communication Skills	3	1	-	100	40	50	30	-	-	150
MCA-106	Programming Laboratory in C	-	-	6	-	-	100	60	100	50	200
	Total	15	5	10	500		350		150		1000

**MCA SECOND SEMESTER**

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-201	Operating System	3	1	-	100	40	50	30	-	-	150
MCA-202	Data Base Management System	3	1	-	100	40	50	30	-	-	150
MCA-203	Data Structure	3	1	4	100	40	50	30	50	25	200
MCA-204	Computer Oriented Numerical & Statistical Methods	3	1	-	100	40	50	30	-	-	150
MCA-205	Accounting & Management Control	3	1	-	100	40	50	30	-	-	150
MCA-206	Programming Laboratory in RDBMS	-	-	6	-	-	100	60	100	50	200
	Total	15	5	10	500		350		150		1000

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**MCA THIRD SEMESTER**

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-301	Computer Oriented Optimization Techniques	3	1	-	100	40	50	30	-	-	150
MCA-302	Software Engineering Methodologies	3	1	-	100	40	50	30	-	-	150
MCA-303	Object Oriented Methodology & C++	3	1	4	100	40	50	30	50	25	200
MCA-304	Theory of Computation	3	1	-	100	40	50	30	-	-	150
MCA-305	Computer Networks	3	1	-	100	40	50	30	-	-	150
MCA-306	Programming Laboratory any two tools from VB, VC++, D2K etc.	-	-	6	-	-	100	60	100	50	200
	<b>Total</b>	<b>15</b>	<b>5</b>	<b>10</b>	<b>500</b>		<b>350</b>		<b>150</b>		<b>1000</b>

**MCA FOURTH SEMESTER**

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-401	Artificial Intelligence & Applications	3	1	-	100	40	50	30	-	-	150
MCA-402	Mobile Communication	3	1	-	100	40	50	30	-	-	150
MCA-403	Computer Graphics & Multimedia	3	1	4	100	40	50	30	50	25	200
MCA-404	Design and Analysis of Algorithms	3	1	-	100	40	50	30	-	-	150
MCA-405	Elective I(E1)	3	1	-	100	40	50	30	-	-	150
MCA-406	Minor Project-I (Based on client server technology)	-	-	6	-	-	100	60	100	50	200
	<b>Total</b>	<b>15</b>	<b>5</b>	<b>10</b>	<b>500</b>		<b>350</b>		<b>150</b>		<b>1000</b>

Elective-I

- E-I(a) : Managerial Economics
- E-I(b) : JAVA Programming & Technologies
- E-I(c) : Compiler Design
- E-I(d) : Microprocessors & Interface
- E-I(e) : Advanced Data Base Management System

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**MCA FIFTH SEMESTER**

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-501	Data Warehousing and Mining	3	1	-	100	40	50	30	-	-	150
MCA-502	UNIX & Shell Programming	3	1	4	100	40	50	30	50	25	200
MCA-503	Internet & Its Applications	3	1	-	100	40	50	30	-	-	150
MCA-504	Elective-II (E-II)	3	1	-	100	40	50	30	-	-	150
MCA-505	Elective-III (E-III)	3	1	-	100	40	50	30	-	-	150
MCA-506	Minor Project II	-	-	6	-	-	100	60	100	50	200
	<b>Total</b>	<b>15</b>	<b>5</b>	<b>10</b>	<b>500</b>		<b>350</b>		<b>150</b>		<b>1000</b>

Elective-II

- E-II(a) : Modeling & Simulation
- E-II(b) : Organizational Behavior
- E-II(c) : Soft Computing
- E-II(d) : Networking Programming
- E-II(e) : .Net Technology

Elective-III

- E-III(a) : Distributed Systems
- E-III(b) : Computer Vision & Digital Image Processing
- E-III(c) : Bio-informatics
- E-III(d) : Embedded Systems
- E-III(e) : Network Security

**MCA SIXTH SEMESTER**

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Seminar		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-601	Project work of 4 to 5 months duration*	-	-	-	100	50	200	120	200	100	500

\* Project work should be undertaken in an organization engaged in software/hardware development. Synopsis of project should be approved by HOD of concerned Institution within one month from the beginning of the project.  
 A confidential report of the student should be taken from the project guide and should be made part of sessional.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-101	Information Technology	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

Basic concepts of IT, concepts of Data & Info, data processing, history of computers (generation, type of languages), organization of computers, I/O devices, storage devices, system software, application software, utility packages, numerical based on storage devices.

**UNIT-II**

Assembler : Elements of assembly language programming, a simple assembly scheme, pass structure of assembler, design of two pass assemblers, a single pass assemblers.

Macros & Macro Processors : Macro definition & Call, Macro expansion Nested macro calls, advanced macro facilities, design of macro processors.

**UNIT-III**

Compilers & Interpreters : aspects of compilation, memory allocation, compilation of expression compilation of control structures, code optimization, interpreters.

Software Tools : Software tools for program development, editors, debug monitors, programming environment, user interfaces.

**UNIT-IV**

Linker & Loaders : Relocation & linking concepts, design of linkers, self relocating programs, a linker for MS DOS, linking for overlays, loaders : A two pass loader scheme, Relocating loaders, subroutine linkage, Direct linkage loader, Binders overlays.

**UNIT-V**

Sequential file organisation, random file organisation, index structure, indexed file organisation, alternate key indexed sequential files, multi key organisation, multi key access, multi list file organisation, inverted files & their definitions, insertion, deletion, operations with optimum utilization of memory, comparison of various type of file organisation.

**BOOKS**

1. D.M. Dhamdhere "System Programming & O.S." 2<sup>nd</sup> Ed., Tata Mc. Graw Hill.
2. J. Donovan "System Programming" THM.
3. Rajaraman V. "Fundamental of Computers" (4<sup>th</sup> edition.) Prentice Hall of India, New Delhi 2004.
4. Sardes D.H. "Computer's today" McGraw Hill 1988.
5. S.Jaiswal, "Fundamental of Computer & IT", Wiley dreamtech India..

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-102	Mathematical Foundation of Computer Science	3	1	-	100	40	50	30	-	-	150

**UNIT-I****Sets, Relations and Functions:**

Sets, Subsets, Power sets, Complement, Union and Intersection, Demorgan's law Cartesian products, Relations, relational matrices, properties of relations, equivalence relation, functions, Injection, Surjection and Bijective mapping, Composition of functions, the characteristic functions and Mathematical induction.

**UNIT-II****Proportions & Lattices :**

Proposition & prepositional functions, Logical connections Truth-values and Truth Table, the algebra of propositional functions-the algebra of truth values-Applications (switching circuits, Basic Computer Components).

Partial order set, Hasse diagrams, upper bounds, lower bounds, Maximal and minimal element, first and last element, Lattices, sub lattices, Isotonicity, distributive inequality, Lattice homomorphism, lattice isomorphism, complete lattice, complemented lattice, distributive lattice.

**UNIT-III****Groups and Fields:**

Group axioms, permutation group, sub group, co-sets, normal subgroup, semi group, Lagrange theorem, fields, minimal polynomials, reducible polynomials, primitive polynomial, polynomial roots, applications.

**UNIT-IV****Graphs:**

Finite graphs, incidence and degree, isomorphism, sub graphs and union of graphs, connectedness, walk, paths, and circuits Eulerian graphs, tree properties of trees, pendant vertices in tree, center of tree, spanning trees and cut vertices, binary tree, matrix representation of graph, incidence and adjacency matrix and their properties, applications of graphs in computer science.

**UNIT-V****Discrete Numeric function and Recurrence relation:**

Introduction to discrete numeric functions and generating functions, introduction to recurrence relations and recursive algorithms, linear recurrence relations with constant coefficients, homogeneous solutions, particular solutions and total solutions.

**BOOKS**

1. J.P.Trembley & R.P.Manohar "Discrete Mathematical Structure with applications to Computer Science".
2. Kenneth H. Rosen-203 "Discrete Math & its Applications" 5<sup>th</sup> ed.
3. K.A. Ross and C.R.B. Wriht "Discrete Mathematics".
4. Bernard Kolman & Robert C. Busby "Discrete Mathematical Structures for Computer Science".

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MCA-103	Programming and Problem Solving in C	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

An overview: Problem identification, analysis, design, coding, testing & debugging, implementation, modification & maintenance; algorithms & flowcharts; Characteristics of a good program - accuracy, simplicity, robustness, portability, minimum resource & time requirement, modularization; Rules/conventions of coding, documentation, naming variables; Top down design; Bottom-up design.

**UNIT-II**

Fundamentals of C Programming: History of C; Structure of a C Program; Data types; Constant & Variable, naming variables; Operators & expressions; Control Constructs – if-else, for, while, do-while; Case switch statement; Arrays; Formatted & unformatted I/O; Type modifiers & storage classes; Ternary operator; Type conversion & type casting; Priority & associativity of operators.

**UNIT-III**

Modular Programming: Functions; Arguments; Return value; Parameter passing – call by value, call by reference; Return statement; Scope, visibility and life-time rules for various types of variable, static variable; Calling a function; Recursion – basics, comparison with iteration, types of recursion- direct, indirect, tree and tail recursion, when to avoid recursion, examples.

**UNIT-IV**

Advanced Programming Techniques: Special constructs – Break, continue, exit(), goto & labels; Pointers - & and \* operators, pointer expression, pointer arithmetic, dynamic memory management functions like malloc(), calloc(), free(); String; Pointer v/s array; Pointer to pointer; Array of pointer & its limitation; Function returning pointers; Pointer to function, Function as parameter; Structure – basic, declaration, membership operator, pointer to structure, referential operator, self referential structures, structure within structure, array in structure, array of structures; Union – basic, declaration; Enumerated data type; Typedef; command line arguments.

**UNIT-V**

Miscellaneous Features: File handling and related functions; printf & scanf family; C preprocessor – basics, #Include, #define, #undef, conditional compilation directive like #if, #else, #elif, #endif, #ifdef and #ifndef; Variable argument list functions.

**BOOKS:**

1. Kerninghan & Ritchie “The C programming language”, PHI
2. Schildt “C: The Complete reference” 4th ed TMH.
3. Cooper Mullish “The Spirit of C”, Jaico Publishing House, Delhi
4. Kanetkar Y. “Let us C”, BPB.
5. Kanetkar Y.: “Pointers in C”, BPB
6. Gottfried : “Problem Solving in C”, Schaum Series
7. Jones, Harrow Brooklish “C Programming with Problem Solving”, Wiley Dreamtech India.

Note : Paper is to be set unit wise with internal choice.

