COMPUTER APPLICATIONS
MCA-Syllabus (3 years)

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MCA-PG-C202	Computer Organization and Architecture	4
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Abbreviations: C-Core, L-laboratory, E-Elective, D-Dissertation, I-Internship

MCA-PG-C101	Mathematics I	Credit: 4

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 (15 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 (15 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 (15 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.

Text Books:

1. Bird J, 2010, Engineering Mathematics, Elsevier.
2. Grewal, B S, 2012, Higher Engineering Mathematics, Khanna publishers, 42 E.
3. Ramana, B V, 2006,Higher Engineering Mathematics, TMH.

Reference Books:

1. Sastry S S, 2012, Introductory Methods of Numerical Analysis, PHI, 5E.
2. Iyengar S R K, Jain M K, Jain R K, 2012, Numerical Methods for Scientific and Engineering Computation, 6E.

MCA-PG-C102	Principles of Management	Credit: 4

Introduction: Management: Concept, Nature, Importance; Management: Art and Science, Management as a Profession, Management Vs Administration, Management Skills, Levels of Management, Characteristics of Quality Managers. Evolution of Management: Early contributions, Taylor and Scientific Management, Fayol's Administrative Management, Bureaucracy, Hawthorne Experiments and Human Relations, Social System Approach, Decision

Theory Approach. Social Responsibility of Managers, Managerial Ethics.

UNIT II (15 Hrs)

Planning and Organizing: Introduction to Functions of Management Planning: Nature, Scope, Objectives and Significance of Planning, Types of Planning, Process of Planning, Barriers to Effective Planning, Planning Premises and Forecasting, Planning and Decision Making.
Organizing: Concept, Organization Theories, Forms of Organizational Structure, Combining Jobs: Departmentation, Span of Control, Delegation of Authority, Authority & Responsibility, Organizational Structure and Design- Vertical and Horizontal Dimensions

UNIT III (15 Hrs)

Staffing, Directing and Motivation: Staffing: Concept, System Approach, Manpower Planning, Job Analysis, Recruitment & Selection, Training & Development, Performance Appraisal Directing: Concept, Direction and Supervision
Motivation: Concept, Motivation and Performance, Special Motivational techniques: Money, participation, reward systems, Quality of Work Life, Job Enrichment & Morale Building.

UNIT IV (15 Hrs)

Leadership and Control: Leadership: Concept and Functions, Process and models of Leadership Development, Contemporary views on Leadership: Transformational-Transactional, Charismatic-Visionary leadership.
Controlling: Concept, Types of Control, Process and Techniques of Controlling.

Text Books:

1. Stoner, Freeman, Gilbert Jr, 2009, Management, Prentice Hall of India, 6E.
2. Koontz Harold, Weihrich Heinz, 2008, Essentials of management, Tata McGraw Hill, 5E.
3. Robbins, Coulter, 2008, Management, Prentice Hall of India, 9E.

Reference Books:

1. Robbins S.P. and Decenzo David A., 2007, Fundamentals of Management: Essential Concepts and Applications Pearson Education, 6E.
2. Weihrich H, Koontz H., 2008, Management: A Global and Entrepreneurial Perspective (Mc Graw Hill, 12E.
3. Luthans, Fred, 2008, Organizational Behaviour, McGraw Hill, 7E.

MCA-PG-C103	Digital Logic	Credit: 4

Data and number systems, Binary representation, Codes and their conversions: BCD, Octal, Hexadecimal, ASCII, EBDIC, Gray, Signed binary number representation with 1's and 2's complement methods, Binary arithmetic

UNIT II (15 Hrs)

Boolean algebra, Venn diagram, logic gates and circuits, Minimization of logic expressions by algebraic method, Kmap method and Quine Mc Clauskey method

Combinational circuits- adder, subtractor, encoder, decoder, comparator, multiplexer, de-multiplexer, parity generator, etc.

UNIT III (15 Hrs)

Design of combinational circuits-Programming logic devices and gate arrays
Sequential Circuits- Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology

UNIT IV (15 Hrs)

Memory devices: ROM, RAM, EPROM, EEPROM, etc.
Different types of A/D and D/A conversion techniques
Different Logic families- TTL, ECL, MOS and CMOS, their operation, design and specifications

Text Books:

1. Kohavi Z, 1978, Switching and Finite Automata Theory, 2nd ed., McGraw Hill, New York.
2. Mcclusky, E J, 1986, Logic Design Principles, Prentice Hall International, New York.
3. Biswas, N N, 1994, Logic Design Theory, Prentice-Hall of India, New Delhi.

Reference Books:

1. Freedman A D, Menon P R, 1975, Theory and Design of Switching Circuits, Computer Science Press, California.
2. Bartee, T C, 1985, Digital Computer Fundamentals, 6E, McGraw Hill, New York.
3. Hayes, J, 1988, Computer Architecture and Organization, 2E, McGraw Hill.
4. Choudhury, P P, 1994, Computer Organization and Design, Prentice Hall of India

MCA-PG-C104	Programming using C	Credit: 4

'C' Fundamentals: Evolution of programming languages, Characteristics of C, Structure of C program, C character set, token in C, Data Types in C, Constants, Keywords, Identifiers, Variable and its declaration
Operators and Expressions: Arithmetic operators, Relational operators, logical operators, Increment and decrement operators, Conditional Operators, Bit-wise operators, Special Operators, Assignment operators. Arithmetic expressions and its evaluation, Precedence of operators and associatively, Type conversions.

UNIT II (15 Hrs)

Input and Output: Formatted input and Output: Decision making: Branching statements- if, if-else, else-if ladder, nested if, switch, conditional operator. Looping Statements- while, do while, for. Jumps in loop- break, continue, and goto.
Arrays: Arrays– One Dimensional and multidimensional arrays- Declaration, Initialization. Strings- Initialization, Display, String manipulation functions, array of strings.

UNIT III (15 Hrs)

Pointers: Pointers- declaration and initialization. Pointers and Arrays, Pointer and strings, array of

pointers.
User defined functions: Basics of functions-function types, need for functions, elements and categories of functions, passing parameter to a function, passing array and string to a function, Recursion, Scope rules, function pointer.

UNIT IV (15 Hrs)

Structures, Unions and Dynamic Memory Allocation: Structures- definition, declaration and initialization, accessing structure member, operations on structure member and variables. Arrays of structures, array within structure. Structure within structure, Pointers to structures, Self-referential structures, Unions, Dynamic Memory Allocation and Linked List.
File management in C: Introduction, Defining and opening a file, Closing a file, I/O operations on files, Error handling during I/O operations, Random access to files, command line arguments.

