DEPARTMENT OF COMPUTER APPLICATIONS
SYLLABUS FOR INTEGRATED BCA-MCA (5 YEARS COURSE)

BCA		
CODE	**PAPER NAME**	**CREDIT**
BCA-UG-101	Fundamentals of Computer & C Programming	4
BCA-UG-102	Communication Skill	4
BCA-UG-103	Basic Electronics	4
BCA-UG-104	Digital Logic	4
BCA-UG-105	Mathematics-I	4
BCA-UG-106	Fundamentals of Computer & C Programming	4
		Total Credit: 24

BCA		
CODE	**PAPER NAME**	**CREDIT**
BCA-UG-201	Mathematics-II	4
BCA-UG-202	Principles of Management	4
BCA-UG-203	Environmental Studies	4
BCA-UG-204	Data Structure with C	4
BCA-UG-205	Computer Organization & Architecture	4
BCA-UG-206	Data Structure with C Laboratory	4
		Total Credit: 24

BCA		
CODE	**PAPER NAME**	**CREDIT**
BCA-UG-301	Mathematics-III	4
BCA-UG-302	Operating System	4
BCA-UG-303	Organizational Behavior	4
BCA-UG-304	Object Oriented Programming with Java	4
BCA-UG-305	Operating System Laboratory	4
BCA-UG-306	Object Oriented Programming with Java Laboratory	4
		Total Credit: 24

BCA		
CODE	**PAPER NAME**	**CREDIT**
BCA-UG-401	Microprocessors	4
BCA-UG-402	Database Management System	4
BCA-UG-403	Formal Language & Automata Theory	4
BCA-UG-404	Human Resource Management	4
BCA-UG-405	Database Management System Laboratory	4
BCA-UG-406	Microprocessors Laboratory	4
		Total Credit: 24

BCA		
CODE	**PAPER NAME**	**CREDIT**
BCA-UG-501	Numerical Methods	4
BCA-UG-502	Data Communication & Networks	4
BCA-UG-503	Web Technology	4
BCA-UG-504	Software Engineering	4
BCA-UG-505	Computer Networks Laboratory	4
BCA-UG-506	Web Technology Laboratory	4
		Total Credit: 24

BCA		
CODE	**PAPER NAME**	**CREDIT**
BCA-UG-601D	Dissertation I	12
BCA-UG-602EX	Elective I	4
BCA-UG-603S	Seminar I	4
		Total Credit: 20
		Total BCA Credit: 140

MCA		
CODE	**PAPER NAME**	**CREDIT**
MCA-PG-101	Graph Theory	4
MCA-PG-102	Artificial intelligence	4
MCA-PG-103	Cryptography and Network Security	4
MCA-PG-104	Design and Analysis of Algorithm	4
MCA-PG-105	Algorithm Laboratory	4
MCA-PG-106S	Seminar II	4
		Total Credit:24

MCA		
CODE	**PAPER NAME**	**CREDIT**
MCA-PG-201	Operation Research	4
MCA-PG-202	Mobile and Wireless Communication	4
MCA-PG-203	Compiler Design	4
MCA-PG-204	Elective II	4
MCA-PG-205	Compiler Design Laboratory	4
MCA-PG-206	Operation Research Laboratory	4
		Total Credit:24

MCA		
CODE	**PAPER NAME**	**CREDIT**
MCA-PG-301EX	Elective III	4
MCA-PG-302D	Dissertation II	8
MCA-PG-303IS	Industry Seminar & Group Discussion	4
		Total Credit:16

MCA		
CODE	**PAPER NAME**	**CREDIT**
MCA-PG-401D	Dissertation III	16
		Total Credit:16
		Total MCA Credit: 80
		Total Course Credit: 220

List of Elective I, II, and III		
CODE	**PAPER**	**CREDIT**
BCA-UG-602E1	Object Oriented System Design	4
BCA-UG-602E2	Advanced Web Technology	4
BCA-UG-602E3	Neural Networks and Applications	4
BCA-UG-602E4	Computer Graphics	4
BCA-UG -602E5	Digital Image Processing	4
BCA-UG -602E6	Embedded Systems	4
MCA-PG-204E1	Mobile Computing	4
MCA-PG-204E2	Document Processing and Retrieval	4
MCA-PG-204E3	VLSI System Design	4
MCA-PG-204E4	Data Mining	4
MCA-PG-204E5	Computer Vision	4
MCA-PG-301E1	Fuzzy Logic and Applications	4
MCA-PG-301E2	Advanced Programming Language	4
MCA-PG-301E3	Soft Computing	4
MCA-PG-301E4	Semantic Web Technology	4
MCA-PG-301E5	Cryptology	4
MCA-PG-301E6	Information and Coding Theory	4

Abbreviation: E-Elective, S- Seminar, IS- Industry Seminar, D-Dissertation

BCA-UG-601D (Dissertation I): The students of BCA 6th Semester is required to work for a dissertation on a topic assigned/approved by the faculty committee under the supervision of one or more suitable faculty members. The work for a dissertation should be substantial and relate to some important problem in an area of computer science and/or its applications and should have substantial theoretical or practical significance. A critical review of recent

advances in an area of computer science and/or its applications with some contribution by the student is also acceptable as a dissertation. The dissertation will be evaluated by a committee consisting of the supervisor and an external expert. The student has to defend his/her dissertation in an open seminar.