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					Max	Min	Max	Min	Max	Min	
MCA-104	Computer organization and Assembly Language Programming	3	1	4	100	40	50	30	50	25	200

**UNIT-I**

Representation of Information: Number systems, integer and floating-point representation, character codes (ASCII, EBCDIC), Error detection and correction codes : parity check code, cyclic redundancy code, Hamming code . Basic Building Blocks: Boolean Algebra, Simplification of Boolean Function. Combinational blocks: gates, multiplexers, decoders, Implementation of Boolean Function in form of gates etc. Sequential building blocks: flip-flops, Registers : Buffer register, Right & Left Shift register, Bidirectional Shift register. Counters : Ripple counter, Binary Counter, MOD-10 Counter, Ring Counter. ALU, Random access memory etc.

**UNIT-II**

Register Transfer Language and Micro-operations: concept of bus, data movement among registers, a language to represent conditional data transfer, data movement from/to memory. Design of simple Arithmetic & Logic Unit & Control Unit, arithmetic and logical operations Along with register transfer, timing in register transfer.

**UNIT-III**

Architecture of a simple processor: A simple computer organization and instruction set, instruction formats, addressing modes, instruction cycle, instruction execution in terms of microinstructions, interrupt cycle , concepts of interrupt and simple I/O organization, Synchronous & Asynchronous data transfer, Data Transfer Mode : Program Controlled, Interrupt driven, DMA (Direct Memory Access). implementation of processor using the building blocks.

**UNIT-IV**

Assembly Language programming: Pin Diagram of 8086, Architecture of 8086, Addressing Mode of 8086, detailed study of 8086/8088 assembly language, instruction set of 8086, loops and Comparisons, conditions and procedures, arithmetic operations in assembly language. Simple Assembly Language program of 8086. illustrations using typical programs like: table search, subroutines, symbolic and numerical manipulations and I/O.

**UNIT-V**

Memory organization: Secondary Memory, Primary Memory : Random access memory, Read Only memory basic cell of static and dynamic RAM, Building large memories using chips, Concept of segmentation & Paging, Associative memory, cache memory organization, virtual memory organization.

**BOOKS**

1. M. Morris Mano, "Computer System Architecture", PHI, 3<sup>rd</sup> edition, 1993
2. Govindarajalu "Computer Architecture & Organisation".
3. Liu and Gibson, "8086/8088 Micro processor Assembly Language".
4. M. Mano "Digital Logic & Computer Design"
5. Malvino, "Digital Computer Electronics".

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-105	Communication Skills	3	1	-	100	40	50	30	-		150

**UNIT-I****Communication**

Meaning and process of communication, importance of effective communication, communication situation, barriers to communication. Objectives of communication, types of communication, principles of communication, essentials of effective communication.

**UNIT-II****Media of Communication**

Written, oral, face-to-face, visual, audio-Visual, merits and demerits of written and oral communication.

**UNIT-III****Communication Skills:**

Developing communication skills; Listening; Speaking; Reading-Writing (Oral & Written). Body language; Utility of aids in Communication.

**UNIT-IV****Spoken Skills**

Preparing for oral presentation, conducting presentations; Debates; Seminar; Speeches; Lectures; Interviews; Telephonic Conversation; Negotiations; Group Discussions.

**UNIT-V****Written Skills:**

Preparing of bio-data, seminar, paper, bibliography, and official correspondence; Mechanics of writing; Formal & Informal writings, letters; paragraphing, precise, report writing, technical reports, length of written reports, organizing reports, writing technical reports; Creative writing; Common Errors in Language.

**BOOKS:**

1. Rajendra Pal and J.S. Korlahalli "Essentials of Business Communication", Sultan Chand & Sons Publishers, New Delhi.
2. U.S.Rai & S.M. Rai "Business Communications", Himalaya Publishing House.
3. Menzal and D.H. Jones "Writing a technical Paper", Mc Graw Hill, 1961.
4. Strategy and Skill "Business Communication", Prentice Hall New Jersey, 1987
5. Scot Ober "Contemporary Business Communication", Wiley India.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-201	Operating System	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

**Introduction:** Evolution of operating systems (History of evolution of OS with the generations of computers), Types of operating systems, Multitasking, Timesharing, Multithreading, Multiprogramming and, Real time operating systems, Different views of the operating system, System Programmer's view, User's view, Operating system concepts and structure, Layered Operating Systems, Monolithic Systems.

**Processes:** The Process concept, The process control block, Systems programmer's view of processes, Operating system services for process management, Scheduling algorithms, First come first serve, Round Robin, Shortest run time next, Highest response ratio next, Multilevel Feedback Queues, Performance evaluation of scheduling algorithms stated above

**UNIT-II**

**Memory Management :** Memory management without swapping or paging, Concepts of swapping and paging, Page replacement algorithms namely, Least recently used, Optimal page replacement, Most recently used, Clock page replacement, First in First out (This includes discussion of Belady's anomaly and the category of Stack algorithms), Modeling paging algorithms, Design issues for paging system, Segmentation, Segmented Paging, Paged Segmentation

**UNIT-III**

**Inter-process Communication and Synchronization:** The need for inter-process synchronization, Concept of mutual exclusion, binary and counting semaphores, hardware support for mutual exclusion, queuing implementation of semaphores, Classical problems in concurrent programming, Dining Philosopher's problem, Bounded Buffer Problem, Sleeping Barber Problem, Readers and Writers problem, Critical section, critical region and conditional critical region, Monitors and messages.

**Deadlocks:** Concepts of deadlock detection, deadlock prevention, deadlock avoidance. Banker's Algorithm

**UNIT-IV**

**File System:** File systems, directories, file system implementation, security protection mechanisms.

**Input/output:** Principles of I/O Hardware: I/O devices, device controllers, direct memory access.

**Principles of I/O software:** Goals interrupt handlers, device drivers, and device independent I/O software. User space I/O Software.

**Disks:** Disk hardware, Disk scheduling algorithms (namely First come first serve, shortest seek time first, SCAN, C-SCAN, LOOK and C-LOOK algorithms) Error handling, track-at-a-time caching, RAM Disks.

**Clocks:** Clock hardware, memory-mapped terminals, I/O software.

**UNIT-V**

**Processes and Processors in Distributed Systems:** Threads, System models, processor allocation, scheduling. Distributed File Systems: Design, Implementation, and trends. Performance Measurement, monitoring and evaluation Introduction, important trends affecting performance issues, why performance monitoring and evaluation are needed, performance measures, evaluation techniques, bottlenecks and saturation, feedback loops.

**Case Studies:** WINDOWS and LINUX /UNIX Operating System.

**BOOKS**

1. Deitel, H.M. "An Introduction to Operating Systems". Addison Wesley Publishing Company 1984.
2. Milenkovic, M., "Operating Systems - concepts and Design" McGraw Hill International Edition-Computer Science series 1992.
3. Galvin P., J.L. Abraham Silberschatz. "Operating System Concepts". John Wiley & Sons Company, 1989.
4. Tanenbaum, A.S. "Modern Operating System", Prentice Hall of India Pvt. Ltd.1995.
5. William Stallings "Operating Systems", Prentice Hall of India Pvt. Ltd.
6. Joshi R.C. "Operating System" Wiley India.

Note : Paper is to be set unit wise with internal choice.

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					Max	Min	Max	Min	Max	Min	
MCA-202	Data Base Management System	3	1	-	100	40	50	30	-	-	150

### UNIT-I

**Introduction:** Advantage of DBMS approach, various view of data, data independence, schema and sub-schema, primary concepts of data models, Database languages, transaction management, Database administrator and users, data dictionary, overall system architecture.

**ER model:** basic concepts, design issues, mapping constraint, keys, ER diagram, weak and strong entity sets, specialization and generalization, aggregation, inheritance, design of ER schema, reduction of ER schema to tables.

### UNIT-II

**Domains, Relations and Keys:** domains, relations, kind of relations, relational database, various types of keys, candidate, primary, alternate and foreign keys.

**Relational Algebra & SQL:** The structure, relational algebra with extended operations, modifications of Database, idea of relational calculus, basic structure of SQL, set operations, aggregate functions, null values, nested sub queries, derived relations, views, modification of Database, join relations, DDL in SQL.

### UNIT-III

**Functional Dependencies and Normalization:** basic definitions, trivial and non trivial dependencies, closure set of dependencies and of attributes, irreducible set of dependencies, introduction to normalization, non loss decomposition, FD diagram, first, second, third Normal forms, dependency preservation, BCNF, multivalued dependencies and fourth normal form, Join dependency and fifth normal form.

### UNIT-IV

**Database Integrity:** general idea. Integrity rules, domain rules, attribute rules, relation rules, Database rules, assertions, triggers, integrity and SQL.

**Transaction, concurrency and Recovery:** basic concepts, ACID properties, Transaction states, implementation of atomicity and durability, concurrent executions, basic idea of serializability, basic idea of concurrency control, basic idea of deadlock, failure classification, storage structure types, stable storage implementation, data access, recovery and atomicity- log based recovery, deferred Database modification, immediate Database modification, checkpoints.

**Distributed Database:** basic idea, distributed data storage, data replication, data fragmentation-horizontal, vertical and mixed fragmentation

### UNIT-V

**Emerging Fields in DBMS:** object oriented Databases-basic idea and the model, object structure, object class, inheritance, multiple inheritance, object identity, data warehousing- terminology, definitions, characteristics, data mining and it's overview, Database on www, multimedia Databases-difference with conventional DBMS, issues, similarity based retrieval, continuous media data, multimedia data formats, video servers.

**Storage structure and file organizations:** overview of physical storage media, magnetic disks-performance and optimization, basic idea of RAID, file organization, organization of records in files, basic concepts of indexing, ordered indices, basic idea of B-tree and B+-tree organization

**Network and hierarchical models:** basic idea, data structure diagrams, DBTG model, implementations, tree structure diagram, implementation techniques, comparison of the three models.

### BOOKS

1. A Silberschatz, H.F Korth, Sudersan "Database System Concepts" –, MGH Publication.
2. C.J Date "An introduction to Database Systems" –6<sup>th</sup> ed.
3. Elmasri & Navathe "Fundamentals of Database systems" – III ed.
4. B.C. Desai. "An introduction to Database systems" BPB
5. Raghurama Krishnan "Database Systems" TMH

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-203	Data Structure	3	1	4	100	40	50	30	50	25	200

**Prerequisites:** Array, Structure, pointers, pointer to structure, functions, parameter passing, recursion.

#### UNIT-I

**Stack and Queue:** contiguous implementations of stack, various operations on stack, various polish notations-infix, prefix, postfix, conversion from one to another-using stack; evaluation of post and prefix expressions. Contiguous implementation of queue: Linear queue, its drawback; circular queue; various operations on queue; linked implementation of stack and queue- operations

#### UNIT-II

**General List:** list and it's contiguous implementation, it's drawback; singly linked list-operations on it; doubly linked list-operations on it; circular linked list; linked list using arrays.