Text Books:

1. Balagurusamy, E, 2004, Programming in ANSI C, Tata McGraw Hill.
2. Gottfried B S, 2006, Programming with C, Schaums' Outline Series.
3. Kernighan B W, Ritchie D M, 1998, The C Programming Language, Prentice Hall.

Reference Books:

1. Venugopal K R, Prasad S R, 2006, Mastering C, Tata McGraw Hill.
2. Kanetkar Y, 2010, Let us C, BPB Publications.
3. Kanetkar Y, 2010, Pointer in C, BPB Publications.

MCA-PG-L105	Digital Logic Laboratory	Credit: 4

Introduction to basic gates (AND, OR, NOT, XOR, XNOR, NOR etc.), Combinational circuit design (Adder, Substractor, Comparator, Decoder, Encoder, Multiplexer, DeMultiplexer etc.), Sequential circuit design (various types of Flip Flops, various types of Counters, various types of Registers etc).

Introduction to CAD languages (VHDL, Verilog). Introduction to Programming of combinational and sequential logic.

MCA-PG-L106	C Laboratory	Credit: 4

1. Write a C program to find the sum of individual digits of a positive integer.
2. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to calculate the following Sum: Sum=1-x2/2! +x4/4!-x6/6!+x8/8!-x10/10!
5. Write a C program to find the roots of a quadratic equation.
6. The total distance traveled by vehicle in 't' seconds is given by distance = ut+1/2at2 where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec2).
7. Write C program to find the distance traveled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.
8. Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
9. Write C programs that use both recursive and non-recursive functions
    a. To find the factorial of a given integer.
    b. To find the GCD (greatest common divisor) of two given integers.
10. Write a C program to find both the largest and smallest number in a list of integers.
11. Write a C program that uses functions to perform the following:
    a. Addition of Two Matrices
    b. Multiplication of Two Matrices
12. Write a C program that uses functions to perform the following operations:
    a. To insert a sub-string in to given main string from a given position.
    b. To delete n Characters from a given position in a given string.
13. Write a C program to determine if the given string is a palindrome or not
14. Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
15. Write a C program to count the lines, words and characters in a given text.
16. Write a C program to generate Pascal's triangle.
17. Write a C program to construct a pyramid of numbers.
18. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:
    i. $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$
    b. For example: if n is 3 and x is 5, then the program computes 1+5+25+125.
    c. Print x, n, the sum
19. Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal? If so, test for them too.
20. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
21. Write a C program to convert a Roman numeral to its decimal equivalent.
22. Write a C program that uses functions to perform the following operations:
    a. Reading a complex number
    b. Writing a complex number

c. Addition of two complex numbers
d. Multiplication of two complex numbers
e. (Note: represent complex number using a structure.)

23. Write a C program which copies one file to another.
24. Write a C program to reverse the first n characters in a file.
    a. (Note: The file name and n are specified on the command line.)
25. Write a C program to display contents of a file.
26. Write a C program to merge two files into a third file(i.e., the contents of the first file followed by those of the second are put in the third file)
27. Write C programs that uses non recursive function to search for a key value in a given list of integers using Linear search
28. Write C programs that uses non recursive function to search for a key value in a given list of integers using Binary search
29. Write C programs that implements the Selection sort method to sort a given array of integers in ascending order.
30. Write C programs that implements the Bubble sort method to sort a given array of integers in ascending order.
31. Write C programs that uses functions to perform the following operations
    a. Create a single linked list of integers elements.
    b. Traverse the above list and display the elements.
32. Write C programs that implement Stack (its operations) using singly linked list to display a given list of integers in reverse order.
    a. Ex. Input 10 23 4 6. Output 6 4 23 10
33. Write C programs that implement Queue (its operations) using singly linked list to display a given list of integers in same order.
    a. Ex. Input 10 23 4 6. Output 10 23 4 6
34. Write C program to implement linear regression algorithm.
35. Write C program to implement the polynomial regression algorithm.
36. Write C program to implement the Lagrange interpolation.
37. Write C program to implement the Newton- Gregory forward interpolation.
38. Write C program to implement Trapezoidal method.
39. Write C programs to implement Simpson method.

MCA-PG-C201	Mathematics II	Credit: 4

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 (15 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 (15 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 (15 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.

Text Books:

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

Reference Books:

1. Stephen A. Wiitala, 1987, Discrete Mathematics: A Unified Approach, McGraw-Hill.
2. Trembly J P, Manohar R, 2004, Discrete Mathematical Structure and applications to computer science, McGraw-Hill.

MCA-PG-C202	Computer Organization and Architecture	Credit: 4

Processor Design: Addition of numbers – carry look-ahead and pre-carry vector approaches, carry propagation-free addition. Arithmetic: Multiplication- using ripple carry adders, carry save adders, redundant number system arithmetic, Booth's algorithm. Division- restoring and non- restoring techniques, using repeated multiplication. Floating-point arithmetic- IEEE 754-1985 format, multiplication and addition algorithms.

UNIT II (15 Hrs)

ALU design, instruction formats, addressing modes.
Control UNIT Design: Hardware control UNIT design, hardware programming language, microprogramming, horizontal, vertical and encoded-control microprogramming, microprogrammed control UNIT design.

UNIT III (15 Hrs)

Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance.
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures. Array and vector processors.

UNIT IV (15 Hrs)

Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.
Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers.

Text Books:

1. Patterson D A, Hennessy J L, 2012, Computer Organization and Design: The Hardware/Software Interface, Elsevier.
2. Hamachar C, Vranesic Z, Zaky S, 2002, Computer Organization, McGraw Hill.
3. Hayes J P, 1988, Computer Architecture and Organization, McGraw Hill.

Reference Books:

1. Stallings W, 2007, Computer Organization and Architecture: Designing for Performance, Pearson Education.
2. Heuring V P, Jordan H F, 2008, Computer Systems Design and Architecture, Pearson Education.

MCA-PG-C203	Operating System	Credit: 4

Introduction to Operating System: Basic concepts of OS, Evolution of OS; Type of OS: Simple Batch Systems, Multi-programming Systems, Time-Sharing Systems, and Characteristics of OS.
Processes and CPU scheduling: Process Concept, Process states, Process Control Block (PCB), Process scheduling : Long term, Medium term and Short term scheduler, Operation on Processes, System calls, Cooperating Processes, Inter process Communication (IPC).