MCA-PG-106S (Seminar II): Student will be assigned various topics (minimum 6) by the Department which the students should present in open seminar throughout semester. However, this could be compensated by attending internships in various institutions in India/abroad for a period of minimum 1 week.

MCA-PG-303IS (Industry Seminar and Group Discussion): This subject is normally based on industrial training. The industrial training may be organized anywhere in research institutes or in public/private sector organizations. It is generally not possible to arrange training somewhere of the trainee's choice. However, it is recommended that the students should go outside the Institute (SU). The duration of the training is minimum six weeks. During the period of training, the student is placed under the control of an assigned supervisor belonging to the organization where the training is arranged. Practical training may be arranged at a research/R&D organization based on availability of funds and approval from authority.

However, in special circumstances where industrial training is not practically possible this subject could be modified into a presentation by assigning various topics (minimum 8) by the Department which the students should present in open seminar throughout semester.
However, this could be compensated by attending internships in various institutions in India/abroad for a period of minimum 4 weeks.
The mark distribution for industry seminar and group discussion assigned topic by faculty is 50 each.

MCA-PG-302D and MCA-PG-401D (Dissertation II and **III): 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. The assigned topic for dissertation should be substantial enough and related to important problem in an area of computer science and applications and should have implied theoretical and/or practical significance. Dissertation I 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. Dissertation II should cater 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 should be capable enough to at least publish or communicate the findings of the work in some peer reviewed 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 on the **Dissertation II** outside the University. However, in this case **Dissertation I** should be carried within University and **Dissertation I** and **II** may not be related.

Elective I, II and III papers are subject to teacher's committee and could be modified as per their expertise.

Evaluation Criteria: The weightage of evaluation of each paper is 70 for end semester and 30 for midterm excluding **Seminar** and **Dissertation**.

Pass Criteria: Each student should obtain minimum 40% marks in individual paper to pass and 50% marks in the aggregate in each semester to get promoted in to next semester hence the degree.

BCA-UG-101: Fundamentals of Computer & C Programming

Unit I: Introduction

Characteristics and capabilities of a computer, Generation of Computers, Types of Computers, Memory and its types, Various input and output devices, Storage Devices: Storage Fundamentals: Primary Vs Secondary, Data Storage and Retrieval Method: Sequential, Direct and Index Sequential, Various storage devices.

Computer software & Operating systems: Types of software: System Software and Application Software, Some examples of System and Application software, Programming Languages: Machine Language, Assembly language, High-level language.

Unit II: Overview in C

History of C, Importance of C, Basic structure of a C programme, Different sample programmes, Programming style, Executing a C programme, Constants, variables, data types, Storage classes, Overflow and underflow of data.

Operators and expressions: Introduction, Deferent categories of operators in C language, Type conversions in expression, Operator precedence and associativity.

Looping and branching: Decision making and branching, Decision making and looping, Jumps in loops.

Unit III: Array and strings

Introduction, Declaration & Initialization of an array, Types of arrays, Dynamic arrays, Declaring and initializing string variables. Arithmetic operations on characters, string operations, sorting techniques.

User-defined functions and Pointers: Introduction, function definition, need for a user defined functions, elements of a user defined function, category of functions, nesting of functions, recursion, passing arrays to function, passing strings to a function, Pointers and handling.

Unit IV: Preprocessor and Storage class

Preprocessor directive and its handling techniques, Different storage classes.

Structure, Union, and File: Introduction, defining a structure, declaring structure variables, accessing structure members, array of structures, arrays within structures, unions, File handling.

References

1. William S. Davis, Fundamental Computer Concepts, Addison Wesley, 1989.
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill, 2012.
3. K. Venugopal, Mastering in C, 1997.
4. Gottfried, Fundamentals of C, 2E, Schaum's Outlines 1996.
5. Kerningham and Ritchie, the C Programming, 1990.
6. Y. Kanetkar, Let Us C, 12E, BPB, 2006.

BCA-UG-102: Communication Skill

Unit I: Reading strategies

Practice in various techniques: skimming, scanning, eye reading, Active and Passive reading: Reading and interpreting charts and diagrams, Need and Role of reading in technical/industrial organizations.

Written communication: Introduction to technical writing, Discourse writing: Definition, Description, Instruction, Summary writing Cohesive paragraphs.

Unit II: Business communication

Business correspondence: Format, tone and message of business letters, Perspective/point of view in purposive writing, Sales letters.