#### UNIT-III

**Trees:** definitions-height, depth, order, degree, parent and child relationship etc;  
Binary Trees- various theorems, complete binary tree, almost complete binary tree;  
Tree traversals-preorder, in order and post order traversals, their recursive and non recursive implementations; expression tree- evaluation; linked representation of binary tree-operations. Threaded binary trees; forests, conversion of forest into tree. Heap-definition.

#### UNIT-IV

**Searching, Hashing and Sorting:** requirements of a search algorithm; sequential search, binary search, indexed sequential search, interpolation search; hashing-basics, methods, collision, resolution of collision, chaining; Internal sorting- Bubble sort, selection sort, insertion sort, quick sort, merge sort on linked and contiguous list, shell sort, heap sort, tree sort.

#### UNIT-V

**Graphs:** related definitions: graph representations- adjacency matrix, adjacency lists, adjacency multilist; traversal schemes- depth first search, breadth first search; Minimum spanning tree; shortest path algorithm; kruskals & dijkstras algorithm.

Miscellaneous features Basic idea of AVL tree- definition, insertion & deletion operations; basic idea of B-tree- definition, order, degree, insertion & deletion operations;  
B+-Tree- definitions, comparison with B-tree; basic idea of string processing.

#### BOOKS

1. Kruse R.L. Data Structures and Program Design in C; PHI
2. Aho "Data Structure & Algorithms".
3. Trembly "Introduction to Data Structure with Applications".
4. Tennenbaum A.M. & others: Data Structures using C & C++; PHI
5. Horowitz & Sahney: Fundamentals of Data Structures, Galgotia Publishers.
6. Yashwant Kanetkar, Understanding Pointers in C, BPB.

Note : Paper is to be set unit wise with internal choice.

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					Max	Min	Max	Min	Max	Min	
MCA-204	Computer Oriented Numerical & Statistical Methods	3	1	-	100	40	50	30	-	-	150

**UNIT – I**

Numerical approximation, Representation of integers and real numbers in computers, fixed and floating point arithmetic, normalized floating point numbers, Round off and truncation errors, relative and absolute errors. Iterative methods: Zeros of single transcendental equations and zeros of polynomials using bisections, false position, Newton Raphson methods. Convergence of solutions.

**Unit – II**

Interpolation : Forward, Backward, central (Striplings) and divided difference formulas, lagrange's interpolation, Inverse interpolation for equal and unequal intervals.

Numerical Integration : Newton Cote's formula, Simpson's 1/3<sup>rd</sup> and 3/8<sup>th</sup> rule. Gauss Legendre (two and three points) integration formula.

**Unit – III**

Simultaneous linear equations: Solutions of simultaneous linear equations – Gauss elimination method and pivoting, ill conditioned equations and refinement of solutions, Gauss-seidal iterative methods.

Solution of differential equation: Runge-Kutta fourth order method. Euler's method, Picard's, Taylor's series.

**Unit - IV**

Distributions : Binomial distribution, Poisson distribution and normal distribution,  $\chi^2$  distribution, Rectangular distribution, hypergeometric distribution.

**Unit -V**

Hypothesis testing for sampling: Small samples, t, z and f tests. Chi-square test.

Large samples : Comparison of large samples, testing the significance of the difference between the means of two large samples.

**BOOKS**

1. E. Balaguruswamy "Numerical Methods", TMH, ISBN – 07-463311-2, 1999.
2. B.S. Grewal "Numerical Methods in Engineering & Science".
3. Miller "Mathematical Statistics with applications" 7 ed, Pearson.
4. Gupta & Kapoor, Introduction to Statistics, Chand & Co.
5. V. Rajaraman "Computer Oriented Numerical Methods".
6. M.Ray and Har Swarup Sharma " Mathematical Statistics".

**REFERENCE BOOKS**

1. Iyengyr M.K. Jain & R.K. Jain "Numerical Methods for scientific and engineering computation", Wiley Eastern (New Age), 1995
2. E.V. Krishnamurthy & S.K. Sen "Computer Based Numerical Algorithms".
3. Miller & Freund's "Probability and Statistics for Engineers".

Note : Paper is to be set unit wise with internal choice & emphasis is to be given on computerized implementation.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-205	Accounting & Management Control	3	1	-	100	40	50	30	-		150

**UNIT-I**

Meaning and objects of accounting, accounting concepts and conventions, accounting equations, rules of Journalizing; Cash-book, Ledger posting, preparation of trial balance,

**UNIT-II**

Trading and profit and loss account and balance sheet with adjustments relating to closing stock , outstanding expenses, prepaid expenses , accrued income depreciation, bad debts, provision for bad debts, provision for discount on debtors and creditors .

**UNIT-III**

Inventory pricing , FIFO and LIFO methods; Simple problems of funds flow statement, cost volume, profit analysis.

**UNIT-IV**

Standard costing, computation of material and labour variances, budgetary control, preparation of cash budget and flexible budget.

**UNIT-V**

Management control and its characteristics, goals and strategies, structure and control.

Responsibility centers and control centers: concepts of Responsibility centers, revenue centers, profit centers and investment centers, transfer pricing, Responsibility reporting.

**BOOKS**

1. Bhattacharya S.K. and Deardan John “Accounting for Management” PHI
2. Chadwick “The essence of financial accounting” PHI
3. Chadwick “The essence of Management accounting” PHI
4. Grewal “Introduction to Book – keeping”
5. Subhash Sharma “Management control systems” TMH

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-301	Computer Oriented Optimization Techniques	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

Introduction of operation research. LP Formulations, Graphical method for solving LP's with 2 variables, Simplex method, Duality theory in linear programming and applications, Integer linear programming, dual simplex method,

**UNIT-II**

Transportation problem, Assignment problem.

Dynamic Programming : Basic Concepts, Bellman's optimality principles, Dynamics programming approach in decision making problems, optimal subdivision problem.

Sequencing Models: Sequencing problem, Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines.

**UNIT-III**

Project Management : PERT and CPM : Project management origin and use of PERT, origin and use of CPM, Applications of PERT and CPM, Project Network, Diagram representation, Critical path calculation by network analysis and critical path method (CPM), Determination of floats, Construction of time chart and resource labelling, Project cost curve and crashing in project management, Project Evaluation and review Technique (PERT).

**UNIT-IV**

Queuing Models : Essential features of queuing systems, operating characteristics of queuing system, probability distribution in queuing systems, classification of queuing models, solution of queuing M/M/1 :  $\infty$ /FCFS, M/M/1 : N/FCFS, M/M/S :  $\infty$ /FCFS, M/M/S : N/FCFS

**UNIT-V**

Inventory Models : Introduction to the inventory problem, Deterministic Models, The classical EOQ (Economic Order Quantity) model, Inventory models with deterministe demands(no shortage & shortage allowed), Inventory models with probabilistic demand, multiitem determinise models.

**BOOKS**

1. Gillet B.E. : Introduction to Operation Research, Computer Oriented Algorithmic approach - Tata McGraw Hill Publising Co. Ltd. New Delhi.
2. P.K. Gupta & D.S. Hira, "Operations Research", S.Chand & Co.
3. J.K. Sharma, "Operations Research: Theory and Applications", Mac Millan.
4. S.D. Sharma, "Operations Research", Kedar Nath Ram Nath, Meerut (UP).
5. S.S. Rao "Optimization Theory and Application", Wesley Eastern.
6. Tata Hamdy, A "Operations Research - An Introduction", Fifth Edition, Prentice Hall of India Pvt. Ltd., New Delhi.
7. Taha H.A. "Operations Research an Introduction" McMillan Publication.

Note : Paper is to be set unit wise with internal choice & emphasis is to be given on computerized implementation.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-302	Software Engineering Methodologies	3	1	-	100	40	50	30	-	-	150

**UNIT -I****System concepts and Information system environment:**

The system concept, characteristics of system, elements of system, The System Development Life Cycle, The Role of System Analyst. Introduction system planning & initial investigation, various information gathering tools feasibility study conretions & structures tools of system analysis, various methods of process design, form design methodologies, introduction to information system testing, quality assurance security & diastruct computer various (deleting recovery)

**UNIT -II****Software Process, Product and Project:**

The Product : Software, Software Myths, The process : Software Engineering : A Layered Technology, Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Software Process Models, Component – Based Development, Fourth Generation Techniques, Software process and Project Metrics : Software measurement

**UNIT-III****Software Project Planning and Design:**

Software Project Planning : Project planning objectives, Decomposition Techniques, Empirical estimation models, The Make/Buy Decision., Risk analysis.

Software Design: Design Principles, Cohesion & Coupling, Design notation and specification, structure design methodology.

**UNIT-IV****Software Quality Assurance and Testing:**

Software Quality Assurance : Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, Mistake Proofing for Software, Introduction to ISO standard.

Testing Strategies: A strategic approach of software testing strategic issues, unit testing, integration testing, validation testing, system testing, the art of debugging. OOA, OOD.

**UNIT-V****Advanced Topics:**

MIS & DSS:Introduction to MIS, long range planning, development and implementation of an MIS, applications of MIS in manufacturing sector and in service sector.

Decision Support System concepts, types of DSS.

Object Oriented Software Engineering: Object Oriented Concepts, Identifying the Elements of an Object Model, Management of Object Oriented Software Projects.

CASE tools, Re-engineering

**BOOKS**

1. R. S. Pressman, "Software Engineering – A practitioner's approach", 6<sup>th</sup> ed., McGraw Hill Int. Ed., 2002.
2. Pankaj Jalote "Software Engg" Narosa Publications.
3. Ian Sommerville : Software Engineering 6/e (Addison-Wesley)
4. Richard Fairley : Software Engineering Concepts (TMH)
5. Elis Awad, "System Analysis & Design", Galgotia publications
6. W.S. Jawadekar: Management Information Systems, TMH Publication, India
7. Hoffer " Modern System Analysis & Design" 3e, Pearson Edition

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-303	Object Oriented Methodology & C++	3	1	4	100	40	50	30	50	25	200

**UNIT-I**

C++ basics, loops and decisions, structures and functions, object and classes, object arrays, constructor and destructor functions.

**UNIT-II**

Operator and function overloading, pointers, pointers to base and derived classes inheritance, public and private inheritance, multiple inheritance.

**UNIT-III**

Polymorphism, virtual functions, abstract base classes and pure virtual function, friend function, early and late binding.

