SIKKIM UNIVERSITY
Master of Computer Applications (3 Years)

[Session 2015 Onwards]

SEMESTER 1		
SUBJECT CODE	**SUBJECT NAME**	**CREDIT**
MCA-PG-C101	Mathematics I	4
MCA-PG-C102	Strategic Management	4
MCA-PG-C103	Computer Organization and Architecture	4
MCA-PG-C104	Data Structure and C Programming	4
MCA-PG-L105	Computer Organization and Architecture Laboratory	4
MCA-PG-L106	Data Structure Laboratory	4
		Total Credit: 24

SEMESTER 2		
SUBJECT CODE	**SUBJECT NAME**	**CREDIT**
MCA-PG-C201	Mathematics II	4
MCA-PG-C202	Operation Research	4
MCA-PG-C203	Operating System	4
MCA-PG-C204	Object Oriented Analysis and Design using Java	4
MCA-PG-L205	Operating System Laboratory	4
MCA-PG-L206	Advanced Java Laboratory	4
		Total Credit: 24

SEMESTER 3		
SUBJECT CODE	**SUBJECT**	**CREDIT**
MCA-PG-C301	Formal Language and Automata Theory	4
MCA-PG-C302	Accounting and Financial Analysis	4
MCA-PG-C303	Database Management System	4
MCA-PG-C304	Microprocessor and Microcontroller	4
MCA-PG-L305	Database Management System Laboratory	4
MCA-PG-L306	Hardware Design Laboratory	4
		Total Credit: 24

SEMESTER 4		
SUBJECT CODE	**SUBJECT**	**CREDIT**
MCA-PG-C401	Intellectual Property Rights & Professional Ethics	4
MCA-PG-C402	Software Engineering	4
MCA-PG-C403	Advanced Web Programming	4
MCA-PG-C404	Computer Networks	4
MCA-PG-L405	Advanced Web Programming Laboratory	4
MCA-PG-L406	Network Simulation Laboratory	4
		Total Credit: 24

SEMESTER 5		
SUBJECT CODE	**SUBJECT**	**CREDIT**
MCA-PG-D501	Dissertation I	16
	Elective I	4
	Elective II	4
		Total Credit: 24

SEMESTER 6		
SUBJECT CODE	**SUBJECT**	**CREDIT**
MCA-PG-D601	Dissertation II	24
		Total Credit: 24
		Total MCA Credit: 144

List of Elective I		
SUBJECT CODE	**SUBJECT**	**CREDIT**
MCA-PG-E502	Cloud Computing	4
MCA-PG-E503	Digital Image Processing	4
MCA-PG-E504	Cryptography and Network Security	4
MCA-PG-E505	Computer Graphics	4
MCA-PG-E506	Internet of Things	4
MCA-PG-E507	Embedded Systems	4
	List of Elective II	
MCA-PG-E508	Managerial Economics	4
MCA-PG-E509	Fuzzy Logic and Applications	4
MCA-PG-E510	Compiler Design	4
MCA-PG-E511	Big Data Analytics	4
MCA-PG-E512	Document Processing and Information Retrieval	4

Abbreviations: C-Compulsory, D-Dissertation, E-Elective, L-Laboratory

MCA-PG-D501 and MCA-PG-D601 (Dissertation I and **II)** are designed to advocate the needs of innovative technical contributions to the fields of computer science and applications. The students studying in semester 5^{th} and 6^{th} are required to work for a dissertation on a research topic assigned and approved under the supervision of one or more SU faculty member. In special circumstances joint supervisor from reputed institutes may be assigned on the topic of the student, in such case one internal supervisor shall always act as the guide.

Dissertation I shall focus on critical reviews of recent advances on the assigned topic of computer science and applications or interdisciplinary background with some novel contribution by the student. Dissertation has been divided into two parts: i) Internship Programme** (Credit:4) ii) Mini Project/Research (Credit:12)

Dissertation II shall cater to the implementation of the assigned topic either on theoretical and/or practical depending upon the research work done so far by the student. The student must publish the findings of the research work in at least 1 peer reviewed journal as indexed by the Web of Science (Science Citation Index/Science Citation Index expanded) or as minimum stature not less than SCOPUS and/or conference proceedings (IEEE Explore/ACM DL). The acceptance letter from the journal and/or conference should be submitted during the submission of the research work/thesis. The evaluation of the dissertation shall be monitored by the Department time to time. The student has to defend his/her dissertation in seminar.

In special circumstances, Department may allow the students to carry on the **Dissertation II** outside the University. However, in this case **Dissertation I: project work of Credit 12** should be carried within University and **Dissertation I** and **II** may not be related.

****Internship:** Students studying in 4th semester shall be required to pursue at least 3 weeks' internship programme in terms of Summer School/ Academic Visit/ Short Term Course/ Industry Visit/ In House Project. The credit may be included in next semester in the form of marks in the subject Dissertation I (MCA-PG-D501).

Note: Project mentioned under the particular curriculum shall be mandatory and shall include divisional marks as per the decision made by the concerned faculty or Departmental Committee.

MCA-PG-C101	Mathematics I	Credit: 4

UNIT I (12 Hrs)

Differential Calculus: Method of differentiation, Differentiation for first principles, Differentiation of product, Successive differentiation, Differentiation of implicit and parametric functions, Logarithmic and Partial differentiation, Maxima and Minima.

UNIT II (12 Hrs)

Integral Calculus: Standard integration, Definite integral, Application of integration, Substitution and partial fraction, Integration by parts, Reduction, First order differential equation, Homogeneous differentiation, First order and second order differentiation, Partial differential equation.

UNIT III (12 Hrs)

Laplace Transform: Properties, Inverse LT, Solutions of differential equations using LT, Solutions of simultaneous differential equations using LT.
Fourier Series: Periodic functions of period 2Π, Non-Periodic functions of period 2Π, Even-odd function and half range Fourier series, complex or exponential form Fourier series.

UNIT IV (12 Hrs)

Interpolation and Polynomial Approximation: Lagrange Polynomial, Divided Differences, Hermite Interpolation **Numerical integration and differentiation:** Trapezoidal rule, etc., Gaussian quadrature and Euler-Maclaurin formula. **Applied Linear Algebra:** Direct methods for solving linear systems, numerical factorizations, Eigenvalue problems. **IVP problems for ODE:** Euler's, Taylor, Runge-Kutta, and multistep methods, Stability.

References

1. J. Bird, Engineering Mathematics, Elsevier, 2010
2. B.S. Grewal, Higher Engineering Mathematics, 42E, Khanna publishers, 2012
3. B.V. Ramana, Higher Engineering Mathematics, TMH, 2006
4. S. S. Sastry, Introductory Methods of Numerical Analysis 5E, PHI, 2012
5. S. R. K. Iyengar, Mahinder Kumar Jain, R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 6E, 2012

MCA-PG-C102	Strategic Management	Credit: 4

UNIT I (12 Hrs)

Introduction to Strategic Management: Define Strategy, Strategic Management Process, Levels of Strategies: Corporate, Business and Operational level, Types of Strategies: Functional Strategies, H. R Strategy, Marketing strategy, Financial Strategy, Operational Strategy.
Formulation of Strategy and Strategic Implementation: Business Environment, Components of Environment, Environmental Scanning, Analysis of Strategies and Choice of Strategy.

UNIT II (12 Hrs)

Business, Corporate and Global Strategies: Practices and Issues: Introduction to Corporate Restructuring, Need for corporate restructuring and forms of corporate restructuring.
Evaluation of Strategic Alternatives, Types of Strategic Alternatives like Portfolio, Analysis and its

techniques, SWOC Analysis, Profit Impact of Market Strategy (PIMS).

UNIT III (12 Hrs)

Culture of Organization: Management of Strategies and Cultures, Strategies for Foreign Direct Investment and International Trade in India

New Emerging Strategies in Information Communication Technology (ICT): Concept of Outsourcing, Strategic Reasons of growing Outsourcing in India.

UNIT IV (12 Hrs)

MIS: Meaning of Management Information system (MIS), Strategic MIS, Characteristics of Strategic MIS System and Barriers to Successful Development of Strategic MIS System.

Business firms using Information Technology for creating Strategic Advantages: Reengineering Business Processes, Virtual Company Strategies, knowledge creating Company Emerging Strategies in Telecommunication Sector.

References

1. Mason A. Carpenter, Wm. Gerard Sanders, Prashant Salwan, Strategic Management, A Dynamic Perspective - Concepts and Cases, Dorling Kindersley (India) Pvt Ltd, Pearson Education.
2. Jay B. Barney, William S. Hesterly, Strategic Management and Competitive Advantage-Concepts, PHI Learning Private Limited.
3. V. P. Michael, Globalization, Liberalization and Strategic Management.
4. Sukul Lomash and P.K Mishra, Business Policy and Strategic Management, Vikas Publishing House Pvt. Ltd.
5. Fred R. David, Strategic Management, Prentice Hall International.

MCA-PG-C103 Computer Organization and Architecture **Credit: 4**

UNIT I (12 Hrs)

Introduction to Digital Logic: Basics of Gates (ANR, OR, NOT, XOR, NAND, NOR etc.), Basics of combination logics (Adder, Subtractor, Decoder, Multiplexer, Comparator etc.) and sequential logics (Flip Flop: SR, JK, T, D, Counter, Register etc.).

Basic Blocks of a Computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study - instruction sets of some common CPUs.

UNIT II (12 Hrs)

Data Representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, carry save multiplier, etc. Division - non-restoring and restoring techniques, floating point arithmetic.

Control Unit Design: hardwired and micro-programmed design approaches, Case study - design of a simple hypothetical CPU

Memory System Design: semiconductor memory technologies, memory organization.