UNIT II (15 Hrs)

Scheduling: Scheduling criteria, Scheduling algorithms: First Come First Serve (FCFS), Shortest Job First (SJF), Priority Scheduling, Shortest Remaining Time First (SRTF), and Round Robin scheduling (RR).
Memory Management: Logical versus Physical Address Space, Mapping of Logical to Physical address, Swapping, Contiguous Memory Allocation, Paging, Fragmentation: Internal and External and Memory allocation algorithms: First Fit, Best Fit and Worst Fit.

UNIT III (15 Hrs)

Virtual Memory: Demand paging, Page replacement, Page-replacement algorithms: First in First out (FIFO), Least Recently used (LRU), and Optimal Page Replacement.
Process Synchronization: Concurrent Execution, Precedence graph, Critical-Section problem (CSP), Criteria for CSP; Solutions to CSP: Peterson's solution and Synchronization Hardware, Basics of Semaphores.

UNIT IV (15 Hrs)

Deadlocks: Deadlock characterization: Necessary conditions, Methods of Handling Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm, Deadlock Detection & Recovery from Deadlock.
Multiprocessor Operating System: The thread concept, Uses of threads, Lightweight processes, examples of threads (POSIX).
Case studies on various OS: UNIX, WINDOWS, RTOS, Distributed OS.

Text Books:

1. Silberschatz, Galvin, 1999, Operating System Concepts, Addition Wesley.
2. Diatel H M, 2000, an Introduction to Operating System, Addition Wiley.
3. Andrew S. Tanenbaum, Modern Operating systems, PHI.

Reference Books:

1. Singhal M, Shivaratri N G, 2001, Advanced Concepts in Operating Systems, Tata McGraw- Hill.
2. Prasad P B, Operating Systems, Scitech Publication.
3. Stallings W, 2012, Operating Systems-Internals and Design Principles, Pearson Education.

MCA-PG-C204	Data Structure	Credit: 4

UNIT I (15 Hrs)

Introduction and overview: Definition, Classification of data structures (Linear and Non-Linear), Operations on data structures.

Preliminaries: Mathematical notations and functions, Algorithmic notations, control structures, Complexity of algorithms, asymptotic notations for complexity of algorithms. String Processing: Definition, Storing Stings, String as ADT, String operations, word/text processing, Pattern Matching algorithms

UNIT II (15 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 (15 Hrs)

Stacks and Queues: 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.

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.

UNIT IV (15 Hrs)

Hashing: Hashing Techniques: Hash function, Address calculation techniques, Common hashing functions, Collision resolution, Linear probing, Quadratic, Double hashing, Bucket hashing, Deletion and rehashing. Indexing.

Algorithm Design methods-Greedy method-applications-Kruskal's Algorithm for Minimum cost Spanning trees, Job Sequencing with deadlines, Single Source Shortest path problem, Dynamic Programming method-applications-Ordering matrix multiplications, Optimal Binary Search Trees, All Pairs Shortest Paths (APSP) problem.

Text Books:

1. Lipschutz S, Data Structures, 2006, McGraw Hill Education
2. Samanta D, Classic Data Structures, Second Edition,PHI.
3. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, 2001, Introduction to Algorithms, MIT Press,
4. J. Kleinberg and E. Tardos, 2006, Algorithm Design, Addison-Wesley.

Reference Books:

1. Harry R. Lewis, Larry Denenberg, 1991, Data Structures and Their Algorithms, Harper Collins..
2. Gibbons, 1985, Algorithmic Graph Theory, Cambridge University Press.
3. Michael T. Goodrich and Roberto Tamassia, 2006, Algorithm Design: Foundations, Analysis, and InternetExamples, John Wiley.
4. R. Sedgewick, 2001, Algorithms in C: Part 5, Addison Wesley.

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 available such as Open source OS, Distributed OS, and Embedded OS etc.

Experiment 2

II. Write C program to

(a) Display process ID.

(b) Create process using fork () and return a parent ID.

Experiment 3 (CPU Scheduling Policies)

III. Implement CPU scheduling policies:

(a) FCFS (With same arrival time for all processes).

(b) FCFS (With different arrival time for all processes).

(c) SJF (With same arrival time for all processes).

(d) SJF (With different arrival time for all processes) i.e. SRTF.

(e) Priority scheduling.

(f) Round Robin (With same arrival time for all processes).

(g) Round Robin (With different arrival time for all processes).

Experiment 4 (Contiguous Allocation Techniques)

IV. Implementation of Contiguous allocation techniques:

(a) Best-Fit

(b) First-Fit

(c) Worst-Fit

Experiment 5 (Page Replacement Algorithm)

V. Implementation of Page Replacement techniques:

(a) FIFO page replacement.

(b) LRU page replacement.

(c) Optimal page replacement.

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 such as:

(a) Readers Writers.

(b) Dining Philosopher's.

Experiment 9 (Orientation with different types of OS)

VIII. Implementation of problems such as:

(a) Real-time OS.

(b) Distributed OS.

MCA-PG-L206	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 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 implement string 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.
23. Write a C program to implement all the functions of a dictionary (ADT) using hashing.
24. Write a c program to implement Kruskal's Algorithm.

MCA-PG-C301	Strategic Management	Credit: 4

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 (15 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, SWOT Analysis, Profit Impact of Market Strategy (PIMS).

UNIT III (15 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 (15 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.

Text Books:

1. Carpenter M A, Sanders W G, Salwan P, 2004, Strategic Management, A Dynamic Perspective - Concepts and Cases, Dorling Kindersley (India) Pvt Ltd, Pearson Education.
2. Barney, J B, Hesterly W S, 2008, Strategic Management and Competitive Advantage-Concepts, PHI Learning Private Limited.
3. Michael V P, 2009, Globalization, Liberalization and Strategic Management.

Reference Books:

1. Lomash S, Mishra P K, 2005, Business Policy and Strategic Management, Vikas Publishing House Pvt. Ltd.
2. David F R, 2008, Strategic Management, Prentice Hall International.

MCA-PG-C302	Formal Language and Automata Theory	Credit: 4

Introduction: Mathematical preliminaries, Alphabet, Grammars, Languages, Productions and Derivation, Transition functions, Transition graph, Transition table, Finite Automata: Deterministic Finite Automata (DFA) and Non-Deterministic Finite automata (NFA), Design of NFA and DFA, NFA and its equivalence with DFA, Minimization of FA, Regular set, Regular Expressions (RE), Regular Grammar, Regular Languages, FA and its equivalence with RE and its design, Properties of Regular Languages, Pumping Lemma for Regular Languages.