Unit III: Listening and language development

Barriers to listening: Physical & Psychological, steps to overcome them, Listening with a purpose: Active listening and anticipating the speaker, Practice in note, taking steps to improve speaker's contribution.

Unit IV: Successful speaking techniques

How to improve self expression Need for clear thinking: The Speech process, Fluency & accuracy in speech, developing persuasive speaking skills, Goal oriented group discussion, Formal and public speaking practice.

References

1. Alan Malcy and Sandra Moulding, Learning to listen - Tasks for developing listening skills, Cambridge University Press, 1981.
2. Eric H. Glendinning & Beverly Holmstrom, Study Reading - A Course in reading for academic purpose, Cambridge University Press, 2E, 2004.
3. List Hamp Lyons, Ben Heasley, Study Writing, Cambridge University Press, Updated Edition, 2006.
4. Sharon Bower, Painless public speaking, Thorsons Publishing, New Ed edition, 1986.

BCA-UG-103: Basic Electronics

Unit I: Introduction

Atomic structure: The energy of an electron, Valence electrons: Free electrons, Energy levels,

Energy bands, and important energy bands in solids, Classification of Solids.
Semiconductor Physics: Bonds in semiconductors, commonly used semiconductors, Effect of temperature on semiconductors, Intrinsic and extrinsic semiconductors, n type and p type semiconductors, Majority and minority carriers, p-n junction, Characteristics of forward & reverse biased p-n junction.
Semiconductor Diode: Diode, Different types of Diodes, Diode as rectifier, Resistance of diode, Diode rectifiers (half wave, full wave and bridge rectifiers), Efficiency of rectifiers, Ripple factor, Filter circuits, Zener diode as a regulator.

Unit II: Transistor
Characteristics of Common base, Common emitter and Common collector configuration, Comparison: Transistor as an amplifier (CE), Performance of transistor amplifier: Cut off, Saturation points, D C load line, Voltage gain, Transistor Biasing and Applications Transistor biasing methods: Base resistor methods, Resistor voltage divider bias method: Single stage transistor amplifier, practical circuit of transistor amplifier: D.C and A.C equivalent circuits, load line analysis.

Unit III: Field Effect Transistors (FET)
Types of FET: Junction field effect transistor (JFET), Working of JFET, JFET as an amplifier, Difference between JFET and BJT, Metal oxide semiconductor FET (MOSFET): Working.

Unit IV: Logic Families RTL
DTL, TTL, ECL, Integrated Injection Logic (I2L), Complementary Metal Oxide Semiconductor (CMOS).

References:

1. Theraja B L, "Basic Electronics solid state", S. Chand & Company Ltd, Multi-colour Edition, ISBN:9788121925556
2. Bhargava, N N, Kulshreshtha, D C and Gupta, S C, "Basic Electronics and Linear Circuits", Tata McGraw Hill, 1989, ISBN: 9780074519653
3. Mehta V K and Mehta Shalu, "Principles of Electronics", S. Chand & Company Ltd, 2004, ISBN: 9788121917230

BCA-UG-104 : Digital Logic

Unit I: Introduction
Basic concepts of Diode, BJT, MOSFET, and various logic families.
Number System and Codes: Logic levels and pulse wave forms, Different number systems and their conversions, different complement methods.

Unit II: Boolean algebra and Gate Networks
Fundamental concepts of Boolean algebra, different Gates, universal Gates, Basic laws of

Boolean algebra, DeMorgan's theorems, Simplification of Boolean expression, Karnaug h map (SOP and POS) with examples.

Unit III: Combinational Logic
Adders, Subtractor, Parallel adders, Look ahead carry adder, Decoder, Encoder, Multiplexer, De-multiplexer with applications.

Unit IV: Sequential Logic
Flip-Flops: Latches, Edge triggered flip-flops, Pulse triggered flip flops, Timing diagrams, Buffer registers, Modes of operation of registers (SISO, SIPO, PISO, and PIPO), Asynchronous counters, Synchronous counter.

References

1. R P Jain, Modern Digital Electronics, 4 E, TMH, 2003.
2. Donald Leach, Albert Malvino, Goutam Saha, Digital Principles and Applications, Tata McGraw Hill, 7E, 2010.
3. Thomas Bartee, Digital Computer Fundamentals, 3E, Tata McGraw Hill, 2001.
4. Floyd, Thomas L, Digital Fundamentals, Prentice Hall, 7E, 1999.