UNIT III (12 Hrs)

Peripheral Devices and their characteristics: Input-output subsystems, I/O transfers - program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programmes and processes: role of interrupts in process state transitions; Performance enhancement techniques.

UNIT IV (12 Hrs)

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.
Memory Organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size versus block size, mapping functions, replacement algorithms, write policy.

References

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Elsevier, 2012.
2. Carl Hamachar, Zvonco Vranesic and Safwat Zaky, Computer Organization, McGraw Hill, 2002.
3. John P. Hayes, Computer Architecture and Organization, McGraw Hill, 1998.
4. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson Education, 2007.
5. Vincent P. Heuring and Harry F. Jordan, Computer Systems Design and Architecture, Pearson Education, 2008.

MCA-PG-C104 Data Structure and C Programming Credit: 4

UNIT I (12 Hrs)

Introduction to Computing: Computer Generation, Languages (Assembly, Machine, High Level), Compiler & Interpreter, Introduction to C (syntax, variables, data type, array, function, pointer, structure, union, file).
Introduction to Data Structures: Definition, Classification of data structures (Linear and Non-Linear), Operations on data structures. Complexity: Time-Space complexity.

UNIT II (12 Hrs)

Sorting and Searching Techniques: Bubble, Selection, Insertion, Shell sorts and Sequential, Binary, Indexed Sequential Searches, Interpolation, Binary Search Tree Sort, Heap sort, Radix sort.
Linked Lists: Representation of linked lists in memory-Operations on linked list (Insertion, Deletion, and Display): Circular linked lists (Insertion, Deletion, Display), doubly linked linear list (Insertion, Deletion, Display): Applications of linked linear lists.

UNIT III (12 Hrs)

Stacks: Concepts, Operations, sequential and linked implementation, Application of stacks: Towers of Hanoi, Infix, Prefix and Postfix expressions and Evaluation of postfix expression using stacks Queues Concepts, operations, sequential and linked implementation, Linear Queue (FIFO), Circular queues, and application of queues.

UNIT IV (12 Hrs)

Trees: Binary trees, Complete Binary tree, AVL Tree, B Tree, B+ Tree, Binary Search Trees: Searching, Inserting and deleting in Binary Search Trees, Traversals on a BST (In-order, post-order, pre-order, DFS, BFS), Application of Trees.
Hashing: Hashing Techniques: Hash function, Address calculation techniques, Common hashing functions, Collision resolution, Linear probing, Quadratic, Double hashing, Bucket hashing, Deletion and rehashing. Indexing.

References

1. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press, 2001.
2. J. Kleinberg and E. Tardos, Algorithm Design, Addison-Wesley, 2006.
3. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins. 1991.
4. A. Gibbons, Algorithmic Graph Theory, Cambridge University Press, 1985.
5. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet

Examples, John Wiley, 2006.
6. R. Sedgewick, Algorithms in C: Part 5, Addison Wesley, 2001.
7. M. H. Alsuwaiyel, Algorithm Design Techniques and Analysis, World Scientific, 1999.
8. Gilles Brassard and Paul Bratley, Algorithmics: theory and practice, Prentice-Hall, 1996.
9. Udi Manber, Introduction to Algorithms: A Creative Approach, Addison-Wesley, 1989.
10. Sara Baase and Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, Addison-Wesley, 2000.

MCA-PG-L105 Computer Organization and Architecture Laboratory **Credit: 4**

Laboratory Experiments

1. Verify the truth tables of AND, OR, NOT, NAND, NOR, XOR, and XNOR GATES.
2. Verify that NAND and NOR gates are universal gates.
3. Design a Half adder circuit, Full adder circuit.
4. Design a Half subtractor and Full subtractor circuit.
5. Design a Parallel Adder and Subtractor.
6. Design a Comparator.
7. Design a circuit to convert from Binary to Gray code.
8. Design a circuit to convert from Gray code to Binary.
9. Design a circuit to convert from BCD to Excess-3 code.
10. Design a circuit to convert from Excess-3 to BCD code.
11. Design and implement of Decoder.
12. Design and implement of Encoder.
13. Design and implement of Multiplexer.
14. Design and implement flip flop (SR, JK, D, T, JK Master-Slave).
15. Design of Counters (Ring and Johnson).
16. Design and implement 3-bit binary asynchronous (Ripple) and synchronous counter.
16. Design and implement of Shift registers (SISO, SIPO, PIPO, PISO).
17. Design and implement of Sequence Generator.
18. Implementation of arithmetic algorithms using ALU.
19. Bread Board implementation of Seven Segment Display.
20. Basics of Verilog HDL and VDHL.

MCA-PG-L106 Data Structure Laboratory **Credit: 4**

Laboratory Experiments

1. Write a program to calculate the factorial and Fibonacci series of given number using recursive function.
2. Write a program to use macros as an array and pointers.
3. Write a program to implement linear and binary search also find the location of its first occurrence
4. Write a program to sort the array in ascending/descending order using a) Quick sort b) Merge sort
5. Write a C Program to perform the basic Matrix operations like add, subtract multiply, transpose.
6. Write a program to create a linked list and to perform insert and delete operations (insert at beginning, at last, at any position and same for delete function)
7. Write a program to add two polynomials using a linked list.
8. Write a program to perform insert and delete operations in a circular linked list.
9. Write a program to perform operations on a stack (linked list and array implementation)
10. Write a program to solve the problem of towers of hanoi with 3 pegs and N discs.
11. Write a program to perform operations on a circular queue (linked list implementation).
12. Write a program to a) find the length of a string b) concatenate two strings c) to extract a substring from a given string d) finding and replacing a string by another string in a text (Use pointers and user-defined functions)
13. Write a program to convert the given infix expression into its postfix form.
14. Write a program to evaluate the postfix expression with a set of values.
15. Write a program to devise an expression tree for any given arithmetic expression.
16. Write a menu driven program to create binary tree and to perform insert and delete operations.
17. Write a menu driven program to create a binary search tree and to perform inorder, preorder and postorder traversals (recursive and non-recursive)

18. Write a program sort the array of N elements using Heap Sort.
19. Write a program to implement sorting and searching techniques.
20. Write a program which reads the record of a new employee and inserts the record into the file.
21. Design a linked list data structure to represent the node of an m-way search tree. Write functions like Search_Mway, Insert_Mway and Delete_Mway to perform search, insert and delete operations.
22. Write a program to delete a given ITEM from the AVL search tree T.

MCA-PG-C201 Mathematics II	**Credit: 4**

UNIT I (12 Hrs)

Mathematical reasoning; propositions; negation disjunction and conjuction; implication and equivalence; truth tables; predicates; quantifiers; natural deduction; rules of Inference; methods of proofs; use in program proving; resolution principle; application to PROLOG.

UNIT II (12 Hrs)

Set theory; Paradoxes in set theory; inductive definition of sets and proof by induction; Peono postulates; Relations; representation of relations by graphs; properties of relations; equivalence relations and partitions; Partial orderings; Posets; Linear and well-ordered sets.

UNIT III (12 Hrs)

Graph Theory; elements of graph theory, Euler graph, Hamiltonian path, trees, tree traversals, spanning trees; Functions; mappings; injection and surjections; composition of functions; inverse functions;special functions; Peono postulates; pigeonhole principle; recursive function theory.

UNIT IV (12 Hrs)
Definition and elementary properties of groups, semigroups, monoids, rings, fields, vector spaces and lattices; Elementary combinatorics; counting techniques; recurrence relation; generating functions.

Note: Students shall present solutions to the problems identified by the instructor.

References

1. C. L. Liu, Elements of Discrete Mathematics, 2E, McGraw-Hill, 2000.
2. K. H. Rosen, Discrete Mathematics and applications, 5E, TMH, 2003.
3. J .L. Mott, A. Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, 2E, PHI, 1986.

MCA-PG-C202 Operation Research	**Credit: 4**

Unit I (12 Hrs)

Operations Research: Uses, Scope and Applications of Operation Research in managerial decision-making.
Decision-making environments: Decision-making under certainty, uncertainty and risk situations; Decision tree approach and its applications.

Unit II (12 Hrs)

Linear programming: Mathematical formulations of LP Models for product-mix problems; graphical and simplex method of solving LP problems; sensitivity analysis; duality.
Transportation problem: Various methods of finding Initial basic feasible solution and optimal solution. Assignment model: Algorithm and its applications.

Unit III (12 Hrs)

Game Theory: Concept of game; Two-person zero-sum game; Pure and Mixed Strategy Games; Saddle Point; Odds Method; Dominance Method and Graphical Method for solving Mixed Strategy Game.
Sequencing Problem: Johnsons Algorithm for n Jobs and Two machines, n Jobs and Three Machines, Two jobs and m - Machines Problems.

Unit IV (12 Hrs)

Queuing Theory: Characteristics of M/M/I Queue model; Application of Poisson and Exponential distribution in estimating arrival rate and service rate; Applications of Queue model for better service to the customers.

Replacement Problem: Replacement of assets that deteriorate with time, replacement of assets which fail suddenly. Project Management. Rules for drawing the network diagram, Applications of CPM and PERT techniques in Project planning and control; crashing of operations.

References

1) H. Taha, Operations Research - An Introduction, Prentice-Hall, 2008.
2) R. Panneerselvam, Operations Research, EEE, 2006.
3) Kothari, Quantitative Techniques, Vikas, 2009.
4) V.K. Kapoor, Operations Research, S. Chand, 2005.

MCA-PG-C203 Operating System **Credit: 4**

UNT I (12 Hrs)

Introduction: Basic concepts, Simple Batch Systems, Multi-programmed Batched Systems, Time-Sharing Systems, Protection.
Processes and CPU scheduling: Process Concept, Process scheduling, Operation on Processes, Cooperating Processes, Inter process Communication.