UNIT II (15 Hrs)

Context Free Languages (CFL) and Pushdown Automata (PDA): Context-free grammars (CFG) and languages (CFL), Simplification of CFG, Normalization and Normal Forms: Chomsky Normal Form (CNF) and Greibach Normal Form (GNF), Non-Deterministic Pushdown Automata (NPDA) and equivalence with CFG, Parsing, Parse trees, Ambiguity in CFG, Deterministic Pushdown Automata, and closure properties of CFLs, Parsing the CFG to generate parse tree using any parser.

UNIT III (15 Hrs)

Context Sensitive Languages: Context Sensitive Grammars (CSG) and Languages (CSL). 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.

UNIT IV (15 Hrs)

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

Text Books:

1. Lewis H R, Papadimitriou C H, 1988, Elements of the Theory of Computation, Pearson Education Asia.
2. Hopcroft J E, Motwani R, Ullman J D, 2008, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
3. Kozen D C, 1997, Automata and Computability, Undergraduate Texts in Computer Science, Springer.

Reference books:

1. Sipser M, 2012, Introduction to the Theory of Computation, PWS Publishing.
2. Martin J, 2010, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.

MCA-PG-C303	Object Oriented Programming using Java	Credit: 4

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, constraints).
Introduction to Java: Features of Java, Object Oriented Concepts, Lexical Issues, Data Types, Variables, Arrays, Operators, Control Statements.

UNIT II (15 Hrs)

Classes: Objects, Constructors, Overloading method: Static 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, Deadlock: Suspending, Resuming and stopping threads, Multithreading.

UNIT III (15 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.

UNIT IV (15 Hrs)

J2EE: Architectural overview, J2EE database, JDBC objects, Understanding Java Server Pages, Enterprise JavaBeans, containers and servers; entity vs. Session beans, XML deployment descriptors, Java Swing.
Sockets: Introduction to java sockets, Concurrent client-server, Iterative client-server.

Text Books:

1. Cornell G, Horstmann C S, 2012, Core Java: Advanced Features, Pearson, 9E.
2. Naughton R, Schildt H, 2007, Java The Complete Reference, TMH, 8E.
3. Balagurusamy E, 2009, Programming with Java: A Primer, TMH.

Reference Books:

1. Young B J, Maksimchuk R A, Engel M W, Houston K A, Booch G, Conallen J, 2008, Object-Oriented Analysis and Design with Applications, Pearson.
2. Keogh J. 2011, J2Ee: The Complete Reference, TMH, 1E.

MCA-PG-C304	Microprocessor and Microcontroller	Credit: 4

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 (15 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 (15 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 (15 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.

Text Books:

1. Kumar N S, Saravanan M, Jeevananthan S, 2 0 1 0 , Microprocessors and Microcontrollers, Oxford University.
2. Gaonkar R, 2 0 0 2 , Microprocessor Architecture, Programming, and Applications with the 8085, Penram.
3. Banzi M, 2011, Getting Started with Arduino, Make, O'Reilly.

Reference Books:

1. Margolis M, 2011, Arduino Cookbook, O'Reilly.
2. Richardson M, Wallace S, 2012, Getting Started with Raspberry Pi, O'Reilly.
3. Hohl W, 2009, ARM Assembly Language: Fundamentals and Techniques, CRC.
4. Symes D, 2011, ARM System Developer's Guide: Designing and Optimizing System Software, MK.

MCA-PG-L306	Object Oriented Programming using 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 display multiplication table using arrays.
3. Write a Java Program to find the area, parameter of a circle and square using constructor.
4. Write a Java Program to calculate the percentage of the students mark and grade their points to implement method overriding.
5. Write a Java Program to add and display the book details in the library using inheritance.
6. Write a Java Program to make a calculator implementing the concept of Exception Handling.
7. Write a Java Program to run three threads.
8. Write a Java program for sorting a given list of names.
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. Design an applet to display your Bio-data.
11. Write a Java Program using applet for configuring Applets by passing parameters.
12. Write a Java Program to create Arithmetic Math Calculator Using Applet Class and Event Handling.
13. Write an applet program to design a smiley.
14. Write a Java program to create frame that displays the student information.
15. Write a Java program using java controls to design a calculator.
16. Write a Java Program using Graphics class:
    i. Display basic shapes and fill them with colors.
    ii. Set background and foreground colors.
17. Write a Java Socket programming to perform addition of two numbers.
18. 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).
19. Write a JSP program to print even and odd number.
20. Write a JSP program to design a login page.

MCA-PG-L306	Hardware Design Laboratory	Credit: 4

Microprocessor Laboratory: Assembly language programming using 8085. Exercises to be done based on Delay, Stack, Subroutine, Arithmetic, Interrupts etc. Assembly language programming based on 8085 may be studied
On simulators as well as kits.

Microcontroller Laboratory: Introduction and familiarization with AT Mega, ARM and Intel microcontrollers.
Project: Attention should be given on Arduino, Raspberry Pi, and Intel Galileo based application development like sensor (temperature, flex, gyro, light, etc.), actuator (lcd, dc motor, stepper motor, relay etc.). Priority should be given on web based application development. Android APP may also be included while developing a system.

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

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 (15 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 (15 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 (15 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.

Text Books:

1. Subbaram N R, 1998, Handbook of Indian Patent Law and Practice, S. Viswanathan Printers and Publishers.
2. Martin M, Schinzinger R, 2005, Ethics in Engineering, McGraw Hill.
3. Harris C E, Pritchard M S, Rabins M J, 2000, Engineering Ethics–Concepts and Cases,

Thompson Learning.

Reference Books:

1. Fleddermann C D, 1999, Engineering Ethics, Prentice Hall, New Mexico.
2. Boatright J R, 2003, Ethics and the Conduct of Business, Pearson Education.
3. Seebauer E G, Barry R L, 2001, Fundamentals of Ethics for Scientists and Engineers, Oxford University Press.

MCA-PG-C402	Database Management System	Credit: 4

Introduction: Database, Database Management System (DBMS), Database system environment, data abstraction, instances and schemas, DBMS features, Advantages of DBMS over Traditional File Processing System, Data Definition Language (DDL), Data Manipulation Languages (DML), Actors on the scene, Workers behind the scene, Client-Server: Two-tier, Three-tier architecture, DBMS classifications.

Entity-Relationship model: Various components of ER diagram, mapping constraints, E-R diagram, reducing E-R diagrams to tables.