BCA-UG-105: Mathematics-I

Unit I: Indices and Surds
Fundamental laws and practices.
Logarithm, Arithmetic Progression and Geometric Progression: Practices
Permutation and Combination: Fundamental laws of multiplication and addition, Formulas proof and practices.
Matrix: Fundamental laws and practices

Unit II: Trigonometrical Ratios of Associated Angles
Proof and practices
Compound Angles: Practices
Transformation of Sums and Products: Practices
Vector: Basic laws and practices

Unit III: Logic
Basic theorem and practices
Theory of Set, Relation and Function: Proof and practices
Limit: Definition, First principle, properties, and Simple problems related to limit, Some standard limits.
Continuity: Definition, function at a point and applications

Unit IV: Coordinate system
Practices
Locus, Straight line and Circle: Practices

References

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

BCA-UG-106: Fundamentals of Computer & C Programming Laboratory

The topics taught in the theory course should be appropriately be sequenced for synchronization with the laboratory. A sample sequence of topics and lab classes for the topic are given below:

1. Familiarization of a computer and the environment and execution of sample programmes
2. Expression evaluation
3. Conditionals and branching
4. Iteration
5. Functions
6. Recursion
7. Arrays
8. Structures
9. Different sorting and searching algorithms.

It is suggested that some problems related to continuous domain problems in engineering and their numerical solutions are given as laboratory assignments. It may be noted that some of basic numerical methods are taught in the mathematics course.

BCA-UG-201: Mathematics-II

Unit I: 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: 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: Laplace Transform

Properties, Inverse LT, Solutions of differential equations using LT, Solutions of simultaneous differential equations using LT

Unit IV: 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.

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

BCA-UG-202: Principles of Management

Unit I: Management Basics

Definition, the history of management, types of manager, manager qualities, Management responsibilities, management tasks and functions.

The Business Environment: defining the organization, organization structure, the quality organization, organizational changes, Centralization and Decentralizations, managing changes, Management obligations, social and professional responsibilities, and government regulations.

Strategy Formulation: the elements of strategy, the strategy formulation process, alliances and acquisitions, strategy formulation tools and techniques, plan implementation.

Unit II: Decision Making

The nature of management decision, the decision making process, decision making techniques.

Information Presentation and Reporting: Principle, Type of Reports, Presentation on Modes, Function reporting system, Information and its uses, Characteristics of information, flow of information.

Unit III: Management Information System (MIS)

Computer based MIS: Advantages & Disadvantages, Brief introduction to project planning and management and its tools/techniques-Gantt chart, PERT/CPM.

Human Resources Management: Concepts & functions, Job analysis and role description.

Management Skills, Leadership and Motivation: The nature of leadership, leadership theories, delegation, motivation and motivation theories, need of motivation, motivation techniques.

Unit IV: Team Building & E ffective Communication

Defining and effective team, selecting team members, building teams, training and development, The communication process, presentation skills, Tools and techniques.

Time Management and Entrepreneurship: The importance of time, characteristics of management tasks, determining time elements, time management techniques, Entrepreneur and its role, how to become an entrepreneur, essentials steps to become an entrepreneur, EDP training.

References

1. Horold Koontz and Iteinz Weibrich, Essential of Management, Tata McGraw Hills, 5E, 2009.
2. J. S. Chandan, Management: Concept and Strategies, Vikas Publishing, 1E, 2007.
3. P C Tripathi, P N Reddy, Principles of Management, Tata McGraw Hill, 2008.

BCA-UG-203: Environmental Studies

Unit I: Introduction to Environmental Studies and Natural Resources

Definition, scope and importance: Need for public awareness, forest resources: use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams: benefits and problems, mineral resources: use effects on forests and tribal people, water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies : food resources, world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies: energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies: land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification: role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.

Unit II: Ecosystems and Biodiversity

Concept of an ecosystem , structure and function of an ecosystem , producers, consumers and decomposers, energy flow in the ecosystem , ecological succession: food chains, food webs and ecological pyramid: introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries), introduction to biodiversity: definition: genetic, species and ecosystem diversity, bio-geographical classification of India, value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, biodiversity at global, national and local levels, India as a mega-diversity nation, hot-spots of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts , endangered and endemic species of India, conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Unit III: Environmental Pollution

Definition: causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards, solid waste management: causes, effects and control measures of urban and industrial wastes, role of an individual in prevention of pollution, pollution case studies, disaster management: floods, earthquake, cyclone and landslides.

Unit IV: Social Issues and the environment

From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns, case studies, environmental ethics: issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents

and holocaust, case studies: wasteland reclamation, consumerism and waste products, environment protection act, air (prevention and control of pollution) act, water (prevention and control of pollution) act, wildlife protection act, forest conservation act, issues involved in enforcement of environmental legislation, public awareness.

Human Population and the Environment:

Population growth, variation among nations, population explosion, family welfare programme, environment and human health, human rights, value education: HIV / AIDS, women and child welfare, role of information technology in environment and human health: case studies.

References

1. Gilbert M Masters, "Introduction to Environmental Engineering and Science", Prentice Hall, 3E, 2007.
2. Miller T.G. jr., "Environmental Science", Cengage Learning (Thompson), 11E, 2006.
3. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Wiley-Blackwell, 3E, 2008.