**UNIT-IV**

C++ I/O system, formatted I/O, creating insertors and extractors, file I/O basis, creating disk files and file manipulations using seekg(), seekp(), tellg() and tellp() functions, exception handling: try, catch and throw.

**UNIT-V**

UML concepts, object-oriented paradigm and visual modeling, UML diagrams, UML specifications, object model, object oriented design, identifying classes and object, object diagrams.

**BOOKS**

1. Lafore R. "Object Oriented Programming in C++", Galgotia Pub.
2. Lee "UML & C++ a practical guide to Object Oriented Development 2 ed, Pearson.
3. Schildt "C++ the complete reference 4ed, 2003.
4. Hans Erit Eriksson "UML 2 toolkit" Wiley.
5. Balagurusawmy "Object Orienter Programming with C++".
6. B.G., Boach "Object Oriented Analysis & Design with Applications", Addison Wesley.
7. S. Parate "C++ Programming", BPB.
8. Boggs "Mastering UML" BPB Publications.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-304	Theory of Computation	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

**Review of Mathematical Preliminaries :** Set, Relations and functions, Graphs and trees, string, alphabets and languages. Principle of induction, predicates and propositional calculus.

**Theory of Automata :** Definition, description, DFA, NFA, Transition systems, 2DFA, equivalence of DFA & NDFA, Regular expressions, regular grammar, FSM with output (mealy and moore models), Minimisation of finite automata.

**UNIT-II**

**Formal Languages :** Definition & description, Parse structured grammars & their classification, Chomsky classification of languages, closure properties of families of language, regular grammar, regular set & their closure properties, finite automata, equivalence of FA and regular expression, equivalence of two way finite automata, equivalence of regular expressions.

**UNIT -III**

**Context-Free grammar & PDA :** Properties unrestricted grammar & their equivalence, derivation tree simplifying CFG, unambiguifying CFG,  $\epsilon$ -productions, normal form for CFG, Pushdown automata, 2 way PDA, relation of PDA with CFG, Determinism & Non determinism in PDA & related theorems, parsing and pushdown automata.

**UNIT-IV**

**Turing Machine :** Model, design, representation of TM, language accepted by TM, universal turing machine, determine & non-determinism in TM, TM as acceptor/generator/algorithms, multidimensional, multitracks, multitape, Two way infinite tape, multihead, Halting problems of TM.

**UNIT-V**

**Computability :** Concepts, Introduction to complexity theory, Introduction to undecidability, recursively enumerable sets, primitive recursive functions, recursive set, partial recursive sets, concepts of linear bounded Automata, context sensitive grammars & their equivalence.

**BOOKS**

1. Hopcroft & Ullman "Introduction to Automata theory, languages & Computation" , Narosha Publishing house.
2. Lewis Papadimitrou "Theory of Computation" , Prentice Hall of India, New Delhi.
3. Peter linz, "An Introduction to formal language and automata", Third edition, Narosa publication.
4. Marvin L. Minsky "Computation : Finite & Infinite Machines", PHI.
5. Mishra & Chander Shekhar "Theory of Computer Science (Automata, Language & Computations), PHI.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-305	Computer Networks	3	1	-	100	40	50	30	-		150

**UNIT-I**

**Introduction:** Computer Network, Layered Network Architecture-Review of ISO-OSI Model., Transmission Fundamentals-, Communication Media-Conductive Metal (Wired Cable), Optical Fiber links, Wireless Communication-Radio links, Setellite Links, Communication Services & Devices, Telephone System., Integrated Service Digital Network (ISDN)., Cellular Phone., ATM, Modulation & Demodulation-, Digital to Analog Conversion-Frequency Modulation (FM), Amplitude Modulation (AM), Phase Modulation (PM)., Analog to Digital Conversion-Pulse Amplitude Modulation(PAM), Pulse Code Modulation (PCM), Differential Pulse Code Modulation, (DPCM)., Modem & Modem Types., Multiplexing-, Frequency Division Multiplexing (FDM)., Time Division Multiplexing (TDM), Statistical Time Division Multiplexing (STDM)., Contention Protocol-, Stop-Go-Access Protocol, Aloha Protocol-Pure aloha & Slotted aloha, Carrier sense multiple access with collision detection (CSMA/CD)

**UNIT-II**

**Data Security and Integrity:** Parity Checking Code, Cyclic redundancy checks (CRC), Hemming Code, Protocol Concepts –, Basic flow control, Sliding window protocol-Go-Back-N protocol and selective repeat protocol, Protocol correctness- Finite state machine

**UNIT-III**

**Local Area Network:** Ethernet : 802.3 IEEE standard, Token Ring : 802.5 IEEE standard, Token Bus : 802.4 IEEE standard, FDDI Protocol, DQDB Protocol, Inter Networking, Layer 1 connections- Repeater, Hubs, Layer 2 connections- Bridges, Switches, Layer 3 connections- Routers, Gateways.

**UNIT-IV**

**Wide Area Network:** Introduction, Network routing, Routing Tables, Types of routing, Dijkstra's Algorithm, Bellman-Ford Algorithm, Link state routing, Open shortest path first, Flooding, Broadcasting, Multicasting, Congestion & Dead Lock, Internet Protocols, Overview of TCP/IP, Transport protocols, Elements of Transport Protocol, Transmission control protocol (TCP), User data-gram protocol (UDP).

**UNIT-V**

Network Security, Virtual Terminal Protocol, Overview of DNS, SNMP, email, WWW, Multimedia.

**BOOKS**

1. A.S.Tanenbaum, "Computer Network", 4<sup>th</sup> addition, PHI
2. Forouzan "Data Communication and Networking 3ed", TMH
3. J.F.Hayes, "Moduling and Analysis of Computer Communication Networks", Plenum Press
4. D.E.Comer, "Internetworking with TCP/IP", Volume Ist & IInd, PHI
5. Willium Stalling, "Data & Computer communications", Maxwell Macmillan International Ed.
6. D.Bertsekas and R.Gallager, "Data Networks", 2<sup>nd</sup> Ed. ,PHI.
7. G.E. Keiser, "Local Area Networks", McGraw Hill, International Ed.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-401	Artificial Intelligence & Applications	3	1	-	100	40	50	30	-	-	150

**UNIT-I****General Issues and Overview of AI**

The AI problems, what is an AI technique, Characteristics of AI applications. Introduction to LISP programming: Syntax and numeric functions, Basic list manipulation functions, predicates and conditionals, input output and local variables, iteration and recursion, property lists and arrays.

**UNIT-II****Problem Solving, Search and Control Strategies**

General problem solving, production systems, control strategies forward and backward chaining, exhaustive searches depth first breadth first search.

**Heuristic Search Techniques**

Hill climbing, branch and bound technique, best first search & A\* algorithm, AND / OR graphs, problem reduction & AO\* algorithm, constraint satisfaction problems.

**UNIT-III****Knowledge Representations**

First order predicate calculus, skolemization, resolution principle & unification, interface mechanisms, horn's clauses, semantic networks, frame systems and value inheritance, scripts, conceptual dependency.

**UNIT-IV****Natural Language processing**

Parsing techniques, context free grammar, recursive transitions nets (RNT), augmented transition nets (ATN), case and logic grammars, syntactic analysis.

**Game playing**

Minimax search procedure, alpha-beta cutoffs, additional refinements.

**Planning**

Overview an example domain the block world, component of planning systems, goal stack planning, non linear planning.

**UNIT-V****Probabilistic Reasoning and Uncertainty**

Probability theory, bayes theorem and bayesian networks, certainty factor.

**Expert Systems**

Introduction to expert system and application of expert systems, various expert system shells, vidwan frame work, knowledge acquisition, case studies, MYCIN.

**Learning**

Rote learning, learning by induction, explanation based learning.

**BOOKS**

1. Elaine Rich and Kevin Knight "Artificial Intelligence" - Tata McGraw Hill.
2. "Artificial Intelligence" 4 ed. Pearson.
3. Dan W. Patterson "Introduction to Artificial Intelligence and Expert Systems", Prentice India.
4. Nils J. Nilson "Principles of Artificial Intelligence", Narosa Publishing House.
5. Clocksin & C.S.Melish "Programming in PROLOG", Narosa Publishing House.
6. M.Sasikumar,S.Ramani etc. "Rule based Expert System", Narosa Publishing House.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-402	Mobile Communications	3	1	-	100	40	50	30	-	-	150

**UNIT- I**

Overview of OSI Model : Significance of layered Model , PDUs, SDUs, IDUs, Higher layer Protocols. Switching and Components. Introduction, Applications, history, of wired & wireless Communication systems. Radio Transmission: frequencies ,signal propagation, antenna , types of modulation, FHSS, DSSS. Multiple Access technology for Wireless Communication : FDMA, TDMA, CDMA  
Cellular System: Introduction, types.

**UNIT-II**

Mobile Data Communication: Cellular Telephony, Structure, Fading, Small scale fading, Multi-path Fading, Speech Coding, Error Coding and Correction, Hand off Management, Switching and authentication, MTSO interconnections, frequency hopping, frequency reuse. Circuit Switched Data Services & Packet Switched Data Services on Cellular Networks, Personal Communication Systems (PCS) Architecture, Digital Enhanced Cordless Telecommunications (DECT,) Personal Access Comm. System (PACS).

**UNIT-III**

Digital Cellular Systems and Standards: GSM System overview, Architecture, GSM Protocol Model, GSM Mobility Management, SMS security aspects. Broadcast System overview. General Packet Service (GRPS) Architecture, GRPS Network, Interfaces and Procedures (2.5 G), 3G Mobile Services: UMTS and International Mobile Telecommunications (IMT-2000), W-C DMA and CDMA 2000, Quality of service in 3G .

**UNIT- IV**

WLAN : Components and working of Wireless LAN, Transmission Media for WLAN, Infrastructure & types of WLAN, IEEE 802.11 Standards , Protocols for WLAN , MACA, MACAW, Infrared technology. Wireless Application Protocol (WAP) model, architecture, Gateway, WAP protocols and WML

**UNIT-V**

Introduction to Bluetooth technology. Wireless in Local Loop (WLL) architecture, products. Satellite as a switch, Components of VSAT system, VSAT topologies, access schemes.