UNIT II (15 Hrs)

Relational model: Structure of a relational database, operation on relations, Salient feature of a query language, Structured Query Language (SQL): Features, Various DDL and DML commands.

Normalization: Pitfalls in RDBMS, Importance of Normalization, and Various Normal Forms based on Primary Key, Based on any Key: First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), Boyce-Codd Normal Form (BCNF).

UNIT III (15 Hrs)

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

Importance of Database Tuning and Query Optimization: Index selection and clustering, Importance of query processing, equivalence of queries, cost Estimation for processing a query, Brief Introduction to hierarchical and network model: Data description and tree structure diagram for hierarchical model, retrieval and update facilities, and limitations.

UNIT IV (15 Hrs)

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

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

Text Books:

1. Silberschatz A, Korth H, Sudarshan S, 2010, Database System Concepts, McGraw-Hill.
2. Ramakrishnan R, 2003, Database Management Systems, WCB/McGraw-Hill.
3. Ullman J D, 1989, Principles of Database Systems, Galgotia.

Reference Books:

1. Elmasri R, Navathe S, 2008, Fundamentals of Database Systems, Addison-Wesley.
2. Desai B, 1990, An Introduction to Database Systems, Galgotia.
3. Abiteboul S, Hull R, Vianu V, 1995, Foundations of Databases. Addison-Wesley.

MCA-PG-C403	Advanced Web Programming	Credit: 4

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 (15 Hrs)

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

UNIT III (15 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 (15 Hrs)

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

Text Books:

1. Jackson, 2007.Web Technologies: A Computer Science Perspective, Pearson, 2007.
2. Holzner S, 2007. Php: The Complete Reference, TMH.
3. Murach J, 2008. Andrea Steelman, Murach's Java Servlets and JSP, Murach's, 2E.
4. Hoekman Jr. R, 2004. Java Servlet & JSP Cookbook, Schorr Pub.

Reference Books:

1. David L., Comer Douglas E., 2009. Internetworking With TCP/IP: Design, Implementation, And Internals, 3E, Prentice Hall.
2. Pascal H, Markus K, Sebastian R, 2009. Foundations of Semantic Web Technologies, Chapman and Hall/CRC.
3. Jamsa K, 2002. Konrad King, HTML & Web Design, TMH Publications.
4. Hunter J, 2010. William Crawford, Servlet Programming, O'REILY.

MCA-PG-C404	Software Engineering	Credit: 4

UNIT I (15 Hrs)

Introduction to Software Engineering: The software engineering discipline-evaluation and impact, Programs vs. software products, Why study of software engineering, Emergence of software engineering, Notable changes in software development practice, Computer system engineering.
Software life cycle: Life Cycle Models: Classical waterfall model, Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, comparison of different life cycle models.

UNIT II (15 Hrs)

Software Project Management: Responsibilities of project manager, Project planning, Metrics for project size estimation, Project estimation techniques-Empirical estimation and Heuristic estimation, Staffing Level Estimation, Putnam's Model.
Software Requirements Specification: Contents and Organization of the SRS Document, Functional Requirements, Traceability, Characteristics of a Good SRS Document. Case study on IEEE standard 830 for Software requirement specification (SRS).

UNIT III (15 Hrs)

Design Concepts: Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function oriented design.
Function Oriented Design: Overview of SA/SD methodology, Structured analysis, Data flow diagram, Extending DFD technique to real life systems, Structured design, detailed design, Design review.
Object Oriented Design: Key Concepts Unified Modelling Language (UML), UML Diagrams, Use Case Diagram, Sequence Diagram, Activity Diagram, State Diagram and Class Diagram.

UNIT IV (15 Hrs)

Coding, Testing and Maintenance: Coding guidelines and standards, Block Box Testing, White Box Testing, Unit Testing, Integration testing, System testing. Software Maintenance Models, estimation of maintenance cost.
Software reliability and quality management: Software reliability, Statistical testing, Software quality, Software quality management system, ISO 9000, SEI capability maturity model, Personal software process (PSP), Six sigma, Software quality & Metrics

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.

Text Books:

1. Mall R, 2005, Fundamentals of Software Engineering, Prentice Hall of India.
2. Jalote P, 2005, An Integrated Approach to Software Engineering, 3E, Narosa Publishing House.
3. Fairley R, 2006, Software Engineering Concepts, Tata McGraw Hill.

Reference Books:

1. Pressman R S, 2005, Software Engineering: A practitioner's approach, McGraw Hill.
2. Somerville, 2012, "Software Engineering", Pearson

MCA-PG-L405	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.

Q3: 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.

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.

EXERCISE 6
Title of the Exercise: PL/SQL
AIM OF THE EXPERIMENT: To write various programs using PL/SQL.

EXERCISE 7
Title of the Exercise: Database connectivity using XAMPP server or any other.
AIM OF THE EXPERIMENT: To Write a program in PHP or any other programming language to establish database connectivity.

MCA-PG-L406	Advanced Web Programming Laboratory	Credit: 4

Laboratory Experiments

1. Create a simple html file to demonstrate the use of different tags.

1.a. Headings (h1 to h6)

1.b. Paragraph.

1.c. Line Break.

1.d. Pre tag.

1.e. Different logical style (<b>,<i>,<sub>,<sup>).

1.f. Listing tags.

2. Create a HTML paragraph to illustrate the use of following commands

2.a. Changing Direction of Text.

2.b. Citation

2.c. Abbreviations

2.d. Mark

2.e. Acronyms

2.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.

4.a. Submit button.

4.b. Radio element.

4.c. Text element.

4.d. Reset button.

4.e. Password.

4.f. Datalist.

4.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-C501	Computer Networks	Credit: 4

UNIT I (15 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.

UNIT II (15 Hrs)

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.
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.

UNIT III (15 Hrs)

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.
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, UDP, TCP congestion control & Timer management.

UNIT IV (15 Hrs)

Application layer: DNS, SMTP, POP3, FTP, TELNET, HTTPS, SNMP.
Network Security: Introduction to Cryptography, Certificates, Firewalls.
Wireless and mobile communication: Wireless transmission, cellular radio, Gigabit and Terabit technology, CDMA, WCDMA.

Text Books:

1. Stallings W, 2007. Data and Computer Communication, Prentice Hall of India
2. Forouzan B A, 2007, Data Communication and Networking, McGraw-Hill.
3. Tanenbaum A S, 2008, Computer Networks, Prentice Hall.
4. Comer D, 2006, Internetworking with TCP/IP, Prentice Hall of India, Vol.1.