UNIT II (12 Hrs)

Scheduling: Scheduling criteria, scheduling algorithms,
Virtual Memory: Demand paging, Page replacement, Page-replacement algorithms.
Process Synchronization: The Critical-Section problem, Synchronization Hardware, Basics of Semaphores.

UNIT III (12 Hrs)

Deadlocks: Deadlock characterization, Methods of Handling Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection & Recovery from Deadlock.

UNIT IV (12 Hrs)

Memory Management: Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging.
Multiprocessor Operating System: The thread concept, thread system calls, Uses of threads, Lightweight processes and user threads, examples of threads.

Note: Preliminaries on Real Time OS and Embedded OS shall be introduced to the students. New OS available in market shall be further examined.

References

1. Silberschatz and Galvin, Operating System Concepts, Addition Wesley, 1999.
2. H.M.Diatel, An Introduction to Operating System, Addition Wiley, 1980.

MCA-PG-C204 Object Oriented Analysis and Design using Java Credit: 4

UNIT I (12 Hrs)

Introduction to UML: History; Goals; Tour of the Views, Diagrams, Model Elements and Mechanisms; Use case modeling (use case diagrams, actors, relationships); Modeling classes (class diagrams, associations, generalizations, dependencies, refinement, constraints, interfaces); Modeling objects.
Introduction to Java: Features of Java, Object Oriented Concepts, Lexical Issues, Data Types, Variables, Arrays Operators, Control Statements.

UNIT II (12 Hrs)

Classes: Objects, Constructors, Overloading method: Static and fixed methods, Inner Classes, String Class, Inheritance ,Overriding methods using super, Abstract class.
Packages and I/O: Access Protection, Importing Packages, Interfaces, Exception Handling: Throw and Throws, Thread, Synchronization, Runnable Interface, Inter thread Communication, Deadlock: Suspending, Resuming and stopping threads, Multithreading.

UNIT III (12 Hrs)

The Java Library: String Handling, Exploring java.lang, java.util: The Collections Framework, Utility Classes, Input/Output: Exploring java.io, Exploring NIO, Networking, The Applet Class, Event Handling, Introducing the AWT: Working with Windows, Graphics, and Text, AWT Controls, Layout Managers, and Menus, Images, The Concurrency Utilities, Regular Expressions and Other Packages.

UNIT IV (12 Hrs)

J2EE: Architectural overview, J2EE database, JDBC objects, Understanding Java ServerPages, Enterprise JavaBeans, containers and servers; entity vs. Session beans, transactions, XML deployment descriptors, Software development using Java Swing.
Introduction to C#: Basics, String, Object, File Handling and I/O in precise manner.

Note: Instructor shall assign a set of problems to be solved by the students using various attributes of JAVA.

References

1. Gary Cornell, Cay S. Horstmann, Core Java : Advanced Features, Pearson, 9E, 2013
2. R. Naughton and H. Schildt, Java The Complete Reference 8th E, TMH, 2011.
3. E. Balagurusamy, Programming with Java: A Primer, TMH, 2009.
4. Bobbi J. Young, Robert A. Maksimchuk, Michael W. Engel, Kelli A. Houston, Grady Booch, Jim
5. Conallen Object-Oriented Analysis and Design with Applications, Pearson, 2009.
6. James Keogh, J2Ee: The Complete Reference 1st Edition, TMH, 2002.
7. James Keogh, J2Me: The Complete Reference 1st Edition, TMH, 2003.

MCA-PG-L205 Operating System Laboratory Credit: 4

Operating System Laboratory comprises of following experiments:

Experiment 1

I. (a)Study of hardware and software requirements of different Operating Systems (UNIX, LINUX, WINDOWS XP, WINDOWS 7/8).
(b)Execute various UNIX system calls for: Process management, File management, Input / Output.

Experiment 2

II. Write C programme to

(a) Display process ID.
(b) Create process using fork () and return a parent ID.
(c) Simulate UNIX commands like ls (To list files in the specified directory).
(d) Rename file in directory.

Experiment 3 (CPU Scheduling Policies)

III. Implement CPU scheduling policies:
(a) SJF
(b) Priority
(c) FCFS
(d) Round Robin

Experiment 4 (File Storage Allocation Techniques)

IV. Implement file storage allocation techniques:
(a) Contiguous (using array)
(b) Linked –list (using linked list)

Experiment 5 (Contiguous Allocation Techniques)

V. Implementation of Contiguous allocation techniques:
(a) Worst-Fit
(b) Best-Fit
(c) First-Fit

Experiment 6 (Bankers Algorithm)

VI. Implementation of Banker's Algorithm.

Experiment 7 (Semaphore)

VII. Implementation of Producer Consumer problem using Semaphore.

Experiment 8 (Readers Writers Problem, Dining Philosopher's Problem)

VIII. Implementation of problems:
(a) Readers Writers.
(b) Dining Philosopher's.

MCA-PG-L206 Advanced Java Laboratory	**Credit: 4**

Laboratory Experiments

1. Write a Java Program to take and display the student's details to illustrate class, objects.
2. Write a Java Program to find the area, parameter of a circle and square to demonstrate use of sub class and constructors.
3. Write a Java Program to calculate the percentage of the students mark and grade their points to implement overloading, overriding, polymorphism etc.
4. Write a Java Program to add and display the book details in the library implementing inheritance and implement multilevel inheritance.
5. Write a Java program to calculate the simple interest and user Input by the user implementing the usage of packages.
6. Write a Java Program to make a calculator implementing the concept of Exception Handling by creating user defined exceptions.
7. Write a Java Program to design a class account using multithreading that show all function of bank (withdrawal, deposit) and generate account number dynamically programming.
8. Write a Java Program to show the partial implementation of Interface (calculation of salary of Employee).
9. Write a Java program to calculate the length of the string, to append a string, delete a string and to find a string at a given position using String Buffer class and its methods.
10. Write a Java Program to calculate the area and parameter of the various quadrilateral using interfaces and extending interfaces.
11. Write a Java Program to implement the concept of threading by implementing Runnable Interface.
12. Write a Java Program using Applet to display a message in the Applet.
13. Write a Java Program using Applet for configuring Applets by passing parameters.
14. Write a Java Program applet program for running an audio file.
15. Write a Java Program to create Arithmetic Math Calculator Using Applet Class and Event Handling
16. Write a Java Program to implement Smiley face Using applet
17. Write a Java program to create frame that displays the student information.
18. Write a Java Program for using Graphics class - to display basic shapes and fill them - draw different items using

basic shapes - set background and foreground colors.

19. Write a Java Program for Socket programming to implement communications.
20. Write a Java program to implement the concept of importing classes from user defined package and creating packages.
21. Write a Java Program to demonstrate System clock.
22. Write a java servlet program to download a file and display it on the screen(a link has to be provided in html when the link is clicked corresponding file has to be displayed on screen)
23. Write a java servlet program to implement dynamic html using servlet (username and password should be accept using html and displayed using a servlet)
24. Write a java jsp program to print 10 even and 10 odd number
25. Write a program for tracking the session conversation between the server and a client.
26. Write a java program to illustrate a simple application that connects to an ODBC database and performs a select statement on a table called trades.

MCA-PG-C301 Formal Language and Automata Theory	**Credit: 4**

UNIT I (12 Hrs)

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.

UNIT II (12 Hrs)

Context-free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, and closure properties of CFLs.

Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

UNIT III (12 Hrs)

Turing Machines: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

UNIT IV (12 Hrs)

Undecidability: Church-Turing thesis, Universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages.

Note: Implementation of DFA, NFA, Regular expression, PDA and Turing machine using any language.

References

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia, 1988.
2. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia, 2008.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer, 1997.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing, 2012.
5. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill, 2010.

MCA-PG-C302 Accounting and Financial Analysis	Credit: 4

UNIT I (10 Hrs)

Introduction :Accounting Principles, Concepts and Conventions and principles; Accounting Equation, International Accounting Principles and standards; Matching of Indian Accounting Standards with International Accounting Standards.

UNIT II (13 Hrs)

Mechanics of Accounting :Double entry system of accounting, Journals, Cash book and Subsidiary books, Ledger posting,Trial balance, Preparation of Final accounts: Profit & Loss Account, Profit & Loss Appropriation account and Balance Sheet, Policies related with depreciation, inventory and intangible assets like copyright, trademark, patents and goodwill.

UNIT III (13 Hrs)

Analysis of Financial statement :Ratio Analysis- Liquidity Ratio, Turnover Ratio, Leverage Ratio, Profitability Ration, Return on Investment Ratio, Valuation Ratios,
Common Size Statement; Comparative Balance Sheet and Trend Analysis of manufacturing, service & banking organizations.

UNIT IV (14 Hrs)

Fund Flow and Cash Flow Statements :Working Capital: Gross and Net Working Capital, Preparation of Schedule of Changes in Working Capital, Preparation of Funds Flow Statement and its analysis; Cash Flow Statement: Various cash and non-cash transactions, flow of cash, Preparation of Cash Flow Statement and its analysis.

References:

1) Narayanswami - Financial Accounting: A Managerial Perspective (PHI, 2nd Edition).
2) Mukherjee Hanif- Financial Accounting for Management (TMH, 1st Edition).
3) Ramchandran & Kakani - Financial Accounting for Management (TMH, 2nd Edition).
4) Ghosh T P - Accounting and Finance for Managers (Taxman, 1st Edition).
5) Maheshwari S.N & Maheshwari S K - An Introduction to Accountancy (Vikas, 9th Edition)
6) Ashish K. Bhattacharya- Essentials of Financial Accounting (PHI, New Delhi)
7) Ghosh T.P- Financial Accounting for Managers (Taxman, 3 Edition)
8) Maheshwari S.N & Maheshwari S K - A text book of Accounting for Management (Vikas, 1st Edition)
9) Gupta Ambrish - Financial Accounting for Management (Pearson Education, 2nd Edition)
10) ChowdharyAnil - Fundamentals of Accounting and Financial Analysis (Pearson Education,1st Edition).