**BOOKS**

1. Jochen Schiller "Mobile Communication", Pearson Education.
2. Yi -Bing Lin and Imrich Chlamtac "Wireless and Mobile Network Architectures", Wiley India.
3. Raj Pandaya "Mobile and Personal Communication System & Services".
4. Uwe Hansmann, Lothar Merk "Principles of Mobile Computing" 2<sup>nd</sup> Ed. Wiley India.
5. Roger L. Freeman " Telecom Transmission handbook" 4<sup>th</sup> ed. 1998 John Wiley & Sons Inc. New York.
6. Lee "Mobile Cellular Telecom" 1995 Mc Graw Hill.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-403	Computer Graphics & Multimedia	3	1	4	100	40	50	30	50	25	200

**UNIT-I**

Computer Graphics : definition, classification & Applications, Development of Hardware & Software for Computer Graphics. Display devices, Hard copy devices. Interactive Input devices, display processor, Line drawing; various algorithms and their comparison, circle generation- Bresenham's mid point circle drawing algorithm, mid point ellipse drawing algorithm.

**UNIT-II**

Attributes of output primitives, line style, color and intensity, Area filling algorithms, Scan line algorithm, boundary fill flood fill algorithm, Antialiasing techniques. Two dimensional transformations; translation, scaling, rotation, reflection sheering, composite transformation, transformation commands, character generation.

**UNIT-III**

Viewing coordinates, Window, view port, clipping, Window to view port transformation, line clipping algorithm; Cohen Sutherland, polygon clipping; Sutherland hodgman algorithm, 3D clipping : Normalized view volumes, view port clipping, clipping in homogeneous coordinates.

Illumination model: Light sources, diffuse reflection specular reflection, reflected light, intensity levels, surface shading; phong shading ground shading, color models like RGB, YIQ, CMY, HSV etc.

**UNIT-IV**

3-D Viewing: Three-dimensional concepts, 3D display techniques, 3D representation polygon & curved surfaces. Design of curves & surfaces- Bezier's Method, B-spline methods, 3D transformation translation, scaling, composite transformation rotation about arbitrary axis, projections: Parallel & Perspective, Hidden surface and line removal; back face removal, depth buffer and scan line methods.

**UNIT-V**

Introduction to multimedia, multimedia components, multimedia hardware, SCSI, IDE, MCI, Multimedia data and file formats, RTF, TIFF, MIDI, JPEG, DIB, MPEG, Multimedia tools, presentations tools, Authoring tools, presentations.

**BOOKS**

1. D.Hearn and M.P. Baker "Computer Graphics" (2nd ed), PHI.
2. S. Harrington – "Computer Graphics - a Programming approach" (2nd ed) McGrawhill.
3. New Mann & Sprovl- "Principles of interactive computer graphics" (2nd ed) McGrawhill.
4. Roger S. David "Procedural Elements for Computer Graphics", McGraw Hill.
5. Roger S David "Mathematical Elements for Computer Graphics", McGraw Hill.
6. Foley & Vandan "Computer Graphics Principles & Practice in "C" "Addision Wesley.
7. Tay Vaughan "Multimedia Making it Work" 5<sup>th</sup> Ed. 2001, Tata McGraw Hill.
8. Prabhat K. Andleigh & Kiran Thakur "Multimedia System Design", PHI
9. Drew, "Fundamentals of Multimedia", Pearsons.
10. Nigel Chapman, J. Chapman "Digital Multimedia" Wiley India.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-404	Design and Analysis of Algorithms	3	1	-	100	40	50	30	-	-	150

**UNIT – I**

**Pre-requisites:** Data structure & Discrete structures, models of computation, algorithm analysis, order architecture, time space complexities average and worst case analysis.

**UNIT-II**

**Divide and conquer:** Structure of divide-and-conquer algorithms: examples; Binary search, quick sort, Strassen Multiplication; Analysis of divide and conquer run time recurrence relations.

**Graph searching and Traversal:** Overview, Traversal methods (depth first and breadth first search)

**UNIT-III**

**Greedy Method:** Overview of the greedy paradigm examples of exact optimization solution (minimum cost spanning tree), Approximate solution (Knapsack problem), Single source shortest paths.

**Branch and bound:** LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem, searching & sorting algorithms.

**UNIT-IV**

**Dynamic programming:** Overview, difference between dynamic programming and divide and conquer, Applications: Shortest path in graph, Matrix multiplication, Traveling salesman Problem, longest Common sequence.

**Back tracking:** Overview, 8-queen problem, and Knapsack problem

**UNIT-V**

**Computational Complexity:** Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples.

Combinational algorithms, string processing algorithm, Algebraic algorithms , set algorithms

**BOOKS**

1. Ullman "Analysis and Design of Algorithm" TMH
2. Goodman "Introduction to the Design & Analysis of Algorithms, TMH-2002.
3. Sara Basse, A. V. Gelder, " Computer Algorithms," Addison Wesley
4. T. H. Cormen, Leiserson , Rivest and Stein, "Introduction of Computer algorithm," PHI
5. E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galgotia Publication

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-405	Elective-I : E1(a) Managerial Economics	3	1	-	100	40	50	30	-		150

**UNIT-I**

Nature and scope of managerial economics, objectives of firm, management and behavioral theories of the firm.

**UNIT-II**

Concepts of opportunity cost , incremental, time perspective, principles of discounting and aquamarine, demand analysis purpose and concepts, elasticity of demand, methods of demand forecasting.

**UNIT-III**

Product and cost analysis: short run and long run average cost curves.  
Profits: nature and measurement policy, break even analysis, case study.

**UNIT-IV**

Law of supply, economies and diseconomies of scale, law of variable proportions.  
Production functions: single output isoquants.

**UNIT-V**

Pricing: prescriptive approach, price determination under perfect competition, monopoly, oligopoly and monopolistic competition, full cost pricing, pricing strategies

**BOOKS**

1. Dean J. Managerial Economics PHI, New Delhi
2. Mote V.L. et al Management Economics Concepts and Cases TMH, New Delhi
3. Boyes and Melvin "Text book of Economics" Wiley India.
4. Berry Keating & Wilson "Managerial Economics" Wiley India.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-405	Elective-I : E1(b) Java Programming & Technologies	3	1	-	100	40	50	30	-		150

**UNIT-I**

**The Java Environment:** History of Java: Comparison of Java and C++; Java as an object oriented language: Java buzzwords; A simple program, its compilation and execution; the concept of CLASSPATH; Basic idea of application and applet;

**Basics:** Data types; Operators- precedence and associativity; Type conversion; The decision making – if, if ..else, switch; loops – for, while, do...while; special statements–return, break, continue, labeled break, labeled continue; Modular programming methods; arrays; memory allocation and garbage collection in java keywords.

**Object Oriented Programming in Java:** Class; Packages; scope and lifetime; Access specifiers; Constructors; Copy constructor; this pointer; finalize () method; arrays; Memory allocation and garbage collection in java keywords

**Inheritance :** Inheritance basics, method overriding, dynamics method dispatch, abstract classes.

**UNIT-II**

**Interfaces :** defining an interface, implementing & applying interfaces, variables in interfaces, extending interfaces.

**Multithreading and Exception Handling:** Basic idea of multithreaded programming; The lifecycle of a thread; Creating thread with the thread class and runnable interface; Thread synchronization; Thread scheduling; Producer-consumer relationship; Daemon thread, Selfish threads; Basic idea of exception handling; The try, catch and throw; throws Constructor and finalizers in exception handling; Exception Handling.

**UNIT-III**

**Applets:** Applet security restrictions; the class hierarchy for applets; Life cycle of applet; HTML Tags for applet.

**The AWT:** The class hierarchy of window fundamentals; The basic user interface components Label, Button, Check Box, Radio Button, Choice menu, Text area, Scroll list, Scroll bar; Frame; Layout managers- flow layout, Grid layout, Border layout, Card layout.

**The Java Event Handling Model:** Java’s event delegation model – Ignoring the event, Self contained events, Delegating events; The event class hierarchy; The relationship between interface, methods called, parameters and event source; Adapter classes; Event classes action Event, Adjustment Event, Container Event, Focus Event, Item Event, Eey Event, Mouse Event, Text Event, Window Event.

**UNIT-IV**

**Input/Output :** Exploring Java i.o., Directories, stream classes

The Byte stream : Input stream, output stream, file input stream, file output stream, print stream, Random access file, the character streams, Buffered reader, buffered writer, print writer, serialization.

**JDBC:** JDBC-ODBC bridge; The connectivity model; The driver manager; Navigating the resultset object contents; java.sql Package; The JDBC exception classes; Connecting to Remote database.

**UNIT-V**

**Networking & RMI:** Java Networking : Networking Basics : Socket, Client server, reserved sockets, proxy servers, Inet address, TCP sockets, UDP sockets.

; RMI for distributed computing; RMI registry services; Steps of creating RMI Application and an example.

**Collections:** The collections framework, collection interfaces, collection classes.

**BOOKS**

1. Naughton & Schildt “The Complete Reference Java 2”, Tata McGraw Hill
2. Deitel “Java- How to Program.” Pearson Education, Asia
3. Horstmann & Cornell “Core Java 2” (Vol I & II) , Sun Microsystems
4. Ivan Bayross “Java 2.0” : BPB publications
5. Ivor Horton’s “Beginning Java 2, JDK 5 Ed., Wiley India.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-405	Elective-I : E1(c) Compiler Design	3	1	-	100	40	50	30	-		150

**UNIT-I**

**Introduction to Compiling and one pass compiler :** Compilers and translators, phases of compilers, Structure of a compiler, compiler writing tools, bootstrapping, overview of one pass compiler, Error handling.

**Finite Automata & Lexical Analysis :** Role of lexical analyser, specification of tokens, recognition of tokens, regular expression, finite automata, form regular expression to finite automata, DFA and NFA, implementation of lexical analyser, tools for lexical analyser, only introduction to LEX.

**UNIT-II**

**Syntax Analysis & Parsing Techniques :** Context free grammars, Phase tree, ambiguity of parse tree, bottom up parsing and top down parsing, shift reduce parsing, operator precedence parsing, elimination of left recursion, recursive descent parsing, predictive parser construction, Transition diagram.

**UNIT-III**

LR parsers, constructing SLR and canonical LR parsing tables, using ambiguous grammar, Introduction to YACC, LR(1) & LALR Parsers.

**Syntax Directed Translation :** Syntax directed translation scheme, construction of syntax trees, SDT with inherited and synthesized attributes, symbol tables.

**UNIT-IV**

**Intermedicate code generation :** Intermedicate languages, prefix notation, three address code, quadruples and triples, translation of assignment statements, boolean expression, procedural calls and iterative statements.

**Run time Environment :** Source language issues, storage organisation and allocation strategies, parameter passing, implementation of block structured languages.

**UNIT-V**

**Error Detection and Recovery :** Errors, sources of errors, Lexical & syntactic phase error, semantic errors:panic mode error recovery & parse level error recovery mechanisms.

**Code Optimization :** Optimization of basic blocks, loop optimization, global data flow analysis, loop invariant computations and other related optimization techniques.