Reference Books:

1. Stevens W R, 2011, TCP/IP Illustrated: The Protocol, Volume 1, Addison-Wesley.
2. Stallings W, 2008, Cryptography and Network Security: Principles and Practice, PHI.
3. Koblitz N, 2008, A course in number theory and cryptography, Springer.

MCA-PG-E5XX	Elective I	Credit: 4

MCA-PG-E504	Cloud Computing	Credit: 4

UNIT I (15 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 (15 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 (15 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 (15 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, Auto provisioning, 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.

Text Books:

1. Kavis M J, 2014, Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, & IaaS), Wiley.
2. Gonzales D, 2010, Cloud Computing Bible: A Practical Approach To Cloud Computing Security, CloudProblems To Be Aware of and More, Kindle E.
3. Erl T, 2013, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall.

Reference Books:

1. Nielsen L, 2014, The Little Book of Cloud Computing, Kindle E.
2. Guy Bunker G, Thomson D, 2006, Delivering Utility Computing, John Wiley & Sons.
3. Reese G, 2009, Cloud Application Architectures, O'Reilly.
4. Gillam L, 2010, Cloud Computing: Principles, Systems and Applications, Springer.

MCA-PG-E505	Operation Research	Credit: 4

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 (15 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 (15 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 (15 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.

Text Books:

1. Taha H, 2008, Operations Research - An Introduction, Prentice-Hall.
2. Panneerselvam R, 2006, Operations Research, EEE.

Reference Books:

1. Kothari, 2009, Quantitative Techniques, Vikas.
2. Kapoor V K, 2005, Operations Research, S. Chand.
3. Hiller F. and Leibermann G. J., 2001, Operation Research, Holder Day Inc.

MCA-PG-E506	Wireless Sensor Network	Credit: 4

Motivation for a Network of Wireless Sensor Nodes and Its Applications
Definitions and background; sensing and sensors-sensor classification, wireless sensor networks; applications of wireless sensor networks; Difference between WSNs and Ad Hoc Wireless Networks challenges and constraints- energy, self-management, wireless networking, decentralized management, design, constraints, security, other challenges
Node Architecture and Operating System: sensing subsystem, the processor subsystem, communication interfaces, the IMote node architecture, operating systems - functional aspects, nonfunctional aspects; prototypes-TinyOS

UNIT II (15 hrs)

Physical Layer: Basic components, source encoding, channel encoding, modulation, signal propagation
Medium Access Control : overview, wireless MAC Protocols - Carrier Sense Multiple Access, Multiple Access with Collision Avoidance (MACA) and MACAW , MACA By Invitation, IEEE 802.11, IEEE 802.15.4 and ZigBee; Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols

UNIT III (15 Hrs)

Network Layer: overview, categories of routing protocol, routing metrics, flooding and gossiping, data-

centric routing- sensor protocols for information via negotiation, directed diffusion, rumor routing, gradient-based routing; proactive routing-destination sequenced distance vector, optimized link state routing; on-demand routing-ad hoc on-demand distance vector, dynamic source routing; hierarchical routing, location-based routing

Node and Network Management: power management- local power management, dynamic power management, architectural overview; time synchronization- clocks and the synchronization problem, time synchronization in wireless sensor networks, Sensor Database Challenges, In Network Aggregation, and Temporal Data.

UNIT IV (15 hrs)

Localization: overview, ranging techniques, range-based localization- triangulation, GPS-based localization; range-free localization- ad hoc positioning system (APS); event-driven localization Security : Fundamentals of network security, challenges of security in wireless sensor networks, security attacks in sensor networks, protocols and mechanisms for security, IEEE 802.15.4 and ZigBee security

Text Books:

1. Dargie W, Poellabauer C, 2009, Fundamentals of Wireless Sensor Networks: Theory and Practice, Wiley.
2. Zheng J, Jamalipour A, 2008, Wireless Sensor Networks: A Networking Perspective, Wiley.
3. Zhao F, Guibas L, 2010, Wireless Sensor Networks: An Information Processing Approach, Elsevier.

Reference Books:

1. Karl H, Willig A, 2008, Protocols and Architectures for Wireless Sensor Networks, Wiley.
2. Faludi R, 2006, Building Wireless Sensor Networks, O'Reilly Publication.

MCA-PG-E507	Compiler Design	Credit: 4

Introduction: Phases of compilation and overview Lexical Analysis (scanner): Regular language, Finite Automata, Regular Expression, Regular Languages, Regular expression to Finite Automata, Normalization, Scanner generator (lex, flex).

UNIT II (15 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 (SDD), Syntax Directed Translation (SDT), Evaluation and flow of attribute in a syntax tree using Top down and Bottom up parser.

UNIT III (15 Hrs)

Symbol Table: Its structure, symbol attributes and Scope 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 (15 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

Text Books:

1. Aho A V, Sethi R, Ullman J D, 2007, Compilers: Principles, Techniques and Tools, Addison-

Wesley.
2. Scott M L, 2009, Programming Language Pragmatics, Elsevier.
3. Appel A W, 2004, Modern Compiler Implementation in C/Java, Cambridge University Press.
4. Cooper K D, Torczon L, 2011, Engineering a Compiler, Elsevier.

Reference books:

1. Holob A I, 1994, Compiler Design in C, Prentice-Hall.
2. Muchnik S S, 1997, Advanced Compiler Design and Implementation, Elsevier.
3. Allen R, Kennedy K, 2007, Optimizing Compilers for Modern Architectures, Elsevier.

MCA-PG-E508	Big Data Analytics	Credit: 4

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

UNIT II (15 Hrs)

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

UNIT III (15 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 (15 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 j
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.

Text Books:

1. Schonberger V M, Cukier K, 2013, Big Data: A Revolution That Will Transform How We Live, Work, and Think, Kindle E.
2. Chellappan S, Acharya S, 2015, Big Data and Analytics (WIND), Wiley.
3. Kulkarni P, Joshi S, Brown M S, 2016, Big Data Analytics, PHI.

Reference Books:

1. EMC Education Services, 2015, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley.
2. Erl T, Kattak W, Buhler P, 2016, Big Data Fundamentals: Concepts Drivers: Concepts, Drivers and Techniques, PHI.

