Post Graduate Department of Computer Sciences,

The University of Kashmir, Srinagar - 190006

Proposed
Credit Based Choice Based Curriculum
for

Master of Computer Applications (MCA) Programme
2015 – 2017

Structure of CBCSCurriculum for MCA

Semester-I (24 Credit unit Semester)						
Course Code	**Course name**	**Paper category**	**Hours / Week**			**Credits**
			L	T	P	
12 Core Credit Units						
MCA-101-CR	Advanced Programming Concepts in C / C++	Core	3	0	2	4
MCA-102-CR	Advanced Database Systems	Core	3	0	2	4
MCA-103-CR	Discrete Mathematics	Core	4	0	0	4
6 Elective Credit Units						
MCA-104-DCE	Assembly Language Programming	DCE	3	0	0	3
MCA-105-DCE	Technical Communication	DCE	3	0	0	3
MCA-106-DCE	Computer Architecture	DCE	3	0	0	3
MCA-107-DCE	Programming Languages	DCE	3	0	0	3
6 credit units to be taken from outside departments						

Semester-II(24 Credit unit Semester)						
Course Code	**Course name**	**Paper category**	**Hours / Week**			**Credits**
			L	T	P	
12 Core Credit Units						
MCA-201-CR	Data and File Structures	Core	3	0	2	4
MCA-202-CR	Numerical and Statistical Computing	Core	3	0	2	4
MCA-203-CR	Advanced Data Communication	Core	4	0	0	4
6 Elective Credit Units						
MCA-204-DCE	Advance Computer Architecture	DCE	3	0	0	3
MCA-205-DCE	Advanced Operating Systems	DCE	3	0	0	3
MCA-206-DCE	Optimization Techniques	DCE	3	0	0	3
MCA-207-DCE	Management Information System	DCE	3	0	0	3
6 credit units to be taken from outside departments						

Semester-III(24 Credit unit Semester)						
Course Code	**Course name**	**Paper category**	**Hours / Week**			**Credits**
			L	T	P	
12 Core Credit Units						
MCA-301-CR	Design and Analysis of Algorithms	Core	3	0	2	4
MCA-302-CR	Advanced Computer Networks	Core	4	0	0	4
MCA-303-CR	Advanced Software Engineering	Core	3	0	2	4
6 Elective Credit Units						
MCA-304-DCE	Advanced Business Systems	DCE	3	0	0	3
MCA-305-DCE	Data Warehousing	DCE	3	0	0	3
MCA-306-DCE	Cloud Computing	DCE	3	0	0	3
MCA-307-DCE	Advanced Web Programming	DCE	3	0	0	3
6 credit units to be taken from outside departments						

Semester-IV(24 Credit unit Semester)						
Course Code	**Course name**	**Paper category**	**Hours / Week**			**Credits**
			L	T	P	
12 Core Credit Units						
MCA-401-CR	Artificial Intelligence	Core	4	0	0	4
MCA-402-CR	Advanced Computer Graphics	Core	3	0	2	4
MCA-403-CR	Object Oriented Modeling Analysis and Design	Core	3	0	2	4
6 Elective Credit Units						
MCA-404-DCE	Advanced Unix/Linux Programming	DCE	3	0	0	3
MCA-405-DCE	Theory of Computation & Formal Languages	DCE	3	0	0	3
MCA-406-DCE	Natural Language Processing	DCE	3	0	0	3
MCA-407-DCE	C# Programming	DCE	3	0	0	3
6 credit units to be taken from outside departments						

Semester-V(24 Credit unit Semester)						
Course Code	**Course name**	**Paper category**	**Hours / Week**			**Credits**
			L	T	P	
12 Core Credit Units						
MCA-501-CR	Java Programming	Core	3	0	2	4
MCA-502-CR	Wireless communication	Core	4	0	0	4
MCA-503-CR	System Programming	Core	4	0	0	4
6 Elective Credit Units						
MCA-504-DCE	Heterogeneous Biological Databases	DCE	3	0	0	3
MCA-505-DCE	Machine Learning	DCE	3	0	0	3
MCA-506-DCE	Modeling & Simulation	DCE	3	0	0	3
MCA-507-DCE	Image processing	DCE	3	0	0	3
6 credit units to be taken from outside departments						

Semester-VI(24 Credit unit Semester)						
Course Code	**Course name**	**Paper category**	**Hours / Week**			**Credits**
			L	T	P	
12 Core Credit Units						
MCA-601-CR	Project Problem Identification & Seminar	Core	0	4	0	4
MCA-602-CR	Project Problem Analysis	Core	0	4	0	4
MCA-603-CR	Project Dissertation	Core	0	4	0	4
6 Elective Credit Units						
MCA-604-DCE	Project Software Development	DCE	0	6	0	6
MCA-605-DCE	Project Research Development	DCE	0	6	0	6
6 credit units to be taken from outside departments						

Note : This revised syllabus shall be implemented from the academic session 2015 as follows :-

- **1st and 2nd Semester - Academic Session 2015**
- **3rd and 4th Semester - Academic Session 2016**
- **5th and 6th Semester – Academic Session 2017**

Semester - I

Course No: – MCA-101-CR
Course Title: Programming Concepts Using C / C++

Unit I

Arrays**:** Declaration; initialization; 2-dimensional and 3-dimensional array, passing array to function, strings and string functions, and character arrays.

Pointers: variables, swapping data, swapping address v/s data, pointers and arrays , pointers to pointers , strings , pointer arithmetic , portability issues, pointers to functions, using pointers with arrays , void pointers .

Structures and unions: syntax and use, members, structures as function arguments, structure pointers, passing structures and their arrays as arguments.

Unit II:

Functions; prototype, passing parameters, storage classes, identifier visibility, Recursive functions. Command-line arguments. Variable scope, lifetime. Multi-file programming, Introduction to macros. File processing in C and C++.

Introduction to graphics, graphic initialization, graphic modes, basic drawing using library functions.

Unit III

Introduction to classes and objects; Constructor; destructor; Operator overloading; Function overloading; friend functions; copy constructor. Use of call-by-reference for efficiency.

Inheritance: Single , Multiple, and Multilevel Inheritance;

Virtual function and Polymorphism: Dynamic binding, Static binding; Virtual functions; Pure virtual function; concrete implementation of virtual functions; Dynamic binding call mechanism; Implementation of polymorphism; Virtual Destructors.

Unit IV

Templates: Function Templates, Class Templates, Member Function Template and Template Arguments, Exception Handling Concepts.

Reference Books:1.

1. FOSTER AND FOSTER “C by discovery” RRI penram.
2. YASHWANT KANETKAR “Let us C” PHI.
3. E. BALAGURUSWAMI “Programming in ANSI C” Tata McGraw Hill.
4. BJARNE STROUSTRUP “The C++ programming language” Pearson Education.
5. HERBERT SCHILD “C++ The complete Reference” Tata McGraw Hill.
6. ROBERT LAFORE “Object orientation with C++ Programming” Waite Group.

Course No: – MCA-102-CR
Course Title: Advanced Database Systems

Unit I
Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Architecture, Data Mining and Information Retrieval,Database Models and Comparison, Relation Algebra, ER Model, CODDS Rules, Normalization..

Unit II
Introduction to SQL, Data Types, Data Definition Language, Data Manipulation Language, Transaction Control Language, Integrity Constraints, SQL Functions, Set Operators and Joins, View, Synonym and Index, Sub Queries and Database Objects, Locks and SQL Formatting Commands.

Unit III
Introduction to PLSQL, Architecture, Data Types, Control Structures, Concept of Error Handling, Cursors and Database Triggers, Subprograms and Packages.

Unit IV
Data Storage and Querying using various storage structures, Indexing and Hashing, Query Processing and Optimization.Transaction Management Concepts, Concurrency Control and Recovery.