**Code Generation :** Issues in design of code generation, simple code generation techniques.

**BOOKS**

1. Alfred V. Aho, Ravi Sethi and J.D. Ullman "Compilers- Principles, Techniques and tools" Addison Wesley. A
2. Alfred V.Aho and J.D. Ullman "Principles of Compiler Design" Narosa Publishing House.
3. Tremblay, "Theory and Practice of compiler writing", Mc Graw Hill.
4. Holuv, "Compiler Design in C", PHI.
5. Dhamdhare D.M., "Compiler Construction Principles and Practice", Macmillan India.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-405	Elective-I : E1(d) Microprocessor and Interfaces	3	1	-	100	40	50	30	-		150

**UNIT –I**

Intel 8086 Microprocessor: 8086 Architecture, Pin out diagram and pin description, Addressing Modes, bus transfer techniques with read/write cycle, 8086 Interrupts and Interrupt Responses.

**UNIT –II**

Interfacing of 8086 with Memories, PPI (8255), Keyboard Controller (8279), DMA Controller (8257)  
Interfacing of 8086 with Programmable Interval Timer (8254) and Programmable Interrupt Controller (8259).

**UNIT-III**

Introduction to Intel 80286, comparison of 80286 with 8086,80286 Architecture signal and system connection, Real and Virtual Addressing Modes, Memory Management Scheme, 80286 Protection Mechanism, 80286 Interrupts.

**UNIT-IV**

Introduction to Intel 80386, comparison of 80386 with 8086,80286, Difference between 80386SX and 80386DX, Memory and I/O system of 80386, Special 80386 Registers, 80386 Memory Management Scheme, memory Paging Scheme

**UNIT-V**

Introduction of 80486, Difference between 80486DX and 80486SX, Basic 80486 Architecture, 80486 Memory and I/O system, 80486 Memory Management Scheme, Introduction to Pentium, Pentium Memory and I/O system, Special Pentium Registers, Pentium Memory Management, Difference between Pentium and Pentium Pro.

**BOOKS**

1. D.V.Hall: “ Microprocessor and Interfacing, Programming and Hardware” TMH
2. D.V.Hall: “ Microprocessor and Interface Programming” TMH
3. Barry. B. Brey : “ The Intel Microprocessors Architecture, Programming and Interfacing” Pearson Education (6<sup>th</sup> Edition)
4. James L. Antonakos : “The Pentium Microprocessor” Pearson Education.
5. V.Korneev,A.Kiselev “Modern Microprocessor” 3<sup>rd</sup> Edition , Wiley Dreamtech Publication

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-405	Elective-I : E1(e) Advanced DataBase Management System	3	1	-	100	40	50	30	-		150

**UNIT-I****Objected Oriented and Object Relational Databases**

Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity and its implementation, Clustering, Equality and Object Reference, Architecture of Object Oriented and Object Relational databases, Persistent Programming Languages, Cache Coherence. Case Studies: Gemstone, O2, Object Store, SQL3, Oracle xxi, DB2.

**UNIT-II****Deductive Databases**

Data log and Recursion, Evaluation of Data log program, Recursive queries with negation.

**Parallel and Distributed Databases**

Parallel architectures, shared nothing/shared disk/shared memory based architectures, Data partitioning, Intra-operator parallelism, pipelining. Distributed Data Storage – Fragmentation & Replication, Location and Fragment Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, and Parallel Query Evaluation.

**UNIT-III****Advanced Transaction Processing**

Advanced transaction models: Savepoints, Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors, Shared disk systems.

**UNIT-IV****Active Database and Real Time Databases**

Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Recursive query processing, Compensation and Databases Recovery, multi-level recovery.

**UNIT-V****Image and Multimedia Databases**

Modeling and Storage of Image and Multimedia Data, Data Structures – R-tree, k-d tree, Quad trees, Content Based Retrieval: Color Histograms, Textures, etc., Image Features, Spatial and Topological Relationships, Multimedia Data Formats, Video Data Model, Audio & Handwritten Data, Geographic Information Systems (GIS).

**WEB Database**

Accessing Databases through WEB, WEB Servers, XML Databases, Commercial Systems – Oracle xxi, DB2.

**BOOKS**

1. Elmarsi, "Fundamentals of Database Systems", 4 th Edition, Pearson Education
2. R. Ramakrishnan, "Database Management Systems", 1998, McGraw Hill International Editions
3. Elmagarmid.A.K. "Database transaction models for advanced applications", Morgan Kaufman.
4. Transaction Processing, Concepts and Techniques, J. Gray and A. Reuter, Morgan Kauffman..
5. S. Abiteboul, R. hull and V. Vianu, "Foundations of Databases", 1995, Addison – Wesley Publishing Co., Reading Massachusetts.
6. W. Kim, "Modern Database Systems", 1995, ACM Press, Addison – Wesley.
7. D. Maier, "The Theory of Relational Databases", 1993, Computer Science Press, Rockville, Maryland

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-501	Data Warehousing and Mining	3	1	-	100	40	50	30	-	-	150

**UNIT – I**

Motivation, importance, Data type for Data Mining : relation Databases, Data Warehouses, Transactional databases, advanced database system and its applications, Data mining Functionalities: Concept/Class description, Association Analysis classification & Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis, Classification of Data Mining Systems, Major Issues in Data Mining.

**UNIT – II**

Data Warehouse and OLAP Technology for Data Mining: Differences between Operational Database Systems and Data Warehouses, a multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology.

**UNIT- III**

Data Preprocessing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation. Data Mining Primitives, Languages, and System Architectures, Concept Description: Characterization and Comparison, Analytical Characterization.

**UNIT – IV**

Mining Association Rules in Large Databases: Association Rule Mining: Market Basket Analysis, Basic Concepts, Mining Single-Dimensional Boolean Association Rules from Transactional Databases: the Apriori algorithm, Generating Association rules from Frequent items, Improving the efficiency of Apriori, Mining Multilevel Association Rules, Multidimensional Association Rules, Constraint-Based Association Mining.

**UNIT – V**

Classification & Prediction and Cluster Analysis: Issues regarding classification & prediction, Different Classification Methods, Prediction, Cluster Analysis, Major Clustering Methods, Applications & Trends in Data Mining: Data Mining Applications, currently available tools.

**BOOKS**

1. J. Han and M. Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Pub.
2. Berson “Dataware housing, Data Mining & DLAP, @004, TMH.
3. W.H. Inmon “ Building the Datawarehouse, 3ed, Wiley India.
4. Anahory, “Data Warehousing in Real World”, Pearson Education.
5. Adriaans, “Data Mining”, Pearson Education.
6. S.K. Pujari, “Data Mining Techniques”, University Press, Hyderabad.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-502	UNIX & Shell Programming	3	1	4	100	40	50	30	50	25	200

**UNIT-I**

**General Overview of the System:** System structure, user perspective, O/S services assumption about Hardware The Kernel and buffer cache architecture of Unix O/S, System concepts, Kernel data Structure, System administration, Buffer headers, Structure of the buffer pool, Scenarios for retrieval of the buffer, Reading and writing disk block, Advantage and disadvantage of buffer cache.

**UNIT-II**

**Internal Representation of Files:** INODES, Structure of regular, Directories conversions of a path name to an inode, Super block, Inode assignment to a new file, Allocation of disk blocks.

**System Calls for the System:** Open read write file and record close, File creation, Operation of special files change directory and change root, change owner and change mode, STAT and FSTAT, PIPES Mounting and unmounting files system, Link Unlink.

**UNIT-III**

**Structures of Processes and process control:** Process states and transitions layout of system memory, the context of a process, manipulation of process address space, Sleep process creation/termination. The user Id of a process, changing the size of a process. The SHELL

**Interprocess Communication and multiprocessor system:** Process tracing system V IPO network communication sockets problem of multiprocessors systems, solution with master and hare process, and solution with semaphores.

**UNIT-IV**

Introduction to shell scripts: shell Bourne shell, C shell, Unix commands, permissions, editors, filters sed, grep family, shell variables, scripts, metacharacters and environment, if and case statements, for while and until loops. Shell programming.

**UNIT-V**

Awk and perl Programming: Awk pattern scanning and processing language, BEGIN and END patterns, Awk arithmetic and variables, Awk built in variable names and operators, arrays, strings, functions, perl; the chop() function, variable and operators, \$\_ and \$. , Lists, arrays, regular expression and substitution, file handling, subroutines, formatted printing.

**Linux:**

History & Features of Linux, Linux structure, various flavours of linux.

**BOOKS**

1. M.J. Bach "Design of UNIX O.S.", Prentice Hall of India.
2. Y.Kanetkar "Unix shell programming", BPB Pub.
3. B.W. Kernighan & R. Pike, "The UNIX Programming Environment", Prentice Hall of India, 1995.
4. S. Prata "Advanced UNIX: A Programming's Guide", BPB Publications, New Delhi.
5. Vikas/Thomsaon "Jack Dent Tony Gaddis "Guide to UNIX using LINUX" Pub. House Pvt. Ltd.
6. Linux complete, BPB Publications
7. Linux Kernel, Beck Pearson Education, Asia.
8. Sumitabha Das " Unix concepts and Applications".

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-503	Internet & Its Applications	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

Motivation for internetworking, the TCP/IP internet, internet service, internet protocol and standardization, Ethernet, FDDI, LAN, WAN, ATM, application and network level interconnection, properties of internet, internet architecture, inter connection through IP routers, Internet addresses.

**UNIT-II**

ARP, RARP, **internet protocol** : *connectionless datagram delivery, routing IP datagrams* ,subnet and supernet address extensions.

**UNIT-III**

The TCP/IP internet layering model, the protocol layering principle, boundaries in the TCP/IP model, **UDP**: *the user datagram protocol, format of UDP message, UDP pseudo-header, UDP encapsulation and protocol layering, layering and the UDP checksum computation, UDP multiplexing, demultiplexing, and ports*, **reliable stream transport service**: *properties of the reliable delivery service, transmission control protocol, response to congestion, establishing and closing TCP connection*, **Routing**: *Cores, peers and algorithms*, an exterior gateway protocol.

**UNIT-IV**

The domain name system, applications, Telnet, FTP, SMTP, POP3, IMAP-4, MIME, SNMP, internet security and firewall design,.

**UNIT-V**

Good web design, the process of web publishing, document overview, header elements, heading, image, forms, tables, website hosting, HTTP & URL, search engines, Javascript, ASP, servlets.