MCA-PG-C303 Database Management System	Credit: 4

UNIT I (12 Hrs)

Introduction: Purpose of database systems, data abstraction and modelling, instances and schemes, database manager, database users and their interactions, data definition and manipulation language, data dictionary, overall system structure.

Entity-relationship model: Entities and entity sets, relationships and relationship sets, mapping constraints, E-R diagram, primary keys, strong and weak entities, reducing E-R diagrams to tables, trees or graphs, generalization and specialization, aggregation.

Brief Introduction to hierarchical and network model: Data description and tree structure diagram for hierarchical model, retrieval and update facilities, limitations; Database task group (DBTG) model, record and set constructs retrieval and update facilities, limitations.

UNIT II (12 Hrs)

Relational model: Structure of a relational database, operation on relations, relational algebra, tuple and domain relational calculus, salient feature of a query language.

Structured query language: Description an actual RDBMS and SQL.

Normalization: Pitfalls in RDBMS, importance of normalization, functional, multi-valued and join dependencies, 1NF to 5NF, limitations of RDBMS.

UNIT III (12 Hrs)

Database tuning: Index selection and clustering, tuning of conceptual schema, denormalization, tuning queries and views.

Query optimization: Importance of query processing, equivalence of queries, cost Estimation for processing a query, general strategies, bi-relational and multi-relational join algorithms, algebraic manipulation.

Transaction: Transaction and System Concepts, Desirable properties of Transactions (ACID), Schedules and Recoverability, Lock-Based Protocols: Locks, Granting of Locks, and Two phase locking protocol and implementation of locking.

UNIT IV (12 Hrs)

Object oriented model: Nested relations, modelling nested relations as object model, extension of SQL, object definition and query language (ODL, OQL), object relational database model, storage and access methods. Active databases, Advanced trigger structures, SQL extensions.

Security and Integrity: Discretionary and mandatory access control; Facilities in SQL, access control models for RDBMS and OODBMS.

Distributed Database: Basic Structure, fragmentation algorithms, trade-offs for replication, query processing, recovery and concurrency control; Multi-database systems; Design of Web Databases.

References

1. Abraham Silberschatz, Henry Korth, and S. Sudarshan, Database System Concepts, McGraw-Hill, 2010.
2. Raghu Ramakrishnan, Database Management Systems, WCB/McGraw-Hill, 2003,
3. J. D. Ullman, Principles of Database Systems, Galgotia, 1985.
4. R. Elmasri and S. Navathe, Fundamentals of Database Systems, Addison-Wesley, 2008.
5. Bipin Desai, An Introduction to Database Systems, Galgotia, 1990.
6. Serge Abiteboul, Richard Hull and Victor Vianu, Foundations of Databases. Addison-Wesley, 1995.

MCA-PG-C304 Microprocessors & Microcontrollers	**Credit: 4**

UNIT I (12 Hrs)

Introduction: Historical background; organization and architectural features of microprocessor and microcontrollers; the instruction set: instruction format, addressing modes; assembly language programming with 8085. Analysis of timing diagram of various Opcodes.

UNIT II (12 Hrs)

8085: Interfacing of memory devices (R/W memory, ROM); Data transfer techniques; Memory mapped I/O, I/O mapped I/O; Interfacing with 8155 and 8255; interfacing of keyboard and display devices; Introduction to Programmable interrupts (TRAP, RST 7.5, RST 6.5, RST5.5, INTR) and DMA controllers.

UNIT III (12 Hrs)

Study and programming of advanced microcontroller: Arduino (AT Mega based), Raspberry Pi (ARM based) and Intel Galileo (Intel® Quark SoC X1000 based). Concepts of FPGA boards. Introduction to Embedded C language and programming.

UNIT IV (12 Hrs)

Accessories: Introduction to sensors and transducers, A/D and D/A Converters, data acquisition systems, standard interfaces - RS232, USB (A/B), RJ 45 etc.

Note: Real life system design and implementation to be done by the students.

References

1. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, Microprocessors and Microcontrollers, Oxford University, 2010.
2. R. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, Penram,2002.
3. M. Banzi, Getting Started with Arduino, Make, O'Reilly, 2011.
4. M. Margolis, Arduino Cookbook, O'Reilly, 2011.
5. M. Richardson, S. Wallace, Getting Started with Raspberry Pi, O'Reilly, 2012.
6. W. Hohl, ARM Assembly Language: Fundamentals and Techniques, CRC, 2009.
7. D. Symes, ARM System Developer's Guide: Designing and Optimizing System Software, MK, 2011.
8. M. Richardson, Getting Started with Intel Galileo, O'Reilly, 2014.
9. P. P. Ray., R. Rai, Open Source Hardware: An Introductory Approach, Lap Lambert Pub, 2013.

MCA-PG-L305 Database Management System Laboratory **Credit: 4**

EXERCISE 1
Title of the Exercise: DATA DEFINITION LANGUAGE (DDL) COMMANDS
AIM OF THE EXPERIMENT: To practice and implement data definition language commands and constraints.
Q1. Create a table called EMP with the following structure.

Name	Type
EMPNO	NUMBER (6)
ENAME	VARCHAR2 (20)
JOB	VARCHAR2 (10)
DEPTNO	NUMBER (3)
SAL	NUMBER (7, 2)

Allow NULL for all columns except ename and job.

Q2: Add a column experience to the EMP table.
Q3: Modify the column width of the job field of EMP table.
Q4: Create dept table with the following structure.

Name	Type
DEPTNO	NUMBER (2)
DNAME	VARCHAR2 (10)
LOC	VARCHAR2 (10)

DEPTNO as the primary key

Q5: create the EMP1 table with ename and empno; add constraints to check the empno value while entering (i.e) empno > 100.
Q6: Drop a column experience from the EMP table.
Q7: Truncate the EMP table and drop the dept table

EXERCISE 2
Title of the Exercise: DATA MANIPULATION LANGUAGE (DML) COMMANDS

AIM OF THE EXPERIMENT: To study the various DML commands and implement them on the database.
Q1: Insert a single record into dept table.
Q2: Insert more than a record into EMP table using a single insert command.
Update the EMP table to set the salary of all employees to Rs15000/- who are working as ASP.
Q4: Create a pseudo table employee with the same structure as the table EMP and insert rows into the table using select clauses.
Q5: select employee name, job from the EMP table
Q6: Delete only those who are working as lecturer
Q7: List the records in the EMP table order by salary in ascending order.
Q7: List the records in the EMP table order by salary in ascending order.
Q8: List the records in the EMP table order by salary in descending order.
Q9: Display only those employees whose deptno is 30.
Q10: Display deptno from the table employee avoiding the duplicated values.

EXERCISE 3
Title of the Exercise: DATA CONTROL LANGUAGE (DCL), TRANSACTION CONTROL LANGUAGE (TCL) COMMANDS
AIM OF THE EXPERIMENT: To study the various data language commands (DCL, TCL) and implements them on the database.
Q1: Develop a query to grant all privileges of employees table into departments table.
Q2: Develop a query to grant some privileges of employees table into departments table.
Q3: Develop a query to revoke all privileges of employees table from departments table.
Q4: Develop a query to revoke some privileges of employees table from departments table.
Q5: Write a query to implement the save point.
Q6: Write a query to implement the rollback.
Q6: Write a query to implement the commit.

EXERCISE 4
Title of the Exercise: IN BUILT FUNCTIONS
AIM OF THE EXPERIMENT: To perform nested Queries and joining Queries using DML command.
Q1: Display all the details of the records whose employee name starts with 'A'.
Q2: Display all the details of the records whose employee name does not starts with 'A'.
Q3: Display the rows whose salary ranges from 15000 to 30000.
Q4: Calculate the total and average salary amount of the EMP table.
Q5: Count the total records in the EMP table.
Q6: Determine the max and min salary and rename the column as max_salary and min_salary.
Q7: Display the month between ―1-jun-10‖ and 1-aug-10 in full.
Q8: Display the last day of that month in ―05-Oct-09‖.
Q9: Find how many job titles are available in employee table.
Q10: What is the difference between maximum and minimum salaries of employees in the organization?
EXERCISE 5
Title of the Exercise: NESTED QUERIES AND JOIN QUERIES
AIM OF THE EXPERIMENT: To perform nested Queries and joining Queries using DML command.
Q1: Display all employee names and salary whose salary is greater than minimum salary of the company and job title starts with 'M'.
Q2: Issue a query to find all the employees who work in the same job as Arjun.
Q3: Issue a query to display information about employees who earn more than any employee in dept 1.
Q4: Display the employee details, departments that the departments are same in both the EMP and dept. [EQUIJOIN]
Q5: Display the employee details, departments that the departments are not same in both the EMP and dept. [NON-EQUIJOIN]
Q6: Display the Student name and grade by implementing a left outer join.
Q7: Display the Student name, register no, and result by implementing a right outer join.
Q8: Display the Student name register no by implementing a full outer join.
Q9: Write a query to display their employee names. [Self-Join]
Q10: Display the details of those who draw the salary greater than the average salary.