Reference Books:
William Page,"Using Oracle 9i – Special Edition", Que/PHI.
Database System Concepts by A. Silbershatz, H.F. Korth and S. Sudarshan, 6th edition, 1997, McGraw-Hill, International Edition.
Ivan Bayross, "SQL & PL/SQL Using Oracle 8i & 9i with SQLJ", BPB.
Desai.B , "An introduction to Database Concepts", Galgotia Publications, N.Delhi
Dates.C , " An introduction to Database Systems", Pearson Education, Asia

Course No: MCA-103-CR
Course Title: Discrete Mathematics

UNIT I

Proposition, Logic, Truth tables, Propositional Equivalence, Logical Equivalence, Predicates and Quantifiers, Sets: operations on sets, Computer representation of sets, Functions: Domain, Range, One-to-One, Onto, Inverses and Composition, Cardinality of a Set, sequences and summations, The growth of functions . Methods of Proof: Different methods of proof, Direct Proof, Indirect Proof, Mathematical Induction for proving algorithms.

UNIT II

Discrete probability, Advanced Counting Techniques: Inclusion-Exclusion, Applications of inclusion-exclusion principle, recurrence relations, solving recurrence relation. Relations: Relations and their properties, Binary Relations, Equivalence relations, Diagraphs, Matrix representation of relations and digraphs, Computer representation of relations and digraphs, Transitive Closures, Warshall's Algorithm.

UNIT III

Partially Ordered Sets (Posets), External elements of partially ordered sets, Hasse diagram of partially ordered set, isomorphic ordered set, Lattices: Properties of Lattices, complemented Lattices. Graph theory: Introduction to graphs, Graph Terminology Weighted graphs, Representing Graphs, Connectivity of Graphs: Paths and Circuits, Eularian and Hamiltonian Paths, Matrix representation of graphs. Graph Coloring.

UNIT IV

Trees: Rooted trees, Application of trees: Binary Search Trees, Decision Trees, Prefix Codes, Tree traversal, trees and sorting, spanning trees, minimal spanning trees.
Finite Boolean algebra, Functions on Boolean algebra, Boolean functions as Boolean polynomials. Groups and applications: Subgroups, Semigroups, Monoids, Product and quotients of algebraic structures, Isomorphism, Homomorphism

Reference Books:

1. KENNETH H. ROSEN "Discrete Mathematics and Its Applications" The Random House/Birkhauser Mathematics series
2. LIU "Elements of Discrete Mathematics " Tata McGraw Hill
3. SCHAUMS "Discrete Mathematics " Tata McGraw Hill
4. KOLMAN/REHMAN "Discrete Mathematical Structures " Pearson Education
5. NICODEMI "Discrete Mathematics " CBS

Course No: MCA-104-DCE
Course Title: Assembly Language Programming

Unit I

Architecture of Microcomputer System. Evolution of Intel Microprocessor Architecture (4004 to Multi-Core). 8086/8088 Microprocessor - Micro-architecture, Software Model, Memory Segmentation, Address Space, Generating Physical Address, Instruction Format & Addressing Modes.

Unit II

8086/8088 Microprocessor - Pin-out diagram, Minimum Mode & Maximum Mode Interfacing, Memory Interfacing & Banking, Bus Cycles & T-States, Timing Diagram for I/O & Memory Read/Write Bus Cycle in Mn/Mx mode. Types of I/O – Memory Mapped & I/O Mapped.

Interrupts in 8086/8088 Microprocessor - Mechanism, Pins, Classification, Sequence & Priority, Interrupt Vector Table (IVT), Interrupt Instruction, Enabling/Disabling Interrupts & Programmable Interrupt Controller (PIC).

Unit III

Assembly Language Programming – Significance & Applications, 8086 Instruction Set – Data Transfer, Arithmetic, Logical/Bit Manipulation, Program Execution Transfer, String, Processor Control.

Assembler Directives – Data Definitions, Segments, Subroutines (Parameter passing), Macros, Modular code & Conditional assembly. Using INT 21H for standard I/O. Using TASM for writing programs.

Reference Books:

1. D. V. Hall, “Microprocessors and Interfacing”, Tata McGraw Hill, 2006.
2. Y. Liu, G. A. Gibson, “Microcomputer system: The 8086/8088 Family”, PHI.
3. W.A. Triebel, A. Singh, “The 8088 And 8086 Microprocessors”, Pearson Education, 2007.

Course No: MCA-105-DCE
Course Title: Technical Communication

Unit I

Basics of Technical Communication, Barriers to Communication, Technology in Communication. Communicating in the Workplace: Problem Solving in Workplace Communication, Guidelines for writing with a computer, Human factors in the communication failure.Active Listening: Introduction , types of listening, Traits of a good listener , Active versus Passive listening , Implications of a good listening .

Unit II

Introduction to Effective Presentation strategies , Defining purpose , analyzing audience and locale , organizing contents , preparing outline , visual aids , understanding nuances of delivery, kinesics. Interviews: introduction, Objectives, types of interviews, Job interviews. Group Communication: Introduction, Group discussion, Organizational Group discussions, meetings, conferences

Unit III

Words and Phrases , Dictionary and Thesaurus , Elements of style , Sentence construction , guidelines for effectiveness, Paragraph development , Central components of a paragraph, The art of condensation , steps for effective précis writing , samples and guidelines , Reading comprehension , reading comprehension, reasons for poor comprehension, improving comprehension skills , techniques for good comprehension. How applicants are screened for personal qualities , electronic job hunting , guidelines for surviving a job interview.

Reference Books:

1. Meenakshi Raman and Sangeeta Sharma, “Technical Communication”, Oxford University Press
2. William Pfeiffer, Padmaja ”Technical Communication A Practical Approach”, Pearson Education.

Course No: MCA-106-DCE
Course Title: Computer Architecture

UNIT I

Data representation: signed number representation, fixed and floating point representations. Computer arithmetic: addition and subtraction, multiplication, division – nonrestoring and restoring techniques, floating point arithmetic; Combinatorial Logic: Boolean algebra, simplification of Boolean expressions, k-map, tabulation method. Implementation of Boolean functions (addition, subtraction, multiplication, multiplexer, de-multiplexer) with logic gates; Sequential logic: flip – flops, latches, synchronous and asynchronous logic, finite State machines (moore, mealy), StateTransition Tables state assignment, excitation table. Implementation of Sequential functions:(counters, registers, sequential adder/subtractor) using flip-flops and memory (e.g. micro-coded control unit). !

UNIT II

The Processor Architecture: Von-Neumann and Non-Von-Neumann Machines, introduction to: (RISC & CISC); (Designing a hypothetical CPU) Instruction Set design: Data representation, register sets, types of Instructions, Addressing techniques; ALU/Datapath design: operation codes(opcodes), arithmetic operations, logical operations; Control Unit design: hardwired and micro-programmed design approaches. !

UNIT III

The CPU Buses & I/O systems: local buses (address buses, data buses, and control buses), System buses(bus controller and bus arbiter), DMA(principle, modes of operations: Burst,cycle stealing, transparent); Pipelining: Basic concepts of pipelining, throughput and speedup of Datapaths, pipeline hazards; Memory Hierarchy: hierarchical memory organization, basics of cache (types, mappings, replacement algorithms, write policies, performance/speedup), virtual memory. ! !

References:

1. “Computer Organization and Design: The Hardware/Software Interface”, David A. Patterson and John L. Hennessy: Elsevier.
2. “Computer Organization”, Carl Hamachar, ZvoncoVranesic and SafwatZaky: McGraw Hill.
3. “Computer Architecture and Organization”, John P. Hayes: McGraw Hill.
4. “Computer Organization and Architecture: Designing for Performance”, William Stallings: Pearson Education.
5. “Computer Systems Design and Architecture”, Vincent P. Heuring and Harry F. Jordan: Pearson Education. !