MCA-PG-E509	Real-Time System	Credit: 4

Introduction: Definition and concepts of RTS, Issues in Real Time Computing, Broad categories and characteristics of Real Time (RT) systems, RT tasks classification, Modeling of Time constraints, Task Assignment and Scheduling, Mode changes and Fault Tolerant Scheduling.
Real Time task scheduling: Basics on RT task scheduling, RT task scheduling algorithms, Preemptive RT algorithms (Earliest deadline first, RMA), Static priority scheduling protocols, Resource sharing among RT Tasks, Priority inversion, Priority inheritance protocol (PIP), HLP, PCP, Different types of priority inversion under PCP, Scheduling RT tasks in multiprocessor and distributed systems.

UNIT II (15 Hrs)

Real Time Operating System: RTOS definition and characteristics, comparison with general- purpose OSs, light-weight vs. heavy-weight RTOSs, Commercial RTOS: UNIX V, UNIX based RTOS, RT

POSIX, RT capabilities of Windows NT, Windows CE, Performance benchmarking of RTOS.
Real Time communication : Characteristics of RT traffic, Models for traffic characterization, Applications requiring RT communication, Soft and hard RT communication in a LAN, Network Topologies, Fault tolerant Routing, Fault Error containment Redundancy, Bounded access protocols for LANs, Performance comparison, QoS framework, QoS models.

UNIT III (15 Hrs)

Real Time databases: Definition, , Real time vs General Purpose Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two phase Approach to improve Predictability, Maintaining Serialization Consistency, Commercial RT databases.

UNIT IV (15 hrs)

Evaluation Techniques and Clock Synchronization
Reliability Evaluation Techniques, Software error models, Clock Synchronization, Fault Tolerant Synchronization in hardware and software.
Programming languages and tools
Programming Languages and Tools, Desired language characteristics, Data typing, Control Structures, Facilitating Hierarchical Decomposition, Packages, Programming Environments, Run time support.

Text Books:

1. Mall R, 2007, Real Time Systems, Theory and Practice, Pearson Education, 2E.
2. Liu J W, 2004, Real Time systems, Pearson Education, 5E.
3. Laplante P, 2008, Real Time Systems Design and Analysis, Prentice Hall, 3E.
4. Klein M H, Ralya T, 1994, Practitioner's Handbook for Real-Time Analysis, Kluwers Academic Publishers, 2E.

Reference Books:

1. Gomaa H, 2007, Software Design Methods for Concurrent and Real-time Systems, Addison- Wesley.
2. Bennett S, 1998, Real Time Computer Control – An Introduction, Prentice Hall of India.
3. Allworth S T, Zobel R N, 1987, Introduction to real time software design, Macmillan, 2E.

MCA-PG-E510	Android Application Development	Credit: 4

Basics: What is Android, History and Version, Installing softwares, Setup Eclipse, Hello Android example, Internal Details, Dalvik VM, Software Stack, Android Core Building Blocks, Android Emulator, AndroidManifest.xml, R.java file, Hide Title Bar, Screen Orientation
UI Widgets: Working with Button, Toast, Custom Toast, Button, Toggle Button, Switch Button, Image Button, CheckBox, AlertDialo, Spinner, AutoComplete, TextView, RatingBar, DatePicker, TimePicker, ProgressBar, Quick Contact Budge, Analog Clock and Digital Clock , Working with hardware Button, File Download
Activity, Intent & Fragment: Activity Lifecycle, Activity Example, Implicit Intent, Explicit Intent, Fragment Lifecycle, Fragment Example, Dynamic Fragment, Android Menu, Option Menu, Context Menu, Popup Menu

UNIT II (15 Hrs)

Layout Manager: Relative Layout, Linear Layout, Table Layout, Grid Layout Adaptor:
Array Adaptor, ArrayList Adaptor, Base Adaptor
View: GridView, WebView, ScrollView, SearchView, TabHost, DynamicListView, ExpandedListView
Android Service: Android Service, Android Service API, Android Started Service, Android Bound Service, Android Service Life Cycle, Android Service Example
Data Storage: Shared Preferences, Internal Storage, External Storage SQLit:

SQLite API, SQLite Spinner, SQLite ListView
XML & JSO: XML Parsing SAX, XML Parsing DOM, XML Pull Parser, JSON Parsing

UNIT III (15 Hrs)

Cotent Provider: Content Proivider Fundamental, Contact Content Provider, Other Built-in Content Providers, Creating Custom Content Provider, Understanding Content URI, ContentResolver, Sharing Information from custom content provider
Android Notification: Notification API, Creating Notification Builder, Setting Notification Properties, Attaching Actions, Issuing Notification, NotificationCompat.Builder class, Android Notification Examples
Multimedia: Wallpapaer, Live Wallpaper, Multimedia API, Playing Audio, Creating Audio Player, Playing Video, Alarm Manager, Gallery

UNIT IV (15 Hrs)

API: Speech API, Telephony API, Location API, Android Animation API, Sensor API, Graphics API
Device Connectivity: Bluetooth Tutorial, List Paired Devices, Working with WiFi, Working with Camera
Android P2P Communication: Introducing Instant Messaging, Using the GTalk Service, Monitoring the Roste for Change, Sending and Receiving Data Messages, Transmitting Data Messages, Receiving Data Messages
Android Web Services, Android Google Map

Text Books:

1. Burd B, 2015. Android application development all-in-one for dummies, Wiley, 2E.
2. Griffiths D, 2015. Griffiths D, Head First Android Development, O'Reilly.
3. Maclean D, Komatineni S, Allen G. 2015. Pro Android 5, Apress.

Reference Books:

4. DiMarzio J F, 2016. Beginning Android Programming with Android Studio, Wrox, 4E.
5. Yener M, Dundar O. 2016. Expert Android Studio, Wrox.

MCA-PG-E511	Digital Image Processing	Credit: 4

UNIT I (15 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 (15 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 (15 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 (15 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.

Text Books:

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

Reference Books:

1. Chanda B, Majumder D, 2011. Digital Image Processing and Analysis, Prentice Hall Publications.
2. Jayaraman, 2011. Digital Image Processing, McGraw Hill.
3. Shinghal R,2006, Pattern Recognition, Oxford Publications.

MCA-PG-E512	Cryptography and Network Security	Credit: 4

UNIT I (15 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 (15 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.

UNIT III (15 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 (15 Hrs)

Entity authentication: Passwords, challenge-response algorithms, zero-knowledge protocols. Standards: IEEE 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.

Text Books:

1. Menezes A J, Oorschot P C V, Vanstone S A, 201, Handbook of Applied Cryptography, CRC Press.
2. Stallings W, 2006, Cryptography and Network Security: Principles and Practice, Prentice Hall of India.
3. Koblitz N, 2007, A course in number theory and cryptography, Springer.