BCA-UG-204: Data Structure with C

Unit I: Introduction to Data Structures

Definition, Classification of data structures (Linear and Non-Linear), Operations on data structures. Complexity: Time-Space complexity.

String Processing: Strings, Storing Strings, Fixed length structures, Variable length structures with fixed maximums and linked structures-Primitive Operations on Strings-Substring, Indexing, Concatenation and Length of the string, Pattern Matching Algorithms: First Pattern Matching Algorithms and Fast Pattern Matching Algorithms.

Unit II: Arrays

Definition, Representation of Linear arrays in memory (Both Single and Two Dimensional arrays), Algorithm for Insertion and Deletion in one dimensional arrays (ordered and unordered arrays), advantages and disadvantages of arrays, Sparse Matrices, Linear Search and Binary Search.

Linked Lists: Representation of linked lists in memory-Operations on linked list (Insertion, Deletion, Display): Circular linked lists (Insertion, Deletion, Display), doubly linked linear list (Insertion, Deletion, Display): Applications of linked linear lists.

Unit III: 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: Trees

Binary trees, Complete Binary 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.

Sorting: Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Heap Sort, Radix Sort.

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.

BCA-UG-205: Computer Organization & Architecture

Unit I: 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.

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.

Unit II: 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: Peripheral Devices and their characteristics

Input-output subsystems, I/O transfers - programme 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: 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.

BCA-UG-206: Data Structure with C Laboratory

The laboratory component will emphasize two areas:

Implementation of algorithms covered in class: This will involve running the algorithms under varying input sets and measuring running times, use of different data structures for the same algorithm (wherever applicable) to see its effect on time and space, comparison of different algorithms for the same problem etc.

Design of Algorithms: This will involve design and implementation of algorithms for problems not covered in class but related to topics covered in class.

The exact set of algorithms to design and implement is to be decided by the instructor. In addition, there will be at least one significantly large design project involving some real world application. An efficient design of the project should require the use of multiple data structures and a combination of different algorithms/techniques.

BCA-UG-301: Mathematics-III

Unit I: Combinatorics

Multinomial theorem, principle of inclusion exclusion; Recurrence relations – classification, summation method, extension to asymptotic solutions from solutions for subsequences; Linear homogeneous relations, characteristic root method, general solution for distinct and repeated roots, non-homogeneous relations and examples, generating functions and their application to linear homogeneous recurrence relations, non-linear recurrence relations, exponential generating functions, brief introduction to Polya theory of counting.

Unit I: Graph Theory

Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Minimum spanning tree, rooted trees and binary trees, planar graphs, Euler's formula, statement of Kuratowskey's theorem, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem, dominating sets and covering sets.

Unit III: Logic

Propositional calculus – propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility – natural deduction system and axiom system; Soundness and completeness.

Unit IV: Introduction to Predicate Calculus

Syntax of first order language; Semantics – structures and interpretation; Formal deductibility; First order theory, models of a first order theory (definition only), validity, soundness, completeness, compactness (statement only), outline of resolution principle.

References

1. J. L. Mott, A. Kandel and T. P. Baker: Discrete Mathematics for Computer Scientists, Reston, 1983.
2. D. F. Stanat and D. E. McAllister, Discrete Mathematics in Computer Science, Prentice Hall, 1977.
3. C. L. Liu: Elements of Discrete Mathematics, 2E, McGraw Hill, New Delhi, 1985.
4. R. A. Brualdi: Introductory Combinatorics, North-Holland, New York, 1977.
5. Reingold et al.: Combinatorial Algorithms: Theory and Practice, Prentice Hall, Englewood Cliffs, 1977.
6. J. A. Bondy and U. S. R. Murty: Graph Theory with Applications, Macmillan Press, London, 1976.
7. N. Deo: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall, 1974.
8. E. Mendelsohn: Introduction to Mathematical Logic, 2nd ed. Van-Nostrand, London, 1979.
9. L. Zhongwan: Mathematical Logic for Computer Science, World Scientific, Singapore, 1989.
10. F. S. Roberts: Applied Combinatorics, Prentice Hall, Englewood Cliffs, NJ, 1984.

BCA-UG-302: Operating System

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

Unit IV: 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.
Preliminaries on Real Time OS and Embedded OS.

References

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

BCA-UG-303: Organizational Behavior

Unit I: Introduction
Definition, Nature Characteristics and importance of organizational behaviour, Organisational Behaviour models, Organisational Behaviour: Cognitive Framework, Behaviouristic Framework and Social Cognitive Framework.

Unit II: Individual Behaviour
Perception and Attribution: Concept, Nature, Process, Importance. Management and Behavioural Applications of Perception. Attitude: Concept, Process and Importance, Attitude Measurement. Attitudes and Workforce Diversity. Personality: Concept, Nature, Types and Theories of Personality Shaping, Personality Attitude and Job Satisfaction. Learning: Concept and Theories of Learning.