Course No: MCA-107-DCE
Course Title: Programming Languages

Unit I

The role of Programming Languages: Towards Higher Level Languages programming paradigms, Language implementation. Language Description: Syntactic Structures, Expression Notations, Abstract Syntax trees, Lexical Syntax, Context free grammars , grammars for expression. Data Representation : The role of types , basic types , arrays , records , unions and variant records , Sets , Pointers , Two String tables , types and error checking. Procedure Activations: Introduction to Procedures, parameter passing methods, scope rules for names, nested scope in source text, activation records, lexical scope: procedures as in C

Unit II

Objected oriented programming : Constructs for program structuring , Information hiding , Program design and modules , modules and defined types , class declarations in C++ , dynamic allocation in C++ , templates : Parameterized types , Implementation of Objects in C++., Inheritance , derived classes and information hiding. Functional Programming : Language of expressions , types, values and operations , approaches to expression evaluation , lexical scope , type checking, Function declaration by cases , Functions as first-class values ,Implicit types , data types exception handling

Unit III

An introduction to concurrent Programming : Parallelism in hardware , Streams : implicit synchronization , concurrency as interleaving, Liveliness properties , safe accesses to shared data concurrency in ADA .

Language Description : Semantic Methods , Synthesized attributes, Attribute grammars , natural semantics , Denotational Semantics , Equality of Pure Lambda terms , Substitution revisited , Computation with pure lambda terms , programming constructs as lambda terms , the typed lambda calculus , polymorphic types.

Reference Books:

Ravi Sethi ," Programming Languages ,Concepts and Constructs", Pearson Education
Allen B. tucker, Robert E Noonan "Programming Languages- principles and paradigms" TMH
Freidman, Wand ,Haynes, "Essentials of Programming Languages", PHI.

Semester - II

Course No.: MCA-201-CR
Course Title: Data & File Structures

Unit - I

INTRODUCTION TO DATA STRUCTURE: Data Management concepts, Data types – primitive and non-primitive, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), Types of Data Structures- Linear & Non Linear Data Structures.

Unit II

LINEAR DATA STRUCTURE Array: Representation of arrays, Applications of arrays, sparse matrix and its representation Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue Linked List: Singly Linked List, Doubly Linked list, Circular linked list ,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.

Unit III

NONLINEAR DATA STRUCTURE : Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees, AVL trees, 2-3 trees, Height Balanced, Weight Balance, Graph-Matrix Representation Of Graphs, Elementary Graph operations,(Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree)

Unit IV

HASHING AND FILE STRUCTURES : Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods, Sorting – Bubble Sort, Selection Sort, Quick Sort, Insertion Sort Merge Sort, Searching – Sequential Search and Binary Search

References :

1. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Tata McGraw Hill.
2. Data Structures using C & C++ -By TenenbaunPrenctice-Hall International.
3. Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed.
4. Fundamentals of Data Structures in C++-By SartajSahani.
5. Data Structures: A Pseudo-code approach with C -By Gilberg&Forouzan Publisher Thomson Learning.

Course No. MCA-202-CR
Course Title: Numerical and Statistical Computing

UNIT I

Approximations & Errors – Types of Programming Errors, Data Errors, Computer & Arithmetic Errors, Round Off and Truncation Errors. Accuracy and Precision, Measures of Accuracy,Error Propagation.

Non-Linear Equations, Types of Methods to find solutions to nonlinear equations, Algorithms to Compute Roots of Equation – Methods of Tabulation or Brute Force Method, Method of Bisection, Secant Method, Newton-Raphson Method, Method for False Position.

Derivation of mathematical formulas, geometricinterpretationand implementation of these methods.

UNIT II

Linear Equations, Types of Methods to find solutions to linear equations. Algorithms to Solve Linear Algebraic Equations: Gauss Elimination, Gauss Jordan, Gauss Seidel, L.U. Decomposition, Lagrange Interpolated Polynomial, Newton'sMethods of INTERPOLATION – Forward difference, Backward difference.

Derivation of mathematical formulasand implementation of these methods.

UNIT III

Differential Equations – Concepts and Terminology, Algorithms to solve Ordinary Differential Equations – Euler Method and Modification. The trapezoidal Rule, Simpson's Rule. 4^{th} order R-K Method.

Derivation of mathematical formulas and implementation of these methods.

UNIT IV

Standard Deviation, Correlation, Regression Analysis, Algorithms for Curve Fitting straight line: Least Square Approximation. Concept of Hypothesis, Statistical Tests: Chi-Square Test, Student t-Test, f-Test.

REFERENCE BOOKS:

1. S.C.Chapra&R.P.Canale: "Numerical methods for Engineering". Tata McGraw Hill.
2. Krishenmurty and Sen : "Numerical Algorithms"
3. V. Rajaraman "Computer oriented numerical methods." Prentice Hall of India.
4. McCalla, Thomas Richard: "Introduction to Numerical Methods and FORTRAN Programming", John Wiley & Sons, Inc.
5. Grewal, B. S.: "Higher Engineering Mathematics", Hindustan Offset Problems Series.
6. "SCHAUM'S Solved Problems Series".
7. Sharma, K. D.:"Programming in Fortran".
8. Jain, M. K., Iyengav, S. R. K., Jain, R. K.: "Numerical Methods for Scientific and Engineering Computation"+, Wiley Eastern Ltd, New Delhi.

Course No: MCA-203-CR
Course Title: Advanced Data Communication

Unit I

Bandwidth and Channel Capacity. Quantifying Channel Capacity for noiseless channel(Nyquist Law) and noisy channel(Shannon's Law). Example of a digital telephone system to explain basic concepts of analog signals, digital signals, sampling. Data Rate versus Baud Rate. Nyquist Criterion for Sampling. Data transmission concepts. Characteristics of signals(amplitude, frequency, period, wavelength). Signal-to-Noise ratio. Local area network(LAN) concepts and characteristics.

Unit II

Wide area networks(WANs). WAN technologies (traditional packet and circuit switching, Frame Relay, ATM). ISDN(narrowband) concepts and services. Overview of the OSI model. Transmission media – factors affecting distance and data rate. Guided transmission media: Twisted-Pair, Co-axial Cable. Principles and advantages of optical networks. Types of optical fibers and lasers.

Unit III

Unguided transmission media: Terrestrial Microwave & Satellite Microwave systems and applications. Data encoding. Difference between modulation and encoding. NRZ-L, NRZ-I encoding. Multilevel Binary and Biphase Coding techniques and their implementations. ASK,FSK,PSK and QPSK. PCM concepts: sampling, quantization. Amplitude Modulation.

Unit IV

Reliable transmission of data: Asynchronous and Synchronous transmission. Error detection: Parity-based, CRC-based. FCS computation. Error control and recovery techniques. Concept of ARQ standard and its versions. Concept of Multiplexing. FDM. Synchronous and Statistical TDM.

Reference Books:

1.William Stallings, "Data and Computer Communications", Pearson Education
2.AndrewTanenbaum, "Computer Networks", Pearson Education 4/e.
3. Ulysses Black, "Principles of Data Communications ", PHI.
4. Morley, Gelber, "The Emerging Digital Future", Addison-Wesley.

Course No: MCA-204-DCE
Course Title: Advanced Computer Architecture

Unit I

Introduction to Parallel Processing: basic concepts (Program, process, thread,concurrent & parallel languages), classification of parallel architectures, basic parallelisation techniques and their application in various parallel architectures; Instruction Level Parallelism (ILP): dependencies &hazards (Data, control, resource), dynamic scheduling, basic compiler techniques for exposing ILP, speculations, preserving sequential consistency, the speedup potential of ILP; Introduction to various ILP approaches (Pipelined, VLIW and superscaler processors): principles, structures and performance. !

Unit II

Thread-Level Parallelism: MIMD architectures and its classifications; Shared-Memory & Distributed-Memory MIMD architecture(Cache coherence problem, Synchronisation, Memory consistency, Interconnection topologies); Introduction to various Multithreaded architectures(Von Neumman-based, data-flow based, and hybrid). !

Unit III

Data-Level Parallelism Introduction to data-parallel architectures, connectivity, loop-level parallelism (detection & enhancement); SIMD Architecture: Granularity, Connectivity,Complexity, autonomy; Vector Architecture: Word length, vectorisation, pipelining, parallel computing streams; Systolic Architectures: dimensionality, precision, programmability, connectivity, synchronicity. !