MCA-PG-L306 Hardware Design Laboratory **Credit: 4**

Assembly Language Programming using 8085

1. To write an assembly language program for adding two 8-bit numbers by using microprocessor kit.
2. To write an assembly language program for subtracting two 8-bit numbers by using microprocessors.
3. To write an assembly language program to load two numbers in registers C and D, add them and find if there is a carry.
4. To write an assembly language program to load two numbers in memory and add them.
5. To write an assembly language program to subtract an 8-bit number from a number bigger than it.
6. To write an assembly language program to subtract two 8-bit numbers, bigger number from the smaller one.
7. To write an assembly language to show full subtraction of 8-bit numbers.
8. To write an assembly language program to show subtraction of two numbers stored in memory.
9. To write an assembly language program to show addition of 16-bit numbers.
10. To write an assembly language program to transfer the data stored in memory location 8055 H- 805A H to the locations 8080 H – 8085 H in reverse order.
11. To write an assembly language program to store the data that has been stored in memory locations 8050 H to 805F H, to memory location 8055 H – 8064 H and use any sixteen bytes of data to verify the program.
12. A system designed to monitor the temperature of a furnace has readings stored in memory starting at 8060 H. The high- order byte first and low- order byte second. Write an assembly language program to transfer the low- order readings to consecutive memory locations starting at 8080 H and discard the high-order bytes.
13. To write an assembly language program to eliminate the blanks from the string stored from 8050 H.
14. To write an assembly language program to add the data bytes stored in memory from 8060 H and display the sum.
15. The temperature of two furnaces is being monitored by a microprocessor. A set of five readings of the first furnace is stored in memory starting from 8050 H. A corresponding set of readings from the second furnace is stored in memory starting from 8060 H. Write an assembly language program to check whether each reading from first set is higher than the corresponding from second set and store FF in 8080 H if any readings is lower and 01 if higher.
16. To write an assembly language program to compare two data and store them in another location the following values: if A>B
    if A<B
    if A=B
17. To write an assembly language program to add two bytes at a time and store the sum in the same memory locations, low-order sum replacing the first byte and a carry replacing the second byte, from a set of eight data bytes stored in memory from 8070 H.
18. To write an assembly language program to subtract two bytes at a time and store the result in a sequential order in memory from 8070 H. The data set is stored in memory from 8070 H.
19. To write an assembly language program to multiply two 8-bit numbers.
20. To write an assembly language program to divide 8-bit hexadecimal integers.
21. To write an assembly language program to check each data byte from a set of eight data bytes for bits D_7 and D_0. If D_7 or D_0 is 1 reject it otherwise store the data bytes in memory starting from 8060 H.
22. To write an assembly language program to check whether a byte 40H exists in the set of eight readings stored in memory and if it does, stop checking and display its memory location.
23. To write an assembly language program to find the Fibonacci series upto 10 terms.
24. To write an assembly language program to find the greatest among 10 numbers.
25. To write an assembly language program to find the smallest of 10 numbers.
26. To write an assembly language program to sort a set of ten numbers in descending order.
27. To write an assembly language program to sort a set of 10 numbers in ascending order.
28. To write an assembly language program to convert from hexadecimal to ASCII equivalent.

29. To write an assembly language program to check each byte from a set of ten bytes stored in memory starting with the address 8050 H, and save the bytes that are higher than 60_{10} and lower than 100_{10} in memory locations starting from 8090H.
30. A bar code scanner scans the boxes being shipped from the loading dock and records all the codes in computer memory, the end of the data is indicated by the byte 00. The code 1010 0011 (A3H) is assigned to 19" television sets that were shipped from the following data set:
    FA, 67, A3, B8, A3, A3, FA, 00
31. To write an assembly language program to add the two hex numbers 7A and 46 and to store the sum at 8098 and flag status at location 8097 H.
32. To write an assembly language program to convert a two digit BCD number ranging from (00-99) which is stored in r/w memory location 8050 H. Perform the operation and store the equivalent binary into r/w location 8150 H.
33. To write an assembly language program to convert binary to BCD.
34. To write an assembly language program to convert ASCII hex to binary.
35. To write an assembly language program to light an LED through 8255.

Microcontroller Programming

36. Introduction to Arduino programming.
37. Demonstration in LED blinking, LCD, DHT11 sensor, BMP sensor, IR connectivity, Wi-Fi connectivity with Arduino.
38. Introduction to Raspberry Pi and design of compact desktop computer system.
39. Demonstration in LED blinking, LCD, DHT11 sensor, BMP sensor, Stepper motor, IR connectivity, Wi-Fi connectivity with Raspberry Pi.
40. Introduction to Intel Galileo.
41. Demonstration in LED blinking, LCD, DHT11 sensor, BMP sensor, Stepper motor, IR connectivity, Wi-Fi connectivity with Intel Galileo.
42. Introduction to FPGA kit.
43. Design of Embedded System using Arduino/Raspberry Pi/Galileo/available micro-controller resources.
44. Introduction to wearable systems and Internet of Things.

MCA-PG-C401	**Intellectual Property Rights & Professional Ethics**	**Credit: 4**

UNIT-I (12 Hrs)

Introduction: Invention and Creativity, Intellectual Property (IP), Protection of IPR, Basic types of property: Movable Property, Immovable Property and Intellectual Property.

IP Patents: Copyrights and related rights, Trade Marks and rights arising from Trademark registration: Definitions, Industrial Designs and Integrated circuits: Protection of Geographical Indications at national and International levels, Application Procedures.

UNIT-II (12 Hrs)

Indian Position Vs WTO and Strategies: Indian IPR legislations, commitments to WTO, Patent Ordinance and the Bill, Draft of a national Intellectual Property Policy, Present against unfair competition.

Case Studies on: Patents, Copyright and related rights, Trade Marks, Industrial design and Integrated circuit, Geographic indications, Protection against unfair competition.

UNIT-III (12 Hrs)

Senses of 'Engineering Ethics': Variety of moral issues , Types of inquiry , Moral dilemmas , Moral Autonomy , Kohlberg's theory, Gilligan's theory , Consensus and Controversy , Professions and Professionalism, Professional Ideals and Virtues, Uses of Ethical Theories.

UNIT-IV (12 Hrs)

Safety and Risk: Assessment of Safety and Risk – Risk Benefit Analysis, Reducing Risk , The Government Regulator's Approach to Risk .

Responsibilities and Rights: Collegiality and Loyalty, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Professional Rights, Employee Rights, Intellectual Property Rights (IPR) Discrimination.

Note: Concern faculty shall provide the necessary information and demonstration if required to show how a Patent is Filed in India or Abroad.

References

1. N.R. Subbaram Handbook of Indian Patent Law and Practice, S. Viswanathan Printers and Publishers, 1998.
2. E. Whitney, United States Patent Number: 72X, 1794.
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, 2000.
4. M. Martin and R. Schinzinger, Ethics in Engineering, McGraw Hill, 2005.
5. C. E Harris, Michael S Pritchard and Michael J Rabins, Engineering Ethics–Concepts and Cases, Thompson Learning, 2000.
6. C. D. Fleddermann, Engineering Ethics, Prentice Hall, New Mexico, 1999.
7. J. R. Boatright, Ethics and the Conduct of Business, Pearson Education, 2003.
8. E. G. Seebauer and Robert L Barry, Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, 2001.

MCA-PG-C402 Software Engineering — Credit: 4

UNIT I (12 Hrs)

Introduction to Software Engineering: Characteristics, Emergence of Software Engineering, Software Metrics & Models, Process & Product Metrics.
Software Life Cycle Models: Discussion on SDLC, Waterfall, Prototype and Spiral Models and their Comparison.

UNIT II (12 Hrs)

Software Project Management: Size Estimation- LOC and FP Metrics, Cost Estimation- Delphi and Basic COCOMO, Staffing Level Estimation, Putnam's Model.
Software Requirements Specification: SRS Documents, their Characteristics and Organization.

UNIT III (12 Hrs)

Software Design: Classification, Software Design Approaches, Function Oriented Software Design, Structured Analysis- Data flow Diagrams and Structured Design, Introduction to Object Oriented Design.
Coding and Testing of Software: Unit Testing, Block Box Testing, White Box Testing, Debugging, Program Analysis Tools, System Testing, Coding Standards and Guidelines.

UNIT IV (12 Hrs)

Software Reliability and Quality Assurance: Reliability Metric- Musa's Basic Model.
Software Quality Assurance: ISO 9000 and SEI CMM and their Comparison.
Software Maintenance: Maintenance Process Models and Reverse Engineering, Estimation of Maintenance Costs.

Note: Each student should be given about 3-4 assignments on SRS, design, testing and allied problems. Different students should be asked to use different tools.

References

1. R. Mall, Fundamentals of Software Engineering, Prentice Hall of India, 2005.
2. P. Jalote, An Integrated Approach to Software Engineering, 3E, Narosa Publishing House, 2005.
3. R. Fairley, Software Engineering Concepts, Tata McGraw Hill, 2006.
4. R. S. Pressman, Software Engineering: A practitioner's approach, McGraw Hill, 2005.

MCA-PG-C403 Advanced Web Programming **Credit: 4**

UNIT I (14 Hrs)

Introduction: Overview and evolution of Internet programming and application tools.
Search Mechanisms: Search Engine, Crawler Technology, Filtering Technology Content based Searching, Agent Technology, Internet Robot.
Markup Languages and: HTML5, JavaScript, XML and related concepts.

UNIT II (14 Hrs)

Web Programming PHP: Features of PHP: String, Objects, File handling, Database connectivity, Graphics, AJAX, RSS feed.

UNIT III (14 Hrs)

Web Programming Python: Features of Python: HTML integration, String, Objects, , Functional Programming, File handling, Regular Expression, Client Programming, Multi thread Programming, GUI programming, Database connectivity.

UNIT IV (8 Hrs)

Advance Internet applications: Data and Web mining; e-commerce; Distributed Objects – component object model, common object request broker architecture, Web security.

Note: Semantic Web Technology related studies to be made by students.