Unit III: Group Behaviour
Motivation: Theories of Motivation: Early and Contemporary views, Three level Work Motivation Model, Motivating a Diverse Workforce. Leadership: Style and Theories of Leadership-Trait, Behavioural and
Situational Theories, Leadership styles in Indian Organisations. Analysis of Interpersonal Relationship, Group Dynamics: Definition, Stages of Group Development, Group Cohesiveness, Formal and Informal Groups, Group Processes and Decision Making, Dysfunctional Groups.

Unit IV: Organisational Dynamics

Organisational Power and Politics: Concept, Sources of Power, Distinction between Power, Authority and Influence, Approaches to Power, Political Implications of Power: Dysfunctional Uses of Power. Knowledge Management, Emotional Intelligence in Contemporary Business Organisation Organisational Change: Concept, Nature, Resistance to change, Managing resistance to change, Implementing Change, Kurt Lewin Theory of Change. Conflict: Concept, Sources, Types, Functionality and Dysfunctionality of Conflict, Classification of Conflict

Intra, Individual, Interpersonal, Intergroup and Organisational, Resolution of Conflict, Meaning and Types of Grievance and Process of Grievance Handling. Stress: Understanding Stress and Its Consequences, Causes of Stress, Managing Stress. Organisational Culture: Concept, Characteristics, Elements of Culture, Implications of Organisation

culture, Process of Organisational Culture.

References

1. Newstrom John W, Organizational Behaviour: Human Behaviour at Work, TMH, 2008.
2. Luthans Fred, Organizational Behaviour, TMH, 2007.
3. Me Shane L. Steven, Glinow Mary Ann Von & Sharma Radha R. Organizational Behaviour, TMH, 2005.
4. Robbins Stephen P, Organizational Behaviour, Pearson Education, 2003.
5. Hersey Paul, Blanchard, Kenneth H and Johnson Dewey E, Management of Organsational Behaviour: Leading Human Resources, Pearson Education, 2005.
6. Greenberg Jerald and Baron Robert A, Behavior in Organisations: Understanding and Managing the Human Side of Work, Prentice Hall of India, 2005.

BCA-UG-304: Object-Oriented Programming with Java

Unit I: 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: 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: 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, 25 Using AWT Controls, Layout Managers, and Menus, Images, The Concurrency Utilities, Regular Expressions and Other Packages

Unit IV: J2EE

Architectural overview, J2EE database, JDBC objects, Understanding Java ServerPages
Chapter 12: Enterprise JavaBeans, containers and servers; entity vs. Session beans, transactions, XML deployment descriptors.
Software development using Java Swing

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.
2. E. Balagurusamy, Programming with Java: A Primer, TMH, 2009.
3. Bobbi J. Young, Robert A. Maksimchuk, Michael W. Engel, Kelli A. Houston, Grady Booch, Jim Conallen Object-Oriented Analysis and Design with Applications, Pearson, 2009.
4. James Keogh, J2Ee: The Complete Reference 1st Edition, TMH, 2002.
4. James Keogh, J2Me: The Complete Reference 1st Edition, TMH, 2003.

BCA-UG-305: Operating System Laboratory

Concepts of I/O programming, page removal algorithms & analysis, simulation of a traffic controller of a process scheduler, paging, segmentation, algorithms for 'N' process Synchronization (critical section, semaphores). Algorithms for deadlock Detection & recovery, producer-consumer algorithm, UNIX shell programming.

Familiarization with UNIX system calls for process management and inter-process communication, Experiments on process scheduling and other operating system tasks through simulation/implementation under a simulated environment (like Nachos).

BCA-UG-306: Object Oriented Programming with Java Laboratory

Familiarization with the Object-Oriented concepts such as Encapsulation, Inheritance, Inheritance, Exceptions handling, Polymorphism, IO File handling, Exception handling, Java library exploration, J2EE, Swing and Bean based software development.

BCA-UG-401: Microprocessors

Unit I: Historical background

Organization and architectural features of microprocessor and microcontrollers; the instruction set: instruction format, addressing modes; assembly language programming of 8085 and 8086.

Unit II: Interfacing of memory devices
Data transfer techniques and I/O ports; interfacing of keyboard and display devices; programmable interrupt and DMA controllers.

Unit III: Study and programming of advanced microcontroller boards
Arduino (AT Mega based), ARM based (Raspberry Pi). Concepts of FPGA boards.

Unit IV: Interfacing of transducers
Actuators, A/D and D/A Converters, analog/digital signal conditioning circuits, data acquisition systems, standard interfaces - RS232, USB, application examples.
Real life system design and implementation.

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. William Hohl, ARM Assembly Language: Fundamentals and Techniques, CRC, 2009.
7. Dominic Symes, ARM System Developer's Guide: Designing and Optimizing System Software, MK, 2011.