Reference Books :

1. "Advanced Computer Architecture", Dezso Sima , Terence Fountain , Peter Karsuk: Pearson Education,
2. "Computer Architecture: A Quantitative Approach", John L. Hennessy, and David A. Patterson:Morgan Kaufmann (Elsevier imprint)
3. "Computer Organization", V.C. Hamacher. A.G. Vranesic and S. G. Zaky: Tata McGraw Hill.
4. "Computer Architecture and Organization", J.P. Hayes: McGraw Hill.

Course No: MCA-205-DCE
Course Title :Advanced Operating Systems

Unit I

Introduction to Distributed Systems: Motivation & Goals, Advantages & Disadvantages of Distributed Systems over Centralized Systems, Hardware & Software Concepts. Design Issues: Transparency, Flexibility, Performance, Scalability, Heterogeneity, Reliability and Security. Concept of Client-Server Model

Unit II

Remote Procedure Calling (RPC): Motivation, Mechanism, Complexity, Design Issues & Classification. Synchronization in Distributed Systems: Physical Clock Synchronization (Centralized & Distributed Algorithms), Logical Clocks. Mutual Exclusion: Centralized & Distributed (Contention & Token) Algorithms. Election Algorithms: Bully Algorithm, Invitation Algorithm & Ring Algorithm.

Unit III

Deadlock Detection: Centralized & Distributed Algorithms. Threads: Characteristics, Advantages & Disadvantages, Design Issues & Usage. System Models: Workstation Model, Processor Pool Model & Hybrid Model. Processor Allocation: Goals & Design Issues.

Filesystems: Hierarchical filesystems, Distributed Filesystem (DFS): goals, Requirements, Components, Service Types. SUN-NFS: Design & Issues.

Reference Books:

1. A. S. Tanenbaum, "Distributed Operating systems", Pearson Education, 2008.
2. Couloris et. al., "Distributed Systems: Concepts and Design", Pearson Education, 2005.
3. P. K. Sinha, "Distributed Operating Systems: Concepts & Design", PHI Learning, 2007.

Course No: MCA-206-DCE
Course Title: Optimization Techniques

Unit I

Linear Programming Problem (LPP): Formulating LPPs, Simplex Algorithm, Two-Phase Method.

Duality in LPP: Duality Theorems, Dual Simplex Method

Assignment problems: Algorithm, Unbalanced Assignment Problem, Hungarian Method

Unit II

Transportation Problems: Mathematical Formulation of Transportation problem, Selecting initial basic feasible solution Using Vogel's approximation method: Unbalanced Transportation Problem; Degeneracy in Transportation Problem and its resolution through MODI Method (U-V Method).

Game theory: Definition and Terminologies; Pure Strategy: saddle point, Game with two saddle points; mixed strategies: games without saddle points, Dominance Property.

Sequencing models: Sequencing of n jobs on two machines and three machines with no passing.

Unit III

Inventory Models: Stochastic order level system

Replacement Theory: Replacement of items that deteriorate with time, Replacement of items that fail suddenly.

CPM- Determination of critical tasks.

PERT- probability of completing the project on schedule.

Reference Books:

1. H.A.TAHA," Operations Research". Pearson Education
2. S.D. Sharma," Operations Research & Optimization".
3. KantiSwaroop, " Operations Research and Applications
4. R. PanneerSelvam :Operations Research"
5. N.D. Vohra "Quantitative Techniques"

Course No: MCA-207-DCE
Course Title : MANAGEMENT INFORMATION SYSTEM (MIS)

Unit I

Organization and Information Systems , The Organization: Structure, Managers and activities - Data, information and its attributes - The level of people and their information needs - Types of Decisions and information - Information System, categorization of information on the basis of nature and characteristics. , Transaction Processing System (TPS) - Management Information System (MIS) - Decision Support System (DSS) and Group Decision Support System (GDSS).

Unit II

Need for System Analysis - Stages in System Analysis - Structured SAD and tools like DFD, Context Diagram Decision Table and Structured Diagram. System Development Models: Water Flow, Prototype, Spiral, RAD – Roles and responsibilities of System Analyst, Database Administrator and Database Designer.

Unit III

Enterprise Resources Planning (ERP): Features, selection criteria, merits, issues and challenges in Implementation - Supply Chain Management (SCM): Features, Modules in SCM - Customer Relationship Management (CRM): Phases. Knowledge Management and e-governance, Security and Ethical Challenges , Ethical responsibilities of Business Professionals – Business, technology, Computer crime – Hacking, cyber theft, unauthorized use at work. Ergonomics and cyber terrorism.

RECOMMENDED BOOKS:

1. "Management Information Systems", Kenneth J Laudon, Jane P. Laudon, Pearson/PHI,10/e, 2007
2. "Management Information Systems", W. S. Jawadekar, Tata McGraw Hill Edition, 3/e, 2004
3. Turban, Efraim, Ephraim McLean, and James Wetherbe. 2007. Information Technology for Management: Transforming Organizations in the Digital Economy. New York, John Wiley & Sons.

Semester - III

Course No.: MCA-301-CR

Course Title: Design and Analysis of Algorithms

Unit I

Introduction to Algorithms, Analysis of algorithms, Designing Algorithms, Growth of Functions, Asymptotic notations, Recurrences , Substitution method , Iteration method, Recursion trees , The Master Method, Time and Space Complexity study of some basic algorithms.

Unit II

Randomized Algorithms: Identifying the repeated element, Primality testing, Advantages and Disadvantages.

Divide and Conquer, General method, Binary search, Quick sort.

Greedy Method, General method, Knapsack problem, Single source shortest paths.

Unit III

Dynamic programming, General methods, All pair shortest paths, Traveling salesman problems.

Backtracking, General method, 8-Queen problem, Sum of subsets, Knapsack problem.

Branch and Bound, General method, Least Cost Branch and Bound, 8-Queen Problem,

Unit IV

Lower boundary theory, Lower bound theory through reductions, P and NP problems. NP hard and NP complete problems. Approximate Algorithms and their need, The vertex Cover Problem, The traveling salesman problem, The subset sum problem.

Text Book:

2. Pearson Horowitz, Sahni, " Fundamentals of Computer Algorithms", Galgotia Publications
3. Goodrich and Tamassia " Algorithm design"

Reference Books:

1. Coremen, Leiserson, Rivest,Stein, "Introduction to Algorithms", 2nd edition, PHI.
2. Aho, Hopcroft and Ullman, "The Design and Analysis of Computer Algorithms", Pearson.

Course No: MCA-302-CR
Course Title : Advanced Computer Networks

Unit I

Goals and applications of networks. LAN, MAN & WAN architectures. Concept of WAN subnet. Overview of existing networks. OSI Reference Model Architecture, TCP/IP Model and their comparison.

Unit II

Internetworking concept and architectural model. Connection-oriented and connection-less approaches. Concept of Autonomous systems and Internetwork Routing. Classful IP addresses. Subnetting, IP Multicasting. Internet Protocol (IP): connectionless delivery of datagrams (MTU, fragmentation, reassembly).

Unit III

Internet control protocols: ICMP, ARP and RARP. Routing algorithms: Interior (OSPF), Exterior (BGP). Transport Layer: UDP and TCP concepts.
Socket API for Network Programming.

Unit IV

Client-Server application development using TCP & UDP sockets. Basic Server Architectures. Network Security: Firewalls and their components; Encryption techniques and examples of encryption standards.

Reference Books:

1.AndrewTanenbaum, ”Computer Networks”,4th Edition by Pearson.
2.Douglas Comer, ”Internetworking with TCP/IP, Volume 1”, Pearson.
3.W.Richard Stevens, “UNIX Network Programming”, Pearson.
4.Maufer, “IP Fundamentals”, Pearson.
5. Douglas Comer, “Client-Server Programming with TCP/IP, Volume 3”,Pearson.