References

1. Jackson, Web Technologies: A Computer Science Perspective, Pearson Education, 2007.
2. S. Holzner, Php: The Complete Reference, TMH, 2007.
3. K. Jamsa, Konrad King, HTML & Web Design, TMH Publications, 2002.
4. J. Hunter, William Crawford, Servlet Programming, O'REILY, 2010.
5. T. Negrino and Dori Smith, JavaScript for the World Wide Web, 3E, 2011.
6. J. Murach, Andrea Steelman, Murach's Java Servlets and JSP, Murach's, 2E, 2008.
7. R. Hoekman Jr., Java Servlet & JSP Cookbook, Schorr Pub, 2004.
8. S. Kumar K, JDBC, Servlets, And Jsp Black Book, Kogent Solutions Inc., 2008.
9. B. Forouzan, TCP/IP Protocol Suite 4E, TMH, 2010.
10. S. David L., Comer Douglas E., Internetworking With TCP/IP: Design, Implementation, And c Internals, 3E, Prentice Hall, 2009.
11. Comer, Internetworking with TCP/IP: Principles, Protocols, and Architecture, 6E, PHI, 2013.
12. H. Pascal, K. Markus, R. Sebastian, Foundations of Semantic Web Technologies, Chapman and Hall/CRC, 2009.
13. S. Holzner, PHP: The Complete Reference, Mc Graw Hill, 2007.
14. M. C. Brown, Python : The Complete Reference, Mc Graw Hill, 2001.

MCA-PG-C404 Computer Networks **Credit: 4**

UNIT I (12 Hrs)

Introduction: Introduction of network, topology, Use of computer network, network hardware: LAN, WAN, MAN, Wireless Network, Reference Models: ISO-OSI model, TCP model.
Physical layer: Transmission media-Magnetic Media, Twisted Pair, Coaxial pair, Fiber Optics, Line coding and multiplexing.
Data link layer: Data link layer design Issue, Error Detection and correction, Elementary Data link protocol, stop-and-wait ARQ, sliding window, Go-back-n, Selective Repeat ARQ. Related advanced algorithms to be studied.

UNIT II (12 Hrs)

Mac sub layer: Multiple Access protocol: ALOHA, Slotted ALOHA, CSMA protocols, Introduction to MAC Protocols: 802.3, 802.4, 802.5, 802.11 b/g/n.
Network layer: Network Design Issue, Routing algorithm-introduction, optimality Principle, Shortest Path, Flooding, Distance Vector Routing. Congestion Control Routing: General principle of Congestion control, leaky bucket algorithm, Token Bucket Algorithm.

UNIT III (12 Hrs)

TCP/IP: TCP/IP architecture, the Internet Protocol, ARP, DHCP and mobile IP, Internet routing protocols:- RIP, OSPF, BGP. TCP/IP Implementation related case studies to be studied.
Transport layer: Transport Services, Element of transport protocols, TCP connection management, TCP Transmission policy, TCP congestion control & Timer management.

UNIT IV (12 Hrs)

Application layer: DNS, SMTP, POP3, FTP, TELNET, HTTPS. Advanced protocols such as REST and related shall be studied.
Network Security: Electronic mail, directory services and network management.
Wireless and mobile communication: Wireless transmission, cellular radio, personal communication service, wireless protocol. Network planning, Gigabit and Terabit technology, CDMA, WCDMA, WDM, optical communication networks.

Note: Instructor shall assign advanced topics for example but not limited to PAN, BAN, ZigBee, 6Lowpan, mm Wave, nano communication technology etc. to students.

References

1. W. Stallings, Data and Computer Communication, Prentice Hall of India, 2007.
2. B. A. Forouzan, Data Communication and Networking, McGraw-Hill, 2007.
3. A. S. Tanenbaum, Computer Networks, Prentice Hall, 2008.
4. D. Comer, Internetworking with TCP/IP, Volume 1, Prentice Hall of India, 2006.
5. W. Richard Stevens, TCP/IP Illustrated: The Protocol, Volume 1, Addison-Wesley, 2011.
6. W. Stallings, Cryptography and Network Security: Principles and Practice, PHI, 2008.
7. N. Koblitz, A course in number theory and cryptography, Springer, 2008.
8. R. C. Seacord, Secure Coding in C and C++, Addison-Wesley, 2005.
9. J. Viega, M. Messier, P. Chandra, Network Security with OpenSSL, O'Reilly, 2009.
10. J. Viega, M. Messier, Secure Programming Cookbook for C and C++: Recipes for Cryptography, Authentication, Input Validation & More, O'Reilly, 2009.

MCA-PG-L405 Advanced Web Programming Laboratory **Credit: 4**

Laboratory Experiments

1. Create a simple html file to demonstrate the use of different tags.
   a. Headings (h1 to h6)
   b. Paragraph.
   c. Line Break.
   d. Pre tag.
   e. Different logical style (<b>,<i>,<sub>,<sup>).
   f. Listing tags.
2. Create a HTML paragraph to illustrate the use of following commands
   a. Changing Direction of Text.
   b. Citation
   c. Abbreviations

   d. Mark
   e. Acronyms
   f. Strong Text
3. To create an html file to link to different html page which contains images, tables, and also link within a page.
4. Create a registration form having the following elements.
   a. Submit button.
   b. Radio element.
   c. Text element.
   d. Reset button.
   e. Password.
   f. Datalist.
   g. Select.
5. Create an html file by applying the different styles using inline, external & internal style sheets.
6. Write a javascript program to define user defined function for sorting the elements of an array.
7. Write a javascript program to display time on your page.
8. Create an HTML page to explain the use of various predefined functions in a string and math object in javascript.
9. Display calendar using javascript code by getting year from the user.
10. Create a html registration form and validate the form using javascript code.
11. Write an XML file which will display the Book information which includes the following:
    a) Title of the book
    b) Author Name
    c) ISBN number
    d) Publisher name
    e) Edition
    f) Price
12. Write a Document Type Definition (DTD) to validate the above XML file. Display the XML file as follows. The contents should be displayed in a table. The header of the table should be in color GREY. And the Author names column should be displayed in one color and should be capitalized and in bold. Use your own colors for remaining columns. Use XML schemas XSL and CSS
13. Show how to use PHP to validate form data.
14. Write a PHP program to store current date ,time in a COOKIE and display the 'last visited on' date and time on the webpage upon reopening of the same webpage.
15. Install a database (Mysql or Oracle). Create a table which should contain at least the following fields: name, password, email-id, phone number (these should hold the data from the registration form). Write a PHP program to connect to that database and extract data from the tables and display them. Experiment with various SQL queries. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.
16. Write a python program to merge mails.
17. Write a python program to find hash of file.
18. Write a python program to find the resolution of a image.
19. Demonstration of preprocessing on dataset.
20. Demonstration of association rule on dataset using apriori algorithm.
21. Demonstration of classification rule on dataset using naïve bayes algorithm.
22. Demonstration of clustering rule on dataset using simple k means .

MCA-PG-L406 Network Simulation Laboratory	**Credit: 4**

Laboratory Experiments

1. Simulation of various topologies.
2. Simulation of router configuration.
3. Simulation of Sliding Window Protocol.
4. Simulation of Routing Protocol.
5. Write a program to implement basic network commands.
   a) Socket Program for Echo Command
   b) Socket Program for Talk Command
   c) Socket Program for Ping Command
6. Implement the following forms of IPC.

a) Pipes
b) FIFO

7. Implement file transfer using Message Queue form of IPC.
8. Write a Program to create an integer variable using Shared Memory concept and increment the variable simultaneously by two processes. Use Semaphores to avoid Race conditions.
9. Design TCP iterative Client and Server application to reverse the given input sentence.
10. Design TCP concurrent Client and Server application to reverse the given input sentence.
11. Design TCP Client and Server application to transfer file.
12. Design UDP Client and Server application to reverse the given input sentence.
13. Design UDP Client Server to transfer a file.
14. Design using Poll Client Server application to multiplex TCP and UDP requests for converting a given text into upper case.
15. Design a RPC application to add and subtract a given pair of integers.
16. Write a program to implement Multithreading and exception handling.
17. Simulation of NS3, OMNET++, Cloudsim etc.

ELECTIVE I

MCA-PG-E502 Cloud Computing	**Credit: 4**

UNIT I (12 Hrs)

Data Centre foot prints & Concepts.
Introduction To cloud: Virtualization Concepts: Types of Virtualization & its benefits, Introduction to Various Virtualization OS such as Vmware, KVM etc, HA/DR using Virtualization , Moving VMs, SAN backend concepts .

UNIT II (12 Hrs)

Cloud Fundamentals: Cloud Building Blocks, Understanding Public & Private cloud environments.
Cloud as IaaS: Private Cloud Environment: Basics of Private cloud infrastructure, QRM cloud demo.

UNIT III (12 Hrs)

Public Cloud Environment: Understanding & exploring Amazon Web services, Managing and Creating Amazon EC2 instances, Managing and Creating Amazon EBS volumes, Tata Cloud details & demo.
Managing Hybrid Cloud environment.
Big Data, IoT and Cloud.

UNIT IV (12 Hrs)

Setting up your own Cloud: How to build private cloud using open source tools, Understanding various cloud plugins, setting up your own cloud environment, Autoprovisioning, Custom images, integrating tools like Nagio, Integration of Public and Private cloud.
Future directions: Cloud Domain and scope of work, Cloud as PaaS, SaaS, Cloud Computing Programming
Introduction, Trends and market of cloud.

Note: Practice on available cloud platforms shall be done by the students. New architecture based cloud could be designed.
References

1. M. J. Kavis, Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, & IaaS), Wiley, 2014.

2. D. Gonzales, Cloud Computing Bible: A Practical Approach To Cloud Computing Security, CloudProblems To Be Aware of and More, Kindle Edition.
3. T. Erl, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 2013
4. L. Nielsen, The Little Book of Cloud Computing, Kindle Edition, 2014.