BCA-UG-402: Database Management System

Unit I: Introduction
Database management system, Characteristics of the database approach, Actors on the scene, Workers behind the scene, Advantages of Using a DBMS and when not to use a DBMS.
DBMS Architecture: Data Models: Categories of data models, Database state, DBMS Architecture and Data Independence, DBMS architecture, DBMS Languages and Interfaces, Classifications of Database Management Systems.

Unit II: Data Modeling Using E-R Model
Using High Level Conceptual Data Models for Database Design, Example Database applications, Entity Sets and types, Attributes and Keys, Relationship and its types , Constraints, Designing E- R Diagrams, Mapping E-R diagram to relations.
Index Structures for Files: Single Level Ordered Indexes, Primary indexes, Clustering indexes and Secondary indexes. Multi-level indexes, Dynamic Multilevel indexes using B-trees (Introductory concepts), hashing concepts.

Unit III: Relational Data Model
Relation, Integrity constraints, Basic Relational algebra operations, Functional dependencies, Normalization for Relational Databases: Normalization concepts, first, second, third and Boyce-Codd normal form.

Unit IV: SQL (DDL/ DML)
Queries, sub queries, updation of a database through views, Update, Delete.
Transaction Processing Concepts and Concurrency Control Techniques: 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.

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.

BCA-UG-403: Formal Language & Automata Theory

Unit I: 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: 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, closure properties of CFLs.
Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Unit III: 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: Undecidability

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

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.

BCA-UG-404: Human Resource management

Unit I: Introduction

Human Resources Management (HRM): Meaning, Nature and Scope, Difference between HRM and Personnel Management, HRM functions and objectives, Evolution of HRM environment-external and internal. Human Resources Development in India: evolution and principles of HRD, HRD vs. Personnel functions, Role of HR managers. Strategic Human Resource Management : Nature of Strategies and Strategic Management, Strategic Management Process - Environmental Scanning, Strategy Formulation, implementation and evaluation.

Unit II: Human Resource Planning

Human Resources planning: Definition, purposes, processes and limiting factors; Human Resources Information system (HRIS): HR accounting and audit, Job Analysis - Job Description, Job Specification. The systematic approach to recruitment: recruitment policy, recruitment procedures, recruitment methods and evaluation. The systematic approach to selection: the selection procedure, the design of application form, selection methods, the offer of employment, and evaluation of process.

Unit III: Training, Development and Compensation

Training and Development: Purpose, Methods and issues of training and management development programmes. Performance Appraisal: Definition, Purpose of appraisal, Procedures and Techniques including 360 degree Performance Appraisal, Job Evaluation. Compensation Administration: Nature and Objectives of compensation, components of pay structure in India, Wage Policy in India - Minimum Wage, Fair Wage and Living Wage. Incentive Payments :

Meaning and Definition, Prerequisites for an effective incentive system, Types and Scope of incentive scheme, Incentive Schemes in Indian Industries, Fringe Benefits.

Unit IV: Discipline and Grievance Handling

Discipline and Grievance Procedures: Definition, Disciplinary Procedure, Grievance Handling Procedure. Industrial Relations: Nature, importance and approaches of Industrial Relations.
Promotion, Transfer and Separation: Promotion - purpose, principles and types; Transfer- reason, principles and types; Separation - lay-off, resignation, dismissal, retrenchment, Voluntary Retirement Scheme.

References

1. Aswathappa K, Human Resource and Personnel Management, Tata McGraw Hill, 5E, 2007.
2. Rao VSP, Human Resource Management, Text and Cases, Excel Books, 2E, 2009.
3. Ivansevich, Human Resource Management, Tata McGraw Hill, 10E, 2007.
4. Dessler, Human Resource Management, Prentice Hall, 10E, 2009.
5. Bernard, Human Resource Management, Tata McGraw Hill, 4E, 2009.

BCA-UG-405: Database Management System Laboratory

Database schema design, database creation, SQL / Pl-SQL programming and report generation using a commercial RDBMS like ORACLE/SYBASE/DB2/SQL-Server/INFORMIX. Students are to be exposed to front end development tools. Real life database connectivity with some application to be studied.

BCA-UG-406: Microprocessors Laboratory

The laboratory focuses on implementation of sequential and combinational circuits such as adders, Substractor, Decoder, Multiplexers, Flip-flops, counters, Registers etc.

8085 interfacing with basic I/O devices like keypad, LED display, usage of timers and USART peripherals, multi- port device access, stepper motor movement control, DC motor speed control. Main attention should be given on Arduino and Raspberry Pi based application like sensor (temperature, flex, gyro, etc.), actuator (lcd, dc motor, stepper motor etc.). Set up communication between two or more Arduino. Set up communication between two or more Raspberry Pi. Priority should be given on web based applications. ARM assembly language programming should be done.

BCA-UG-501: Numerical Methods

Unit I: Probability theory

Probability, conditional probability and independence; Random variables and their distributions (discrete and continuous), bivariate and multivariate distributions; Laws of large numbers, central limit theorem (statement and use only).