**BOOKS**

1. Douglas E. Comer "Internetworking with TCP/IP", Volume-I, PHI.
2. Thomas A. Powell "The Complete reference HTML", TMH.
3. Douglas Comer "The Internet Book - Pearson Education", Asia
4. K.Kalata "Internet Programming Thomson learning".
5. E.Stephen Mack & Janan Platt "HTML 4.0", BPB Pub
6. Joel sklar "Principles of Web Design", Vikas Pub. House.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-504	Elective-II : E-II(a) : Modeling & Simulation	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

Systems: Models types, principles used in modelling, system studies, interacting subsystems and example, simulation definition, examples, steps in computer simulation, advantages and disadvantages of simulation, simulation study, classification of simulation languages.

**UNIT-II**

**System Simulation** : Techniques of simulation, monte carlo method, comparison of simulation and analytical methods, numerical computation techniques for continuous and discrete models, distributed leg models, cobweb models.

**UNIT-III**

**Continuous system simulation** : Continuous system models, differential equation, analog computer analog methods, digital analog simulators, CSSLS, CSMPIII language.

**System Dynamics** : Historical background, exponential, Growth and decay models, modified exponential growth models, logistic curves and generalization of growth models, system dynamics diagrams, dynamo language.

**UNIT-IV**

**Probability concepts in simulation** : Stochastic variables, discrete and continuous probability function, continuous uniform distributed and computer generation of random numbers, uniform random number generator, non uniform continuously distributed random numbers, rejection method.

Discrete system simulation : Discrete events, representation of time, generation of arrival patterns, simulation of telephone system, delayed calls, simulation programming tasks, gathering statistics, discrete simulation languages.

**UNIT-V**

Object Oriented approach in simulation, simulation in C++, Introduction to GPSS, general description, action times, choice of paths, simulation of a manufacturing shop, facilities and storage, program control statements, priorities and parameters, numerical attributes, functions, simulation of a supermarket transfer models, GPSS model applied to any application, simulation programming techniques like entry types.

**BOOKS**

1. G.Gordan "System Simulation" , 2<sup>nd</sup> Ed, 2002 PHI.
2. T.A. Payer "Introduction to Simulation", McGraw Hill.
3. W.A. Spriet "Computer Oriented Modeling and Simulation".
4. Narsingh Deo "System Simulation with Digital Computers", PHI.
5. V. Rajaraman "Analog Simulation", PHI
6. Law & Kelton "Simulation Modelling and Analysis" 3<sup>rd</sup> Ed., 2000, McGraw Hill.

Note : Paper is to be set unit wise with internal choice.

Course No	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-504	Elective – II: EII(b) Organizational Behaviour	3	1	-	100	40	50	30	-	-	150

**UNIT – I**

Organizational Behavior Today: What is Organizational Behavior, shifting paradigms of organizational behavior, organizational behavior and diversity.

Learning about Organizational Behavior: Organizational Behavior and learning imperative scientific foundations of organizational behavior.

**UNIT – II**

Challenge and Opportunities for organizational behavior: Towards improving quality & productivity, improving people skills from management control to empowerment, from staterility of flexibility, improving ethical behavior, organizational social responsibility work and quality of life.

**UNIT- III**

A Micro Perspective of Organizational Behavior: The perception process, personality and attitudes, motivation: motivating performance through job design and goal setting, learning: processes rewards systems and behavior management.

**UNIT – IV**

Micro and Macro Dynamics of Organizational Behavior: Graph dynamics and teams, interactive conflict and negotiation skills, stress: cause effects and coping strategies, leadership styles, activities and skills.

A Macro Perspective of Organizational Behavior: Communications, decision-making, Organizational Theory & Design, Organizational Culture.

**UNIT – V**

Horizons for Organizational Behavior: International Organizational Behavior(IOB), the impact of culture on IOB, Communication in IOB, motivation across culture, managerial leadership across cultures

Organizational Change & Development: Learning objectives, the changes facing organizations, managing change and organizational development, future of organizational Behavior.

**BOOKS**

1. Fred Luthans “Organizational Behavior”, McGraw Hills international Edition, Management & Organization series.
2. Schermerhorn, Hunt & Osborn “Organizational Behavior” (7<sup>th</sup> Edition), John Wiley & Sours Inc.
3. Stephen P. Robbins “Organizational Behavior: Concepts controversies applications”, PHI publications.
4. A.J.Robertson Lvan T. and Cooper, Cary.L. “Work Psychology Understanding Human Behavior in the workplace” Macmillan India Ltd. Delhi 1996.
5. M.N. Mishra “Organizational Behavior”, Vikas Pub. Co.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-504	Elective II : EII(c) : Soft Computing	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

Introduction, Soft Computing concept explanation, brief description of separate theories.

Neural Networks and Probabilistic Reasoning; Biological and artificial neuron, neural networks and their classification. Adaline, Perceptron, Madaline and BP (Back Propagation) neural networks. Adaptive feedforward multilayer networks. Algorithms: Marchand, Upstart, Cascade correlation, Tilling. RBF and RCE neural networks. Topologic organized neural network, competitive learning, Kohonen maps.

**UNIT-II**

CPN , LVQ, ART, SDM and Neocognitron neural networks. Neural networks as associative memories (Hopfield, BAM). Solving optimization problems using neural networks. Stochastic neural networks, Boltzmann machine.

**UNIT-III**

Fundamentals of fuzzy sets and fuzzy logic theory, fuzzy inference principle. Examples of use of fuzzy logic in control of real-world systems.

**UNIT-IV**

Fundamentals of genetic programming, examples of its using in practice. Genetic Algorithms Applications of GA's – Class.

**UNIT-V**

Fundamentals of rough sets and chaos theory. Hybrid approaches (neural networks, fuzzy logic, genetic algorithms, rough sets).

**BOOKS**

1. Cordón, O., Herrera, F., Hoffman, F., Magdalena, L.: Genetic Fuzzy systems, World Scientific Publishing Co. Pte. Ltd., 2001, ISBN 981-02-4016-3
2. Keeman, V.: Learning and Soft Computing, The MIT Press, 2001, ISBN 0-262-11255-8
3. Mehrotra, K., Mohan, C., K., Ranka, S.: Elements of Artificial Neural Networks, The MIT Press, 1997, ISBN 0-262-13328-8
4. Munakata, T.: Fundamentals of the New Artificial Intelligence, Springer-Verlag New York, Inc., 1998. ISBN 0-387-98302-3
5. Goldberg : Introduction to Genetic Algorithms
6. Jang, “ Nero-Fuzzy & Soft Computing”, Pearsons

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-504	Elective II : E-II(d) : Network Programming	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

Communication protocol, Internet Protocols, Novell, System Network Architecture, UUCP, IPX/SPX for LANS, protocol comparisons.

**UNIT-II**

Berkeley sockets

Overview, unix domain protocols, socket address, socket system call, reserved ports, passing file descriptions, I/O asynchronous and multiplexing, socket implementation.

**UNIT-III**

Winsock programming

Using windows socket, API window socket and blocking I/O, other window extension, network dependent UNRI, DLL. sending and receiving data over connection/termination.

**UNIT-IV**

Novell IPX/SPX

Novell's windows drivers, netware C interface for windows, IPX/SPX procedure, datagram communication, connection oriented communication with SPX, IPX/SPX implementation of DLL.

**UNIT-V**

Programming Applications

Time and data routines, trivial file transfer protocol, remote login.

**BOOKS**

1. Davis R, Windows Network Programming, Add Wesley.
2. Steven R, Unix Network Programming, (Vol I & II) PHI.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-504	Elective II : EII(e) : .Net Technology	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

Introduction to .NET Technology, Introduction to VB.NET, Software development and Visual Basic .NET, Visual Basic .NET and .NET frame.

**UNIT-II**

Visual Basic fundamentals: The Visual Basic .NET Development Environment, The element of VB.NET, VB.NET operators, Software design, Conditional structure and control flow, Methods.

**UNIT-III**

Classes and Objects: Types, Structure and Enumeration, Classes, Interfaces, Exception handling and Classes, Collections, Arrays and other Data Structure.

**UNIT-IV**

Advance design concepts, Patterns, Roles and Relationships, Advanced Interface Patterns: Adapters and Delegates and Events Data Processing and I/O.

**UNIT-V**

Writing Software with Visual Basic .NET, Interfacing with the End User, Introduction to ASP.NET and C#.NET and their features.

**BOOKS**

1. Jeffrey R. Shapiro "The Complete Reference Visual Basic .NET" Tata Mcgraw Hill (2002 Edition).
2. Rox "Beginner and Professional Edition VB.NET" Tata Mcgraw Hill.
3. Steven Holzner "Visual Basic .NET Black Book" Wiley Dreamtech Publication.
4. Alex Homer, Dave Sussman "Professional ASP.NET1.1" Wiley Dreamtech
6. Bill Evzen, Bill Hollis "Professional VB.NET 2003" Wiley Dreamtech
7. Tony Gaddis "Starting Out VB.NET PROG.2<sup>nd</sup> Edition" Wiley Dreamtech
8. Chris Ullman, Kauffman "Beg. ASP.NET1.1 with VB.NET 2003" Wiley Dreamtech
9. Chris Ullman, Kauffman "Beg ASP.NET1.1 with VC#.NET 2003" Wiley Dreamtech

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-505	Elective-III : EIII(a) Distributed Systems	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

**Introduction to Distributed Systems** : Goals of Distributed Systems, Hardware and Software concepts, the client server model, Remote procedure call, remote object invocation, message and stream oriented communications.

**UNIT-II**

**Process and synchronization in Distributed Systems** : Threads, clients, servers, code migration, clock synchronization, mutual exclusion, Bully and Ring Algorithm, Distributed transactions.

**UNIT-III**

**Consistency, Replication, fault tolerance and security** : Object replication, Data centric consistency model, client-centric consistency models, Introduction to fault tolerance, process resilience, recovery, distributed security architecture, security management, KERBEROS, secure socket layer, cryptography.

**UNIT-IV**

Distributed Object Based and File Systems : CORBA, Distributed COM, Goals and Design Issues of Distributed file system, types of distributed file system, sun network file system,.

**UNIT-V**

Distributed shared memory, DSM servers, shared memory consistency model, distributed document based systems : the world wide web, distributed co-ordination based systems: JINI

Implementation: JAVA RMI, OLE, ActiveX, Orbix, Visbroskes, Object oriented programming with SOM

**BOOKS**

1. Andrew S. Tanenbaum, Maarten Van Steen "Distributed Systems Principles and Paradigms" Pearson Education Inc. 2002.
2. Lui "Distributed Computing Principles and Applications".
3. Harry Singh "Progressing to Distributed Multiprocessing" Prentice-Hall Inc.
4. B.W. Lampson "Distributed Systems Architecture Design & Implementation", 1985 Springer Verlag.
5. Parker Y. Verjies J. P. "Distributed computing Systems, Synchronization, control & Communications" PHI.
6. Robert J. & Thieranf "Distributed Processing Systems" 1978, Prentice Hall.
7. George Coulios, "Distribute System: Design and Concepts", Pearson Education

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-505	Elective-III : EIII(b) Computer Vision and Digital Image Processing	3	1	-	100	40	50	30	-	-	150

**UNIT-I**

**Introduction:** The role of Computer Vision, applications, successes, research issues; its relationship to natural vision, basic image properties. Digital image representation, fundamental steps in image processing, elements of digital image processing systems digitization, Display and recording devices.