MCA-PG-E503 Digital Image Processing Credit: 4

UNIT I (12 Hrs)

Digital Image Fundamentals: A simple image model, Sampling and Quantization, Imaging Geometry, Digital Geometry, Image Acquisition Systems, Different types of digital images.
Bilevel Image Processing: Basic concepts of digital distances, distance transform, medial axis transform, component labeling, thinning, morphological processing, extension to grey scale morphology.

UNIT II (12 Hrs)

Binarization and Segmentation of Grey level images: Histogram of grey level images, Optimal thresholding using Bayesian classification, multilevel thresholding, Segmentation of grey level images, Water shade algorithm for segmenting grey level image.
Detection of edges and lines in 2D images: First order and second order edge operators, multi-scale edge detection, Canny's edge detection algorithm, Hough transform for detecting lines and curves, edge linking.

UNIT III (12 Hrs)

Images Enhancement: Point processing, Spatial Filtering, Frequency domain filtering, multi-spectral image enhancement, image restoration.
Color Image Processing: Color Representation, Laws of color matching, chromaticity diagram, color enhancement, color image segmentation, color edge detection, color demosaicing.

UNIT IV (12 Hrs)

Image Registration and depth estimation: Registration Algorithms, Setreo Imaging, Computation of disparity map. **Image compression:** Lossy and lossless compression schemes, prediction based compression schemes, vector quantization, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme.

Note: Study on various algorithms shall be devised and new algorithms shall be developed and simulated by the students.

References

1. Gonzalez and Woods, Digital Image Processing, Pearson, 3E, 2009.
2. S. Sridhar, Digital Image Processing, Oxford University Press, 2006.
3. K. R. Castleman, Digital Image Processing, Pearson, 1E, 2007.

MCA-PG-E504 Cryptography and Network Security Credit: 4

UNIT I (12 Hrs)

Introduction: Basic objectives of cryptography, secret-key and public-key cryptography, one-way and trapdoor one-way functions, cryptanalysis, attack models, classical cryptography.
Block ciphers: Modes of operation, DES and its variants, RCS, IDEA, SAFER, FEAL, Blow Fish, AES, linear and differential cryptanalysis.
Stream ciphers: Stream ciphers based on linear feedback shift registers, SEAL, unconditional security.

UNIT II (12 Hrs)

Message digest: Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions.
Public-key parameters: Modular arithmetic, GCD, primality testing, Chinese remainder theorem, modular square roots, finite fields.
Intractable problems: Integer factorization problem, RSA problem, modular square root problem, discrete logarithm problem, Diffie-Hellman problem, known algorithms for solving the intractable problems.

UNIT III (12 Hrs)

Public-key encryption: RSA, Rabin and EI Gamal schemes, side channel attacks.
Key exchange: Diffie-Hellman and MQV.
Digital signatures: RSA, DSA and NR signature schemes, blind and undeniable signatures.

UNIT IV (12 Hrs)

Entity authentication: Passwords, challenge-response algorithms, zero-knowledge protocols.
Standards: IEEE, RSA and ISO standards.
Network security: Certification, public-key infra-structure (PKI), secure socket layer (SSL), Kerberos. **Assignments:** System Modeling assignment using Rhapsody; system Verification assignment using SPIN; performance analysis assignment using Chronos.

Note: Students shall have hands on encryption using binary/byte addition, Exclusive-OR (XOR), Triple DES with CBC mode and Weak DES keys, RSA Encryption and Factorization Attacks, Attack on RSA encryption with short RSA modulus, hash generation and sensitivity of hash functions to plaintext modifications, Digital Signature Visualization, RSA Signature, Attack on Digital Signature/Hash Collision.

References

1. A. J. Menezes, Paul, C. V. Oorschot and A. Scott Vanstone, Handbook of Applied Cryptography, CRC Press, 2010.
2. W. Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India, 2006.
3. N. Koblitz, A course in number theory and cryptography, Springer, 2007.
4. J. A. Buchmann, Introduction to Cryptography, Undergraduate Text in Mathematics, Springer, 2000.
5. D. Stinson, Cryptography Theory and Practice, CRC Press, 2006.
6. A. Das and C. E. Veni Madhavan, Public-Key Cryptography: Theory and Practice, Pearson Education Asia, 2009.

MCA-PG-E505 Computer Graphics **Credit: 4**

UNIT I (10 Hrs)

Introduction: Objective, applications, GKS/PHIGS, normalized co-ordinate system, aspect ratio.
Graphics system: Vector and raster graphics, various graphics display devices, graphics interactive devices, segmented graphics, attribute table.

UNIT II (13 Hrs)

Raster scan Graphics: Line drawing algorithms, circle/ellipse drawing algorithms, polygon filling algorithms.
Geometric transformation: Homogeneous co-ordinate system, 2D and 3D transformations, projection – orthographic and perspective.
Curve and Surfaces: Curve approximation and interpolation, Lagrange, Hermite, Bezier and B-Spline curves/surfaces and their properties, curves and surface drawing algorithms.

UNIT III (14 Hrs)

Geometric modeling: 3D object representation and its criteria, edge/vertex list, constructive solid geometry, wire-frame model, generalized cylinder, finite element methods.
Clipping: Window and viewport, 2D and 3D clipping algorithms.
Hidden line and hidden surfaces: Concept of object- and image-space methods, lines and surface removal algorithms.

UNIT IV (12 Hrs)

Intensify and color models: RGB, YIQ, HLS and HSV models and their conversions, gamma correction, halftoning.
Rendering: Illumination models, polygon mesh shading, transparency, shadow, texture.
Some advance topics/applications: (i) Animation and morphing, (ii) Virtual reality, (iii) User-interface design, (iv) Fractal graphics, (v) Multimedia authoring, (vi) 3D visualization.

Note: Students shall have hands on OpenGL based algorithms.

References

1. D. D Hearn, M. P. Baker, Computer Graphics, C Version 2nd Edition (Paperback), Version C, 2E, Pearson Education, 1997.
2. W. K.Giloi, Interactive Computer Graphics, Data Structure, Algorithms, Languages, Prentice Hall, Englewood Cliffs, 1978.
3. W. M. Newman and R. F. Sproull, Principles of Interactive Computer Graphics, McGraw Hill, New Delhi, 1979.
4. J. D. Foley et al., Computer Graphics, 2nd ed., Addison-Wesley, Reading, Mass., 1993.
5. D. Hearn and P. M. Baker, Computer Graphics, 2nd ed. Prentice Hall of India, New Delhi, 1997.
6. F. S. Hill, Computer Graphics, McMillan, New York, 1990.
7. D. P. Mukherjee, Fundamentals of Computer Graphics and Multimedia, Prentice Hall of India, 1999.

MCA-PG-E506 Internet of Things **Credit: 4**

UNIT I (12 Hrs)

Internet in general and Internet of Things (IoT): layers, protocols, packets, services, performance parameters of a packet network as well as applications such as web, Peer-to-peer, sensor networks, and multimedia.
Transport services: TCP, UDP, socket programming.
Network layer: forwarding & routing algorithms (Link, DV), IP-addresses, DNS, NAT, and routers; Local Area Networks, MAC level, link protocols such as: point-to-point protocols, Ethernet, WiFi 802.11, cellular internet access, and Machine-to-machine.

UNIT II (12 Hrs)

Mobile Networking: roaming and handoffs, mobile IP, and ad hoc and infrastructure less networks.
Real-time networking: soft and real time, quality of service/information, resource reservation and scheduling, and performance measurements.

UNIT III (12 Hrs)

IoT definitions: overview, applications, potential & challenges, and architecture.
Domains of IoT, M2M vs IoT, Management of IoT, IoT Platforms, IoT Languages, IoT Physical systems.

UNIT IV (12 Hrs)

Application: Data Analytics using IoT.
IoT examples: Case studies, e.g. sensor body-area-network and control of a smart home.

Note: Students shall develop new architectures to enhance IoT and devise new paradigm to build new IoT based

solutions.

References

1. A. McEwen and H. Cassimally, Designing the Internet of Things, Wiley, 2013.
2. C. Pfister, Getting started with the Internet of Things, O'Reilly, 2013.
3. P. P. Ray, R. Rai, Open Source Hardware: An Introductory Approach, 1E, Lambert Academic Publishing, 2013.

MCA-PG-E507 Embedded Systems	**Credit: 4**

UNIT I (10 Hrs)

Introduction to Embedded Systems: definitions and constraints. Hardware and processor requirements.

UNIT II (12 Hrs)

Special purpose processors.
Input-output design and I/O communication protocols. Design space exploration for constraint satisfaction, co-design approach, Example system design.

UNIT III (12 Hrs)

Formal approach to specification.
Specification languages. Specification refinement and design.

UNIT IV (12 Hrs)

Design validation. Real Time operating system issues with respect to embedded system applications. Time constraints and performance analysis.

Note: Students shall learn how to design energy efficient, small size special purpose computing system.

References

1. P. Marwedel, Embedded System Design, Kluwer, 2011.
2. W. Wolf, Computers as Components: Principles of Embedded Computing Systems Design, Morgan-Kaufmann, 2008.
3. F. Vahid and T. Givargis, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley, 2006.
4. Gajski, Vahid, Narayan, and Gong, Specification And Design Of Embedded Systems, Pearson, 2007.
5. P. P. Ray., R. Rai, Open Source Hardware: An Introductory Approach, Lap Lambert Pub, 2013.