Reference Books:

1. Buchmann J A, 2000, Introduction to Cryptography, Undergraduate Text in Mathematics, Springer.
2. Stinson D, 2006, Cryptography Theory and Practice, CRC Press.
3. Das A, Madhavan C A V, 2009, Public-Key Cryptography: Theory and Practice, Pearson Education Asia.

MCA-PG-E513	Computer Graphics	Credit: 4

UNIT I (15 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 (15 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 (15 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 (15 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.

Text Books:

1. Hearn D D, Baker M P, 1997, Computer Graphics, C Version 2nd E (Paperback), Version C, Pearson
2. Education, 2E.
3. Giloi W K, 1978, Interactive Computer Graphics, Data Structure, Algorithms, Languages, Prentice Hall, Englewood Cliffs.

Reference Books:

1. Newman W M, Sproull R F, 1979, Principles of Interactive Computer Graphics, McGraw Hill, New Delhi.
2. Foley J D, 1993, Computer Graphics, Addison-Wesley, 2E.
3. Hearn D, Baker P M, 1987, Computer Graphics, Prentice Hall of India, New Delhi, 2E.
4. Hill F S, 1990, Computer Graphics, McMillan, New York.

MCA-PG-E514	Internet of Things	Credit: 4

UNIT I (15 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 (15 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 (15 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 (15 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.

Text Books:

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

Reference Books:

1. Hersent O, Boswarthick D, Elloumi,O, 2915, The Internet of Things: Key Applications and Protocols, Wiley.
2. Cassimally H, Mcewen A, 2015, Designing The Internet of Things, Wiley.

MCA-PG-E515	Embedded Systems	Credit: 4

UNIT I (15 Hrs)

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

UNIT II (15 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 (15 Hrs)

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

UNIT IV (15 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.

Text Books:

1. Marwedel P, 2011, Embedded System Design, Kluwer.
2. Wolf W, 2008, Computers as Components: Principles of Embedded Computing Systems Design, Morgan Kaufmann.
3. Vahid F, Givargis T, 2006, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley.

Reference Books:

1. Vahid G, Narayan, Gong, 2007, Specification And Design Of Embedded Systems, Pearson.
2. Ray P P, Rai R, 2013, Open Source Hardware: An Introductory Approach, Lap Lambert Pub.

MCA-PG-E516	Mobile and Wireless Network	Credit: 4

UNIT I (15 Hrs)

The Cellular Concept-System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference , Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring .

UNIT II (15 Hrs)

Mobile Radio Propagation: Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection-Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two-Ray) Model, Diffraction-Fresnel Zone Geometry, Knife- edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley- Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

UNIT III (15 Hrs)

Mobile Radio Propagation: Small Scale Fading and Multipath: Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel-Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels- Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels-Clarke's model for flat fading, spectral shape due to Doppler spread in Clarke's model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT IV (15 Hrs)

Equalization and Diversity: Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non linear Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. Diversity Techniques- Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration- Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

Text Books:

1. Rappaport T S, 2002, Wireless Communications, Principles, Practice, PHI, 2E.
2. Goldsmith A, 2005, Wireless Communications, Cambridge University Press.

3. Rao G S, 2012, Mobile Cellular Communication, Pearson Education.

Reference Books:

1. Basagni S, Conti M, Giordano S, Stojmenovic I, 2012, Mobile Ad Hoc Networking, Wiley, 2E.
2. Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, 2014, Wireless and Mobile Networks, Wiley, 2E.

MCA-PG-E517	Programming with Python	Credit: 4

UNIT I (15 Hrs)

Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator
Conditional Statements: If, If- else, Nested if-else
Looping: For, While, Nested loops
Control Statements: Break, Continue, Pass
String Manipulation: Accessing Strings, Basic Operations, String slices, Function and Methods
Lists: Introduction, Accessing list, Operations, Working with lists, Function and Methods Tuple: Introduction, Accessing tuples, Operations, Working, Functions and Methods

UNIT II (15 Hrs)

Dictionaries: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties Functions
Functions: Defining a function, Calling a function, Types of functions, Function Arguments Anonymous functions, Global and local variables
Modules: Importing module, Math module, Random module, Packages, Composition
Input-Output: Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions
Exception Handling: Exception, Exception Handling, Except clause, Try?, finally clause, User Defined Exceptions

UNIT III (15 Hrs)

Advance Python: OOPs concept, Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding
Regular expressions: Match function, Search function, Matching VS Searching, Modifiers, Patterns
CGI: Introduction, Architecture, CGI environment variabl, GET and POST methods, Cookies, File upload
Database: Introduction, Connections, Executing queries, Transactions, Handling error,

UNIT IV (15 Hrs)

Networking: Socket, Socket Module, Methods, Client and server, Internet modules Multithreading: Thread, Starting a thread, Threading module, Synchronizing threads, Multithreaded Priority Queue
GUI Programming: Introduction, Tkinter programming, Tkinter widgets

R language: Overview of R, R data types and objects, reading and writing data, Control structures, functions, scoping rules, dates and times, Loop functions, debugging tools, Simulation, code profiling

Text Books:

1. Mueller J P, 2015. Beginning Programming with Python for Dummies, Wiley.
2. Dierbach C. 2015. Introduction to Computer Science Using Python : A Computational

Problem - Solving Focus , Wiley.
3. Hall T, Stacey J P. 2009. Python 3 for Absolute Beginners, Apress.

Reference Books:

1. Rao R N, 2016. Core Python Programming, Dreamtech.
2. Lubanovic B. 2014. Introducing Python, O'Reilly.

MCA-PG-D502 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 topic assigned/approved under the supervision of one or more SU faculty member

Minor Project might 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.

Major Project shall cater the implementation of the assigned topic on practical depending upon the work done so far by the student. The student may publish or communicate the findings of the work in journals or conferences. The evaluation of the dissertation should be monitored by the faculty time to time. The student has to defend his/her dissertation in an open seminar.
In special circumstances, Department may allow the students to carry out the **Major Project inside** the University. However, Minor Project should be carried within University and **Major Project and Minor Project** may not be related.

MCA-PG-I503 (Internship): Students studying semester 4^{th} shall be required to pursue at least 3 weeks internship program in terms of Summer School/ Academic Visit/ Short Term Course/ Industry Visit/ In House Project. The credit may be included in next semester in form of marks in the subject.

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