Course No.: MCA-303-CR

Course Title: Advanced Software Engineering

UNIT I: TESTING BASICS & TEST CASE DESIGN

Software Testing Techniques Classification. Test case design strategies. Evaluating test adequacy criteria. White Box Testing: Static white box testing, dynamic white box testing. Structural Testing - Control Flow Testing and its techniques. Data Flow Testing and its techniques. Mutation testing and its techniques. Automated code coverage analysis. Test Adequacy Criteria, Additional white box test design approaches. Black Box Testing: Static black box testing, dynamic black box testing, Functional testing and its techniques, Random testing and its techniques. Additional black box test design approaches, Black box testing and COTS.

UNIT II: SOFTWARE TESTING EXECUTION & TESTING TOOLS

Unit test – Unit test planning – Designing the unit tests – The class as a testable unit – The test harness – Running the unit tests and recording results – Integration tests – Designing integration tests – Integration test planning – System test – The different types – Regression testing – Alpha, beta and acceptance tests.

UNIT III: SOFTWARE RELIABILITY

Introduction to Software Reliability: Basic Concepts, Software Reliability, Hardware Reliability, System Reliability, Software Reliability metrics, Operational Profile, Reliability Modelling, General Model Characteristics, Execution Time Component, Calendar Time Component, Calendar Time to Execution Time Relationship, Markovian Models: Poisson Type Models, Binomial Type Models, Poisson Type Models versus Binomial Type Models, Numerical examples.

UNIT IV: SOFTWARE RELIABILITY MODELS

Specific Models: Finite and Infinite Poisson Type Models, Musa Basic Model versus Logarithmic Poisson Model. Numerical examples. Parameter Estimation: Maximum Likelihood Estimation versus Least Squares Estimation. Comparison of SRGMs: Comparison criteria, Calendar Time Modelling and its Estimation.

Text Book:

1. Roger S. Pressman - Software Engineering - A Practitioner's Approach, Sixth edition,
2. J.D. Musa, A. Iannino, K. Okumoto "Software Reliability: Measurement, Prediction and Application" Tata McGraw Hill
3. PankajJalote - An Integrated approach to Software Engineering, 3rd edition, Narosa Publication.
4. Sommmerville - Software Engineering. Pearson , 7/e , 2006.
5. SCHAUM'S Outlines, TMH.
6. James F. Peters Software Engineering – An Engineering Approach, Wiley& Sons

Course No: MCA-304-DCE
Course Title : Advanced Business Systems

Unit-I

ERP: An Overview, Evolution of ERP-MRP and MRP- II,
Problems of Information islands, Risks and Benefits of ERP, Major ERP Packages (SAP, Oracle, BAAN, PeopleSoft, QAD),
Market opportunities and problems in ERP selection and implementation.

Unit - 2

ERP implementation: Identifying ERP benefits team formation, consultant intervention, selec tion ERP, process of ERP implementation, Project Management and Monitoring, Measurin g benefits of ERP.

Unit- 3

Post ERP Implementation, Maximizing the ERP System, ERP and Related Technologies: Business Process Reengineering, ERP and World Wide Web, ERP and E-Business, Future directions and Trends in ERP

Suggested Readings:

1. Modern ERP: Select, Implement, and Use Today's Advanced Business Systems
2. Hammer, Michael and J. Champ, Reengineering the corporation
3. Leon, Alexis, Enterprise Resource Planning, Tata McGraw Hill
4. Ray, Rajesh, ERP, Tata McGraw Hill

Course No: MCA-305-DCE
Course Title: Data Warehousing

Unit I

Data warehouse: Definitions, features, building blocks/ components, data marts, Meta data in data warehouse; planning a data warehouse, Business requirements; data design, the architectural plan, Data storage specifications, Information delivery strategy. Architecture and Infrastructure: Concept of data warehouse architecture, operational infrastructure, physical infrastructure. The role of metadata, metadata types, metadata requirements.

Unit II

Principles of dimensional modeling: Dimensional modeling basics, Use of CASE tools, The STAR schema, The Snowflake Schema. Data Extraction, Data Transformation, Data Loading. Data Quality: Need, Data Quality Challenges, Data Quality Tools. Information access and delivery, Information delivery tools. Online Analytical Processing (OLAP): Features, functions, OLAP models,

Unit III

Physical Design in data warehouse: Steps, Physical Design considerations, Physical storage.
RAID technology, estimating storage sizes, Indexing the data warehouse: B-Tree Index, Bitmapped Index, Clustered Index, Performance Enhancement Techniques: Data Partitioning, Data Clustering, Parallel processing, data arrays. Data warehouse deployment.

Text Book: Paulraj Pooniah , " Data Warehousing Fundamentals " Wiley
Reference:
Alex Berson , Stephen J. Smith " Data Warehousing , Data Mining and OLAP , Tata McGraw Hill , 2004 Tenth reprint 2007.
Sam Anahory , Dennis Murray ," Data Warehousing in the real world " , Pearson Education

Course No: MCA-306-DCE
Course Title: Cloud Computing

UNIT-I

Introduction to Cloud Computing: Cloud Computing in a Nutshell, System Models for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles of Cloud Computing, Challenges and Risks, Service Models.

UNIT-II

Virtual Machines and Virtualization of Clusters and Data Centers, Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization Data-Center Automation.

Unit-III

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, parallel and distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments. Common Standards in Cloud Computing: The Open Cloud Consortium, the Distributed Management Task Force, Standards for Application Developers, Standards for Messaging. Internet Messaging Access Protocol (IMAP), Standards for Security, Examples of End-User Access to Cloud Computing.

Text Books :

1) John W. Rittinghouse, "Cloud Computing: Implementation, Management, and Security ". James F. Ransome, CRC Press 2009.
2) Kai Hwang. Geoffrey C.Fox, Jack J. Dongarra, “Distributed and Cloud Computing From Parallel Processing to the Internet of Things”, Elsevier, 2012.
3) RajkumarBuyya, James Broberg and Andrzej M. Goscinski,” Cloud Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing), Wiley Publishing ©2011
4) Raluca Ada Popa, Catherine M.S. Redfield, NickolaiZeldovich, and Hari Balakrishnan, “CryptDB: Protecting Confidentiality with encrypted Query Processing”23rd ACM Symposium on Operating Systems Principles (SOSP 2011), Cascais, Portugal October 2011.
5) A Fully Homomorhic Encryption Scheme, Craig Gentry, September 2009.
6) David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

Course No: MCA-307-DCE
Course Title: Advanced Web Programming

Unit - I

What is Internet?, Introduction to internet and its applications, E- mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, domain name server, internet address World Wide Web (WWW) : World Wide Web and its evolution, uniform resource locator (URL), browsers -Search engine, web saver - apache, IIS, proxy server, HTTP protocol.

Unit II

Java Script : Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security, Operators : Assignment Operators, Comparison Operators, Arithmetic Operators, Logical Operators, Short-Circuit Evaluation, String Operators, Special Operators, ? (Conditional operator), ,(Comma operator), delete, new, this, void Statements : Break, comment, continue, delete, do … while, export, for, for…in, function, if…else, import, labelled, return, switch, var, while, with, Core JavaScript (Properties and Methods of Each) : Array, Boolean, Date, Function, Math, Number, Object, String, regExp Document and its associated objects : document, Link, Area, Anchor, Image, Applet, Layer Events and Event Handlers : General Information about Events, Defining Event Handlers and events

Unit III

PHP : Why PHP and MySQL?, Server-side web scripting, Installing PHP, Adding PHP to HTML, Syntax and Variables, Passing information between pages, Strings, Arrays and Array Functions, Numbers, Basic PHP errors / problems. Advanced PHP and MySQL : PHP/MySQL Functions, Displaying queries in tables, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, Type and Type Conversions, E-Mail

References :

1. Web Design The complete Reference, Thomas Powell, Tata McGrawHill
2. HTML and XHTML The complete Reference, Thomas Powell, Tata McGrawHill
3. JavaScript 2.0 : The Complete Reference, Second Edition by Thomas Powell and Fritz Schneider
4. PHP : The Complete Reference By Steven Holzner, Tata McGrawHill

Semester - IV

Course No: MCA-401-CR
Artificial Intelligence

Unit I

Introduction to Artificial Intelligence, First Order Logic, Inference in First Order Logic, Prepositional Versus First Order Logic, Expert Systems, Forward chaining , Backward chaining, Conflict Resolution, Knowledge representation , Uncertainty theory.