ELECTIVE II

MCA-PG-E508 Managerial Economics	**Credit: 4**

UNIT I (10 Hrs)

Introduction to Economics: Nature, Scope and significance of Managerial Economics, Role of Managerial Economics in Decision Making, Decision Making under risk and uncertainty.
Demand Supply and Production Analysis: Demand Analysis; Law of Demand, Exceptions to the law of Demand, Determinants of Demand. Elasticity of Demand- Price, Income, Cross Elasticity; Uses of Elasticity of Demand, Measurement of Elasticity of Demand. Demand Estimation, Demand forecasting,

UNIT II (12 Hrs)

Supply Analysis: Law of Supply, Supply Elasticity; Analysis and its uses for managerial decision making. **Production concepts & analysis:** Production function, law of variable proportion, Law of returns to scale, Scale Economies, Cost concept and analysis, short-run and long-run cost curves and its managerial use, Estimation of Cost Function, Relationship between cost and production function.

UNIT III (12 Hrs)

Market Structure and Pricing: Market Equilibrium and Average Revenue Concept. Market Structure: Perfect Competition, Features, Price determination under perfect competition. Monopoly: Feature, pricing under monopoly, Price Discrimination. Monopolistic: Features, pricing under monopolistic competition, product differentiation. Oligopoly: Features, kinked demand curve, cartels, price leadership.
Pricing Strategies; Price determination, Full cost pricing, product line pricing, price skimming, penetration pricing.

UNIT IV (12 Hrs)

National Income and Employment Determination: National Income: Concepts and various methods of its measurement, Inflation, types and causes, Business Cycle, Profit concept and major theories of profits; Dynamic Surplus theory, Risk & Uncertainty bearing theory and Innovation theory.
Employment Determination Classical theory, Keynesian theory, Neo-classical theory.

References

1. S. Damodaran, Managerial Economics,Oxford, 2006.
2. M. Hirschey, Economics for Managers, Thomson, India Edition, 2007.
3. C. H. Petersen, Managerial Economics, Pearson Education, 2006.
4. S. Dominick, Managerial Economics, Oxford, 2007.
5. Atmanand, Managerial Economics ,Excel Books, 2007.
6. D.M. Mithani, Principles of Economics, Himalaya Publishing House, 2005.
7. D.N. Dwivedi, Managerial Economics, 7E, Vikas Publication, 2009.
8. A. Koutsyannis, Modern Microeconomics, 2E, Macmillan, 2009.

MCA-PG-E509 Fuzzy Logic and Applications **Credit: 4**

UNIT I (10 Hrs)

Brief overview of crisp sets: the notion of fuzziness; what, why and when to apply fuzzy set; operations on fuzzy sets; fuzzy numbers. Crisp relations, fuzzy relations, Max_-composition of fuzzy relation; Max_-transitive closure; probability measures of fuzzy events; fuzzy expected value.

UNIT II (12 Hrs)

Approximate reasoning: different methods of rule aggregation and defuzzification. Fuzzy measures – belief, plausibility and their properties; Dempster's rule of combination; consonant body of evidence – possibility, necessity.

UNIT III (12 Hrs)

Measures of uncertainty – axiomatic formulation of Hartley information, Shannon's entropy, concepts of joint and conditional entropy and their properties; measures of non-specificity; measures of dissonance and confusion; fuzziness measures.

UNIT IV (12 Hrs)

Fuzzy geometry. Applications to some selected topics like pattern recognition, image processing, computer vision, optimization, control, data mining. Integration with other computing paradigm.

References

1. G. J. Klir and T. A. Folger: Fuzzy Sets, Uncertainty, and Information, Prentice Hall, Englewood Cliffs, 1988.
2. A. Kandel: Fuzzy Mathematical Techniques With Applications, Addison-Wesley, Englewood Cliffs, 1986.
3. J. C. Bezdek and S. K. Pal (Eds.): Fuzzy Models for Pattern Recognition – Methods that Search for Structures in Data, IEEE Press, Los Alamos, California, 1992.
4. S. K. Pal and D. Dutta Majumder: Fuzzy Mathematical Approach to Pattern Recognition, John Wiley (Halsted Press), New York, 1986.
5. M. M. Gupta: Fuzzy Mathematical Models with Applications to Engineering and Management Science, North Holland, Amsterdam, 1988.
6. A. Kaufmann: Introduction to Theory of Fuzzy Subsets, Academic Press, New York, 1975.
7. H. Zimmermann: Fuzzy Set Theory and Its Application, 2nd ed., Kluwer, Boston, 1990.
8. T. J. Ross: Fuzzy Logic With Engineering Applications, McGraw Hill, Singapore, 1997.
9. J. C.Bezdek, J. M. Keller, R. Krishnapuram, and N. R. Pal: Fuzzy Models and Algorithms for Pattern Recognition and Image Processing, Kluwer Academic Publisher, Boston, 1999.
10. G. J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice hall, Englewood Cliffs, 1995.

MCA-PG-E510 Compiler Design — Credit: 4

UNIT I (12 Hrs)

Introduction: Phases of compilation and overview Lexical Analysis (scanner): Regular language, finite automata, regular expression, from regular expression to finite automata, scanner generator (lex, flex).

UNIT II (12 Hrs)

Syntax Analysis (Parser): Context-free language and grammar, push-down automata, LL(1) grammar and top-down parsing, operator grammar, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison).
Semantic Analysis: Attribute grammar, syntax directed definition, evaluation and flow of attribute in a syntax tree.

UNIT III (12 Hrs)

Symbol Table: Its structure, symbol attributes and management.
Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope.
Intermediate Code Generation: Translation of different language features, different types of intermediate forms.

UNIT IV (12 Hrs)

Code Improvement (optimization): Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc. Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc.
Register allocation and target code generation
Advanced topics: Type systems, data abstraction, compilation of object oriented features and non-imperative programming languages.

Note: Students shall have hands on to develop new compiler using Lex and Yacc/ Lemon/ANTLR etc.

References

1. A. V. Aho, R. Sethi, J. D. Ullman, Compilers: Principles, Techniques and Tools, Addison-Wesley, 2007.
2. M. L. Scott, Programming Language Pragmatics, Elsevier, 2009.
3. A. W. Appel, Modern Compiler Implementation in C/Java, Cambridge University Press, 2004.

4. K. D. Cooper and Linda Torczon, Engineering a Compiler, Elsevier, 2011.
5. A. I. Holob, Compiler Design in C, Prentice-Hall, 1994.
6. S. S. Muchnik, Advanced Compiler Design and Implementation, Elsevier, 1997.
7. R. Allen, K. Kennedy, Optimizing Compilers for Modern Architectures, Elsevier, 2007.

MCA-PG-E511 Big Data Analytics **Credit: 4**

UNIT I (10 Hrs)

Introduction to Big Data: Definition, Challenges in processing Big data, Technologies supported by Big data : Hadoop, Apache Pig, HIVE, HBase, Flume, Sqoop.

UNIT II (12 Hrs)

Hadoop: History, Use cases of Hadoop, RDBMS Vs. Hadoop, When to use and when not to use Hadoop.

UNIT III (12 Hrs)

HDFS (Hadoop Distributed File System) : Significance of HDFS in Hadoop, 5 daemons of Hadoop, Features of HDFS, Data storage in HDFS, Accessing HDFS.

UNIT IV (12 Hrs)

Map Reduce: Map reduce architecture, How Map reduce works, Developing map reduce, Map reduce programming modules, creating input and output format in map reduce jobs.

Note: Hands on experience on Amazon EC2/Cloudera/open source shall be done by the students. Algorithms need to be run on the cloud platforms.

References

1. V. M. Schonberger and K. Cukier, Big Data: A Revolution That Will Transform How We Live, Work, and Think, Kindle Edition, 2013.
2. N. Marz, and J. Warren, Big Data: Principles and best practices of scalable realtime data systems, 2015.

MCA-PG-E512 Document Processing and Information Retrieval **Credit: 4**

UNIT I (12 Hrs)

Document generation: Curve drawing-Bezier Polynomial, Splines, Digital Character generation and Fontographics, Analog and Digital Halftoning, Document Layout creation and Page Makeup, Multimedia content creation, Static and Dynamic Website document creation.

Document processing and analysis: Document noise cleaning, Binarization, Automatic Layout recognition and segmentation, Logical structure analysis and recognition. Color document processing, Text and hypertext data compression, Document image data compression, Graphics analysis and recognition in maps, drawings and diagrams. Lines, curves, logo recognition.

UNIT II (12 Hrs)

Optical Character Recognition (OCR): Skew detection, Thinning and Skeletonization Line, Word and Character segmentation, Character size normalization, Feature detection, Supervised and unsupervised classification, Tree classifier, Maximum Likelihood method, Minimum distance, K-nearest neighbor classifier, Bayes' classifier, Hidden Markov Model, Support vector machine, Neural Net classifier, Handprinted Character recognition, Table form document, On-line and offline handwritten character recognition, Multiscript OCR systems.

UNIT III (12 Hrs)

Applications: Signature verification, Postal Address reading system, Table-form reading system, Mathematical expression, Chemical equation, Table recognition.

UNIT IV (12 Hrs)

Information retrieval (IR): indexing, text-based information retrieval techniques, content based information retrieval (CBIR), multimedia information retrieval, multimodal query formulation/decomposition, relevance judgment/feedback, evaluation techniques.

References

1. L. O'Gorman and R. Kasturi, Document Image Analysis, IEEE Computer Society Press, Los Alamitos, 1995.
2. H. S. Hou: Digital document Processing, Wiley-interscience, New York, 1983.
3. H. S. Baird, H. Bunke and K. Yamamoto: Structured document image analysis, Springer-Verlag, Berlin, 1992.
4. B. B. Chaudhuri and D. Dutta Majumder, Two tone Image Processing and Recognition, Wiley Eastern, New Delhi, 1993.
5. R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley Pub Co, 1999.
6. W. Frakes, R. Baeza-Yates , Information Retrieval: Data Structures and Algorithms, Prentice Hall, New Jersey, 1992.