**UNIT-II**

**Digital Image fundamentals:** A simple Image model. Sampling and quantization, Relationship between pixel, imaging geometry, image transformation, introduction to fourier transformation, Discrete fourier transformation, fast fourier transformation.

**UNIT-III**

**Image Enhancement:** Histogram processing, image subtraction, image averaging, smoothing filters, sharpening filters, enhancement in frequency domain, low pass filtering, high pass filtering.

**UNIT-IV**

**Image Encoding & Segmentation:** Segmentation, detection of discontinuation by point detection, line detection, edge detection. Edge linking & Boundary Detection: Local analysis, global by Hough transform & Global by graph theoretic techniques.

**UNIT-V**

**Image Representation and Description:** Chain codes, polygonal approximation, signatures, boundary segments, boundary descriptors, regional descriptors, introduction to image understanding. Motion Tracking , Image differencing, Feature matching, Optic flow

**BOOKS**

1. Gonzalez and Woods "Digital Image Processing", Addison Wesley
2. Gonzalez and Woods "Digital Image Processing using MATLAB", Addison Wesley
3. SchalKoff: Digital Image Processing & Computer Vision, Addison Wesley.
4. M. Sonka et.al : Image Processing and Machine Vision, Prentice Hall.
5. Ballard & Brown: Computer Vision, Prentice Hall.
6. Jain A. K. Fundamentals of Digital Image Processing, PHI
7. Boyle and Thomas, "Computer Vision - A First Course" 2nd Edition, ISBN 0-632-028-67X, Blackwell Science 1995.
8. Low, "Introductory Computer Vision and Image Processing", McGraw-Hill 1991, ISBN 0-07-707403-3

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-505	Elective- III : EIII(c ) Bioinformatics	3	1	-	100	40	50	30	-		150

**UNIT-I**

**Fundamentals of Bioinformatics and Information Technology** : Introduction to bioinformatics, experimental sources of biological data fundamentals of molecular biology available databases operating system, including windows and Unix networks-including the intranets and the Internet.

**Analytical science and Bioinformatics** : High throughput sequencing, experimental determination of protein structures, Gene expression monitoring, proteomics, metabiomics.

**UNIT-II**

**Protein Information resources** : Introduction, biological databases, primary sequence databases, composite protein sequence database, secondary databases, composite protein pattern databases, structure classification databases, web addresses.

**Genome information resources** : Introduction, DNA sequence databases, specialised genomic resources.

**DNA Sequence analysis** : Introduction, why analyse DNA, Gene structure and DNA sequences, features of DNA sequence analysis, issues in the interpretation of EST searches, two approaches to gene hunting, the expression profile of a cell, cDNA libraries and ESTs, different approaches to EST analysis, effects of EST data on DNA databases.

**UNIT-III**

**Pairwise alignment techniques** : Introduction, database searching, alphabets and complexity, algorithms and programs, comparing two sequences a simple case, sub-sequences, identity and similarity, the dotplot, local and global similarity, global alignment the needleman and Wunsch algorithm, local alignment the Smith Waterman algorithm, dynamic programming, pairwise database searching.

**Multiple sequence alignment** : Introduction, the goal of multiple sequence alignment, multiple sequence alignment a definition, the consensus, computational complexity, manual methods, simultaneous methods, progressive methods, database of multiple alignment, searching databases with multiple alignments.

**Secondary database searching** : Introduction, why bother with secondary database searches, what is a secondary database.

**UNIT-IV**

**Bioinformatics tools** : Visualisation of sequence data, sequence alignment, homology searching, including BLAST, gene expression informatics, introduction to gene finding.

**Building a sequence search protocol** : Introduction, a practical approach, when to believe a result, structural and functional interpretation.

**Analysis packages** : Introduction, what's in an analysis package, commercial databases, commercial software, comprehensive packages, packages specialising in DNA analysis, intranet packages, internet packages.

**UNIT-V**

**Applications and commercial aspects of Bioinformatics** : Drug discovery, genetic basis of disease, personalised medicine and gene-based diagnostics, legal, ethical and commercial ramifications of bioinformatics.

**Perl Programming** : Data manipulation, file maintenance, pipelining, packaging and interfacing system facilities.

**Macromolecular Modelling and Chemoinformatics** : Acquisition of chemical information, including molecular structure from databases visualisation of molecules simulation of molecular interaction introduction to industry standard modelling software.

**BOOKS**

1. Attwood TK & Parry-smith DJ "Introduction to Bioinformatics" 2001, Pearson Education Asia.
2. Setup Joao & Meidanis Joa "Introduction to computational Molecular Biology" PWS Publishing Company, 1997 (An international Thomson publishing company).
8. Andreas D. Baxevan's & B.F. Francis Quellet, "Bio Informatics: A Practical guide to the analysis of Genes & Proteins", Second edition 2001, A John Wiley & Sons.
9. Martin Tompa Lechre notes on Biological sequence Analysis, Department of Computer Science & Engineering, university of Washington, Seattle USA <http://www.cs.washington.edu/education/courses/527/oowi/>
10. Jean Michael "Bioinformatics : A beginner's Guide", Wiley India.

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-505	Elective III : EIII(d) : Embedded Systems	3	1	4	100	40	50	30	-	-	150

**UNIT-I**

Princeton (Von Neumann) and Harvard Architecture, CISC and RISC architecture, General-purpose processor, microcontroller, Embedded processor, Digital Signal processor, Application specific processor, Super scalar, VLIW, pipelined Architecture. Definition of Embedded System, classification of embedded system, skills required for an Embedded System Designer, Trends in embedded system various examples of an embedded system, Challenges to design embedded system, embedded system development design methodology.

**UNIT-II**

Hardware units required to design embedded system like power source, clock oscillator circuit, Real time clock and timer, reset circuit, watchdog timer, memories, interrupts, DAC and ADC, LCD and LED display, PWM, Keypad/keyboard, pulse dialer, modem and transceiver.

**UNIT-III**

Embedded Software: Development tools for embedded software, Assemblers, Compilers, Editor, Interpreter, Cross Assembler, Simulator, Emulator, Locator, Linker, Profiler, Coding strategies for obtaining optimized time and space requirements, Debugging Embedded Software, Software in high level language, coding of software in machine language, Software for Device drivers and device management.

**UNIT-IV**

Introduction to Real Time Operating System, comparison of RTOS with O.S., Tasks and Task States, Task and Data, Semaphores and Share data, Interrupt, Interrupt handler, Share data problem, Messages, Queue, Mailboxes and pipe. Introduction to U-COS II Real time operating system, main features of U-COS-II

**UNIT-V**

Embedded Communication System: Standard for Embedded Communication, USART, SPI, I2C, CAN, USB, Firewire, Ethernet, Wireless communication like IRDA, Bluetooth, 802.11, PCI Bus, SoC, IP Core, Case Study of Digital camera

**BOOKS**

1. Frank Vahid & Tony Givargis "Embedded System Design" John Wiley & Sons.
2. Dr. Rajkamal "Embedded System" TMH
3. David E.Simon "An Embedded Software Primer" Addison Wesley Longman Publication.
4. Prasad..K.V.K.K.: "Embedded/Real Time System Concept & Design Black Book" Wiley Dreamtech Publication.
5. Mark miller "VoIP" Wiley Dreamtech Publication

Note : Paper is to be set unit wise with internal choice.

Course No.	Course Name	L (Hrs)	T (Hrs)	P (Hrs)	Theory Marks		Sessional Marks		Practical Marks		Total Marks
					Max	Min	Max	Min	Max	Min	
MCA-505	Elective-III : EIII (e) Network Security	3	1	-	100	40	50	30	-		150

**UNIT-I**

Classical Encryption Techniques: Symantec Cipher model, substitution Techniques, tranposition techniques, rotor machines, steganography.

Block Ciphers and the Data Encryption standards: Simplified DES, block cipher principles, the data encryption standard, the strength of DES, differential and linear cryptanalysis, block cipher design principles, block cipher modes of operation.

Advanced Encryption Standard: Evaluation Criteria for AES, the AES cipher.

Contemporary symmetric ciphers: Triple DES, blowfish.

Confidentiality using symmetric encryption: Placement of Encryption function, traffic confidentiality, key distribution, and random number generation.

**UNIT-II**

Public key Encryption and Hash functions : Prime numbers, Fermat's and Euler's Theorems, testing for primality, the chinese remainder theorem, discrete logarithms.

Public key cryptography and RSA: Principles of Public key cryptosystems, the RSA algorithm.

Key Management other public key cryptosystems: Key management, diffie-Hallman key exchange, elliptic curve arithmetic, and elliptic curve cryptography.

**UNIT-III**

Message authentication and Hash function : Authentication Requirements, Authentication functions, message authentication codes, hash functions, security of hash function and MACs.

Hash Algorithms: MD5 message digest algorithm, secure Hash algorithm, ripemd-160, HMAC.

Digital Signature and Authentication protocols: Digital signatures, Authentication protocols, and digital signature standard.

Authentication Applications: Kerberos, X.509 Authentication service.

**UNIT-IV**

Electronic Mail Security: Pretty Good privacy, S/MIME.

IP Security: IP Security overview, IP security architecture, authentication header, encapsulating security payload, combining security associations, key management.

Web Security: Web security considerations, Secure sockets layer and transport layer security, secure electronic transaction.

**UNIT-V**

Part four system security: Intruders, intrusion detection, and password management.

Malicious software: Viruses and related threats, virus countermeasures.

Firewalls: Firewall Design Principles, Trusted systems.

**BOOKS**

1. William Stallings "Cryptography and Network Security", 3 ed, Pearson Education.
2. W.Stallings " Network security Essential " Applications & Standards", Pearson ed.
3. Kanfren "Network Security : Private Communications in a public world 2/e
4. Eric Maiwald " Network Security : A Preginner's Guide, second ed.", Tata Mcgraw Hill.
5. Roberta Bragg " Mark Rhodes, Ousley & Keith Strassberg Network Security : The Complete Reference " Tata McGraw Hill.
6. Eric Maiwald "Fundamentals of Network Security" Wiley India.