Unit II

Search Algorithms , Heuristic search, Genetic Algorithms, Cross over, Mutation, Fuzzy Logic, Fuzzification, Fuzzy Sets, Hedges, Max-Product Inferencing, Max-Min Inferencing, Multiple Premise Inference, Multiple Rule Inference, Defuzzification.

Unit III

Knowledge in Learning, Learning Decision Trees , ID3 Algorithm, Inductive Learning Algorithms, AQ Algorithm, Ensemble Learning, Support Vector Machines, Statistical Learning Methods, Reinforcement Learning.

Unit IV

Neural Computing, Network Architectures and Learning Algorithms, Perceptron and its Limitations , Activation Functions, Multilayer Neural Networks, Training by Error Back Propagation, Self-Organising Nets, Kohonen Self-Organising Net.

TEXT BOOK:

1. Artificial Intelligence by Negnevitsky, Addison Wesley Publication.

References :

1. Patterson ," Introduction to Artificial intelligence and expert systems" , PearsonEducation
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill, 2003.
3. Luger, G.F., "Artificial Intelligence , Structures and Strategies for Complex Problem Solving",Pearson Education / Prentice Hall of India, 2002.
4. Russell, S. and Norvig, P., "Artificial Intelligence-A Modern Approach", Pearson Education / Prentice Hall of India.
5. Neural Computing: An Introduction; R Beale and T Jackson; Institute of Physics Publishing.

Course No: MCA-402-CR
Course Title: Advanced Computer Graphics

Unit I

Introduction to Computer Graphics. Applications of Computer Graphics. Graphic Display Devices_ Raster, Refresh, Random. Display Buffer, Concept of Double Buffering and Segmentation of Display Buffer. Use of Lookup tables.

Unit II

2-D Graphics. Cartesian and Homogeneous Coordinate Systems. Line drawing algorithms (Bressenhams and DDA). Circle and Ellipse Drawing Algorithms. 2-Dimensional Transformations.Conceptsof Window& Viewport, Window to Viewport Transformations. Filling, Boundary and Floodfill algorithms.

Unit III:

Clipping, Line Clipping Algorithms (Cohen-Sutherland Algorithm), 3-D Graphics, Projections: perspective and parallel projection transformations. 3-Dimensional Transformations. Hidden Surface Removal Techniques, Z-Buffer Algorithm, Back Face Detection.

Unit IV

Curves and Surfaces, Splines, Spline specification, Interpolated & Approximated Splines. Bezier Splines, Bezier Curves, Cubic Bezier Curves, Bezier Surfaces. B-Splines curves and surfaces. Fractals - Fractal Generation Procedure.Introduction to Illumination models and Surface rendering methods.

Text Book : Hearn and Baker " Computer Graphics" 2nd Edition , Pearson Education.

Reference Books

1. W.M.Newman and Sproull. "Principles of interactive Computer Graphics" ,TMH
2.Steven Harrington." Computer Graphics a Programming Approach" McGraw Hill.
3. Plastock and Kelley. "Schaums outline of theory and problems of computer Graphics"
4. David F Frogers and J Alan Adams. "Procedural Elements of Computer Graphics" McGraw Hill
5. David F Rogers and J Alan Adams. "Mathematical Elements of Computer Graphics" McGraw Hill
6. James. D. Foley, A Vandametal "Computer Graphics" Pearson.

Course No: MCA-403-CR
Course Title: Object Oriented Modeling, Analysis & Design

Unit 1

OOAD – Introduction , Applying UML and Patterns in OOAD , Assigning Responsibilities , What is analysis and Design , An Example , The UML , Iterative Development –an Unified Process idea , Additional UP Best Practices and Concepts , The UP Phases and Schedule oriented Terms , The UP disciplines. Process Customization and the development case. The Agile UP. The Sequential Waterfall Lifecycle. Inception. Artifacts that may start in inception, Understanding requirements, types of requirements.

Unit 2

Use –case Model , Writing requirements in context , goals and stories , background , use cases and adding value , use cases and functional requirements , use case types and formats . Goal and scope of a use case , Finding primary actors , goals and use cases , writing use cases in an essential UI-free style , Actors , Use Case Diagrams , Use Cases witin the UP , Case Study. Identifying other requirements. From inception to elaboration.

Unit 3

Use Case Model: Drawing System Sequence Diagrams. Example of an SSD. Inter System SSDs , SSDs and Use Cases , System Events and the System Boundary , Name System Events and Operations , Showing Use Case Text , SSDs within the UP. Domain Model : Visualizing Concepts , Domain Models , Conceptual Class Identification , Candidate Conceptual classes , Adding Associations , The UML association notation , NextGen POS Domain Model Associations , NextGen POS Domain Model , Adding Attributes , Non Primitive Data Type Classes , Adding Detail with Operation Contracts , Contract Sections , Post Conditions , Contracts , Operations and the UML. Operation Contracts within the UP.

Unit 4

From Requirements to Design , Interaction Diagram Notation , Sequence and Collaboration Diagrams , GRASP , Responsibilities and methods , interactions diagrams , Patterns , GRASP : Pattern of General Principles in Assigning Responsibilities , Information Expert , creator , Low Coupling , High Cohesion , Controller , Object Design and CRC Cards , Design Model : Use Case Realization with GRASP Patterns , Determining Visibility , Creating Design Class Diagrams , Mapping Design to Code. GRASP : More Patterns , Polymorphism , Pure Fabrication , Indirection , Protected Variations , GoF Design Patterns : Adapter , Factory , Singleton , Strategy , Façade , Observer / Publish-Subscribe / Delegation Event Model ,Relating Use Cases , Modeling Generalization , Refining the Domain Model , Adding New SSDs and Contracts , Modeling Behaviour in Statechart Diagrams , Designing Architecture with Patterns , Organizing the Design and Implementation Model Packages , Introduction to Architecture Analysis and the SAD.

Reference Books:

1. James Rumbaugh, “Object Oriented Models and Design” Pearson Education 2/e Harrington.”
2. C & Object Oriented Paradigm” John Viley& sons Publication
3. Ali Bahrani “Object Oriented Systems Development” McGraw -Hill 1999
4. Lafore Robert, “Object Oriented Programming in C++”, Galgotia Publications.
5. Balagurusami, E, “Object Oriented with C++”, Tata McGraw-Hill.

Course No: MCA-404-DCE
Course Title: Advanced UNIX/LINUX Programming

Unit I

Unix Basics: Introduction, history of Unix/Linux, Distributions & Desktop environments, Basic Commands, Text processing utilities & commands; data processing in Unix/Linux, Unix Administration – Directory & File Handling commands, File & Directory ownership/permissions.

Unit II

Introduction to Shell: Unix/Linux Shells, Bash Shell variables, parameters, Environment variables, local variables. Arithmetic, Relational and Logical operators.

Programming with Shell: Shell Programming using Bash, Different Shell constructs, looping statements, decision statements. Filename, variable and command substitution.

Unit III

GUI Development in Unix/Linux: Accessing Unix and Linux in GUI mode, Introduction to X Windows. Introduction to GUI development in Unix and Linux, Introduction to Qt as development tool. Introduction to various controls and forms in Qt. Designing simple forms in Qt, manipulating various controls in Qt.

References Books:

Jasmin Blanchette, Mark Summerfield, "C++ GUI Programming with Qt3", Prentice Hall, Open Source Series.
Neil Matthew, Richard Stones, "Beginning Linux Programming", 4th Edition, WROX/Wiley India Edition.
Matthias Dalheimer, "Programming with Qt", OReilly / Shroff Publishers(SPD India).
SriangaVeeraraghavan, "Shell Programming in 24 hours", SAMS/Techmedia.
Petersen, "LINUX, The Complete Reference", 6th Edition, Tata McGraw Hill(TMH).
Karnetkar, "Shell Programming", BPB Publications.

Course No: MCA-405-DCE
Course Title: Theory of Computation & Formal Languages

Unit I

Basic concepts of theory of computation: Formal Languages and Grammars, Finite State Transducers, Finite-State Automata and Regular Languages, Recursion, Pushdown Transducers,

Unit II

Context-Free Languages, Chomsky classification of grammars, Limitations of Recursive Finite-Domain Programs, Turing Machines. Programs and Turing Transducers, Universal Turing Transducers, Un-decidability.

Unit III

Introduction to resource-bounded computation, Time and Space, A Time Hierarchy, Nondeterministic Polynomial Time, some *NP*-Complete Problems

Text Book:

1. Hopcroft, J., and Ullman, J. (1979), "*Introduction to Automata Theory, Languages and Computation"*, Pearson Education.
1. P. Linz, "*Introduction to Formal Languages and Automata*", 3rd edition, 2000, Jones and Barlett, PWS Publishing Company.

Suggested Readings:

1. Eiton Gurarri : *Introduction to Theory of computation*, Computer Science press
2. Hopcroft J, R. Motwani, and J. Ullman, "*Introduction to Automata Theory, Languages and Computation,* 3rd Ed. 2006, Pearson Education.

Course No : MCA-406-DCE
Course Title: Natural Language Processing

Unit I

Introduction to Natural Language Processing, Finite-state automata and transducers, Computational morphology, N-gram language models; smoothing; interpolation; backoff.

Unit II

Part-of-speech tagging, Syntactic parsing: rule-based parsing; CYK algorithm; Earley's algorithm Computational semantics and lexical semantics, Computational lexicons: WordNet

Unit III

Word Sense Disambiguation and Induction, Roles and frames: FrameNet, Semantic Role Labeling , Discourse and dialogue, Statistical Machine Translation

References

1. Jurafsky and Martin. Speech and Language Processing, Prentice Hall, 2009.
2. Manning and Schűtze. Foundations of Statistical Natural Language Processing, MIT Press, 1999.
3. Larry Wall, Tom Christiansen, Jon Orwant. Programming Perl. O'Reilly. 1996. ISBN 1-56592-149-6.

Course No : MCA-407-DCE
Course Title: C# Programming

Unit I

Introduction to windows Programming. .Net Architecture and Platform, Creating windows forms Windows controls, The role of C# in the .net enterprise architecture. C# IDE, Basic Window Controls: Text Box, Label, Check Box, List Box, Checked List Box, Radio Buttons, Buttons, Tree View and List View Controls,Variables and Data Types,Program Flow Control in C#,Arrays,Console I/O,Error and Exception Handling.

Unit II

Objects and Type: Classes and Structs, Partial classes , static classes ,Function Overloading, Operator Overloading, Inheritance : Types of inheritance, virtual methods, hiding methods , Sealed classes and methods, Interfaces, Derived interfaces. Type safety, Type conversions, Boxing and unboxing , comparing objects for equality , Operator overloading , User defined casts. Delegates and Events, Strings and regular expressions, Collections, Array Lists, The Stack, Queue, and Sorted List class, Hash Tables.

Unit III

Multithreading in C#, ADO.NET overview, Using Database Connections ,Executing commands , The Data Reader, The Dataset Class Populating a Dataset , Persisting Dataset Changes , viewing .net data using Data Grid.

Text Book:

Professional C# 2008 by Christian Nagel , Bill Evgen , Jay Glynn Wrox Publications , 2008.

Reference

1. Dietel&Dietel , “C# , How to Program”,Pearson Education.
2. Visual C#.Net by John Sharp & John Jagger, PHI, New Delhi.
3. Visual Studio .Net by Francisco, Microsoft Publication.

Semester - V

Course NO: MCA-501-CR
Course Title : Java Programming

Unit I

Java Program Development , Java Source File Structure , Comparison with other languages (C & C++), Java and Internet, Features of Java, Java Virtual machine, ByteCode , Lexical Tokens, Identifiers, Keywords, Literals, Comments , Primitive Datatypes, Variables: Assignment, Initialization and Conversions,Operators: Arithmetic, Assignment, Modulus, Relational, Boolean, Bitwise., Precedence Summary ,Unicode Character Set , Arrays: Single and Multidimensional. Control Statements and Looping Structures

Unit II

Class Fundamentals , Object reference , Garbage Collection, Constructors, Access Control, Modifiers, methods , Nested , Inner Class & Anonymous Classes , Abstract Class, Argument Passing Mechanism , Method Overloading, Recursion , Dealing with Static Members. Finalize() Method, Native Method. Use of "this " reference , Cloning Objects, Generic Class Types, Inheritance in Java , Overriding Super Class Methods, Use of "super", Polymorphism in inheritance , Type Compatibility and Conversion ,Packages & Interfaces: Defining and importing packages , Understanding Class path , Implementing interfaces.

Unit III

Exceptions & Errors ,Types of Exception ,Control Flow In Exceptions , Use of try, catch, finally, throw, throws in Exception Handling ,In-built and User Defined Exceptions, Checked and UnChecked Exceptions, Operation on String ,Mutable & Immutable String , Using Collection Bases Loop for String , Tokenizing a String ,Creating Strings using StringBuffer , Multi-Threaded Programming ,Thread Life-Cycle , Thread Priorities , Synchronizing Threads , Inter -communication of Threads, DeadLock. Applet &Application , Applet Architecture, Parameters to Applet , Embedding Applets in Web page. Utility Methods for Arrays , Observable and Observer Objects , Date & Times , Using Scanner.

Unit IV

Streams, Input and Output Classes,The Standard Streams,File Object , File I/O Basics , Reading and Writing to Files ,Buffer and Buffer Management, Read/Write Operations with File Channel , Serializing Objects , The Collection Framework , Collection Types , Sets , Sequence , Map , Hashing ,Use of ArrayList& Vector , Event-Driven Programming ,The Event Delegation Model , Event Classes, Event Sources , Event Listeners , Adapter Classes, Anonymous Inner classes , Keyboard and Mouse Event Handling , Avoiding Deadlocks in GUI Code ,Networking Basics , Client-Server Architecture , Socket Overview, Networking Classes and Interfaces , Network Protocols ,Developing Networking Applications in Java

Suggested Readings:

1. Herbert Schildt, "The Complete Reference Java-2 " ,Sixth Edition 2004,Tata McgrawHill.
2. Dietel&Dietel, "Java: How to Program Java 2, Sixth Edition, 2006, Pearson Education.
3. Horstmann& Cornell, "Java2 Vol-1 & Vol-2",Seven Indian Reprint 2006, Pearson Education.
4. E. BalaGurudamy " Programming with java A Primer" 3rd edition

Course No.: MCA-502-CR
Course Title: Wireless Communications

Unit I

Classification and types of Wireless telephones. Introduction to Cordless, Fixed Wireless(WLL), Wireless with limited mobility(WLL-M) and (Fully)Mobile Wireless phones. Introduction to various generations of mobile phone technologies and future trends. Wireline vs. Wireless portion of mobile communication networks. Mobile-Originated vs. Mobile-Terminated calls. Mobile-Phone numbers vs. Fixed-Phone numbers.

Unit II

Concept of cells, sectorization, coverage area, frequency reuse, cellular networks & handoffs. Wireless Transmission concepts; types of antennas; concepts of signal propagation, blocking, reflection, scattering & multipath propagation. Comparison of multiple access techniques FDM, TDM and CDM. Concept of Spread Spectrum(SS) techniques; Frequency Hopping SS . Direct Sequence SS and concept of chip-sequence.

Unit III

Concept of Forward and Reverse CDMA channel for a cell/sector. Concept/derivation of Walsh codes & Code Channels within a CDMA Channel. Simplified illustration of IS-95 CDMA using chip sequences. Purpose of Pilot, Sync, Paging, Forward Traffic Channels. Purpose of Access & Reverse TCs.

Unit IV

GSM reference architecture and components of Mobile Networks: MS, BTS, BSC, MSC; their basic functions and characteristics. Use of HLR and VLR in mobile networks. Handoff scenarios in GSM.

References Books:

T. Rappaport, "Wireless Communications, Principles and Practice(2nd Edition)",Pearson.
Andy Dornan, "The Essential Guide to Wireless Communications Applications",Pearson.
Jochen Schiller, "Mobile Communications", Pearson.
K.Pahlavan, P.Krishnamurthy, "Principles of Wireless Networks", PHI.

Course No.: MCA-503-CR
Course Title: System Programming

Unit I

Introduction, Machine Structure , Evolution of the Components of programming system Evolution of Operating Systems, General Machine Structure , General Approach to a New Machine , Machine Structure 360-370, Machine Language. Assembly Language

Unit II

General Design Procedure, Assemblers, Design of an single pass assembler and multi pass assembler, Macros: two pass algorithm, single pass algorithm, Implementation of macro calls within macros

Unit III

Loaders and Linkers, Loader Schemes, subroutine linkages, relocating loaders, Linking loaders, Design of an absolute loader, Design of a direct linking loader.

Unit IV

Formal Systems and Programming Languages: Formal specification, Hierarchy of Languages, BNF, Canonic Systems and Formal Systems.
Compilers, Statement of problem, phases of Compiler-Lexical phase, syntax phase Interpretation phase, optimization, storage assignment code generation and assembly phase, Passes of a compiler.

Text Book: John J. Donovan, "Systems Programming", Tata McGrawHill

Reference Books:

Leland L.Beck."System Software" 4th edition Pearson 1997
Barron.D.W."Assemblers and Loaders" Mc Donald and Javes 1978
Ullman.J.D."Fundamentals of Programming System" Addison and Wesley D.M.Dhamdhere."System Programming and Operating Systems"2nd edition

Course No.: MCA-504-DCE

Course Title: Heterogeneous Biological Databases

Unit I

Introduction to biological databases, Definitions and concepts, Types of biological data, types of Biological Databases – flat file databases, relational databases, and object-oriented databases
Nucleotide Sequence databases: EMBL, GenBank, DDBJ; Genome databases, Protein Sequence Databases: SWISS-PROT, UniProt, PRINTS, PIR; Protein structure databases: PDB, CATH, SCOP.

Unit II

Metabolic pathway databases: Biocyc collection, KEGG Pathway database; PubMed database Search engines - SRS, Entrez; BLAST, FASTA
XML representation of biological data

Unit III

Ontologies in Bioinformatics: The need for ontologies (Gene naming, functional classifications, references schemes), Classification of ontologies – one dimensional, 2 dimensional, three dimensional, Gene ontology, EcoCyc etc.
Integration and querying of Biological Databases: Data integration issues, Warehouse Integration, mediator-wrapper based integration, navigational integration
Querying of biological data.

Reference Books:

1. Developing Bioinformatics Computer Skills, Cynthia Gibas& Per Jambeck, O'Reily
2. Bioinformatics – Databases, Tools and Algorithms, OrpitaBasu, Simminder Kaur Thukral, Oxford Higher Education.
3. Introduction to bioinformatics, T. K. Attwood & D J Parry-Smith, Pearson Education
4. Bioinformatics – A beginner's Guide, Jean-Michel Claveriw, CerdricNotredame, WILEYDreamTech India Pvt.
5. Krane ,"Bioinformatic", Pearson Education.

Course No: MCA-505-DCE
Course Title: Machine Learning

Unit I
MATLAB Concepts, Classification Algorithms, Euclidean Distance Classifier, Mahalanobis Classifier, Basic Sequential Algorithm Scheme, KMeans Algorithm, Fuzzy C-Means Clustering, Clustering with Gaussian Probability Density Function.

Unit II
Learning Algorithms, Support Vector Machines, Principal Component Analysis, Projection of Data to an Optimal Plane, Fisher Linear discriminant Analysis, Multiple Discriminant Analysis, Dimensionality Reduction.

Unit III
Emerging Topics in Machine Learning. This may include topics like Biometrics, Algorithms for Face Recognition, Finger Print Recognition, and Iris Recognition.

Reference Books :

1. *Machine Learning* by Tom M. Mitchel, McGraw-Hill publication
2. *Pattern Classification* by Duda and Hart. John Wiley publication
3. The Elements of Statistical Learning: Data Mining, Inference, and Prediction by Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer.
4. Learning From Data, Yaser S. Abu-Mostafa, Hsuan-Tien Lin, Malik Magdon-Ismail, AML Book.
5. Introduction to Machine Learning by EthemAlpaydin, The MIT Press.
6. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
7. Building Machine Learning Systems with Python by Willi Richert, Luis Pedro Coelho, Packt Publishing

Course No: MCA-506-DCE
Course Title: Modeling & Simulation

Unit I

Concepts of Systems, Models, and Simulation. Distributed Lag Model, Cobweb Models, The process of a simulation Study, Exponential Growth Models, Exponential Decay Models, Type of simulation, Discrete-Event Simulation: Time-Advance Mechanisms, Components and Organization of a Discrete-Event Simulation Model. Monte Carlo Method. Simulation of Single-Server Queuing System.

Unit II

Continuous Simulation: Pure-pursuit Problem.
Random Number Generators: Linear Congruential Generators, Other kinds of Generators, Testing Random-Number Generators.
Generating Random Variate: General Approaches, Continuous and Discrete distributions.

Unit III

Output Data Analysis for a Single System: Transient and Steady-State Behavior of a Stochastic Process, Type of Simulations with regard to output Analysis and Statistical Analysis for Testing Simulation. Verification and Validation of Simulation. Introduction to different types of simulation languages.

Reference Books:

- G. Gordon. "System Simulation", (3rd Edition) Pearson Education, 2000.
- Law and Kelton, "Simulation Modeling and Analysis", McGraw Hill, 2001.
- Fred Maryanski, "Digital Computer Simulation", CBSPD 1987
- James A. Pyne, "Introduction to Simulation- Programming Techniques and Methods of Analysis", McGraw Hill 1988
- Zeigler and Kim, "Theory of Modeling and Simulation", Academic Press, 2002
- Banks et al, "Discrete event Simulation", Pearson Education, 2001

Course No: MCA-507-DCE
Course Title: Image Processing

UNIT I

Introduction to digital image processing: Digital Image representation, Fundamental steps in image processing. Elements of digital image processing systems, Applications of digital image processing. Concepts of Spatial domain and Frequency domain Images, Fourier, Inverse Fourier, Fast Fourier.

UNIT II

Image Enhancement: Enhance in the spatial domain, some basic grey level transformations, Histogram processing, Enhancement using arithmetic/logic operations, Basics of spatial filtering, Smoothing of spatial filters, Sharpening spatial filters. Enhancement in frequency domain: Smoothing frequency domain filters, Sharpening frequency domain filters, Holomorphic filtering.

UNIT III

Image Restoration: Model of the image Degradation / Restoration process, Noise models, Restoration in the presence of noise only-spatial filtering, Linear, Position- invariant degradation, Estimating the degradation function, Inverse filtering, Minimum mean square error(Wiener) filtering, Constrained least squares filtering. Image segmentation: Detection of discontinuities, Edge linking and boundary detection, Threshold based segmentation, Region based segmentation. Image Compression models: Error criteria, Lossy compression, Loss-less compression.

Reference Books :

1) Digital image processing 2nd edition by Rafael C.Gonzalez,RichardE.Woods(Pearson edition).
2) Fundamentals of digital image processing by A.K.Jain(Pearson edition) .
3) Fundamentals of digital image processing by Catlemrene(Pearson edition).
4) Image processing analysis and machine vision by Milan Sonka,Vaclahlavac,Roger Boyle.
5) Digital signal processing by John G.Proakis, G.Manolakin “, 4/e Pearson Educatio

Semester – VI

Course No: MCA-601-CR
Course Title: Project Problem Identification& Seminar

Tutorial based

Course No: MCA-602-CR
Course Title: Project Problem Analysis

Tutorial based

Course No: MCA-603-CR
Course Title: Project Dissertation

Tutorial based

Course No: MCA-604-DCE
Course Title: Software Project Development

Tutorial based

Course No: MCA-605-DCE
Course Title: Software Research Development

Tutorial based