Unit II: Stochastic process
Definition and examples of stochastic processes, weak and strong stationarity; Markov chains with finite and countable state spaces – classification of states,

Unit III: Processes
Markov processes, Poisson processes, birth and death processes, branching processes, queuing processes.

Unit IV: Selected applications
Analysis of algorithms, performance evaluation and modeling of computer systems.

Note: This paper should be divided in two segments theoretical (70 marks) and practical (30 marks). Practical should done using C/C++/Java in the departmental laboratory and the theoretical part may be taken by Mathematics Department.

References

1. W. Feller, An Introduction to Probability Theory and its Applications (Volume I and II), 3E, Wiley, 1973.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, University Book Stall/Houghton Mifflin, New Delhi/New York, 1998/1971.
3. K. L. Chung, Elementary Probability Theory and Stochastic Processes, Springer-Verlag, 1974.
4. S. M. Ross, Stochastic Processes, John Wiley, New York, 1983.
5. H. M. Taylor, First Course in Stochastic Processes, 2nd ed. Academic Press, Boston, 1975.
6. H. M. Taylor, Second Course in Stochastic Processes, Academic Press, Boston, 1981.
7. U. N. Bhat, Elements of Applied Stochastic Processes, John Wiley, New York, 1972.
8. K. S. Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Application, Prentice Hall, Englewood Cliffs, 1982.
9. M. Hofri, Probabilistic Analysis of Algorithms, Springer-Verlag, 1987.
10. G. Latouche (Eds.), Probability Theory and Computer Science, Academic Press London, 1983.

BCA-UG-502: Data Communication & Networks

Unit I: 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: 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.
Mac sublayer: Multiple Access protocol: ALOHA, Slotted ALOHA, CSMA protocols, Introduction to MAC Protocols: 802.3, 802.4, 802.5, 802.11

Unit III: 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: The 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.

Unit IV: Transport layer
Transport Services, Element of transport protocols, TCP connection management, TCP transmission policy, TCP congestion control & Timer management.
Application layer: DNS, SMTP, POP3, FTP, TELNET, HTTPS. Related advanced protocols should be studied.

References

1. William Stallings, Data and Computer Communication, Prentice Hall of India, 2007.
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw-Hill, 2007.
3. Andrew S. Tanenbaum, Computer Networks, Prentice Hall, 2008.
4. Douglas 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. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India, 2008.
7. Neal Koblitz, A course in number theory and cryptography, Springer, 2008.
8. R. C. Seacord, Secure Coding in C and C++, Addison-Wesley, 2005.
9. John Viega, Matt Messier), Pravir Chandra, Network Security with OpenSSL, O'Reilly, 2009.
10. John Viega, Matt Messier, Secure Programming Cookbook for C and C++: Recipes for Cryptography, Authentication, Input Validation & More, O'Reilly, 2009.

BCA-UG-503: Web Technology

Unit I: Internet Basics

Basic concepts, Communication on the Internet, Internet Domains, Internet Server Identities, Establishing Connectivity on the Internet, Client IP Address, Brief Overview of TCP/IP and its Services, Transmission Control Protocol, Web Server, Web Client, Domain Registration, Gateways.
HTML: Introduction to Hypertext Markup Language, Common tags, Anchors, Backgrounds, Images, Webpage structure, Hyper linking, Lists, Character Formatting, Color Control, Images, Tables, Frames, Multimedia, Cascading style sheet, Application with layers.

Unit II: JavaScript and XML
Client-side Forms, JavaScript, Incorporating JavaScript in HTML, JavaScript expressions, Control flow and functions, String and Arrays, JavaScript objects, JavaScript Forms: Managing frames in JavaScript, Cookies, history, location. XML, XSL and other markup languages, CGI Scripting with Perl.

Unit III: PHP
Basic concepts strings, functions and OOPs, File handling, Working with database and AJAX.

Unit IV: Servlets & JSP
Introduction to Servlets and JSP basics. Implementation of Sessions, Cookies, Filter, Listener, and Wrapper, Expression language-EL, JSP Standard Tag Library-JSTL, MySQL, JDBC, Connection pooling.

References

1. Jackson, Web Technologies: A Computer Science Perspective, Pearson Education, 2007.
2. S. Holzner, Php: The Complete Reference, TMH, 2007.
3. Kriss Jamsa, Konrad King, HTML & Web Design, TMH Publications, 2002.
4. Jason Hunter, William Crawford, Servlet Programming, O'REILY, 2010.
5. Tom Negrino and Dori Smith, JavaScript for the World Wide Web, 3E, 2011.
6. Joel Murach, Andrea Steelman, Murach's Java Servlets and JSP, Murach's, 2E, 2008.
7. Robert Hoekman Jr., Java Servlet & JSP Cookbook, Schorr Pub, 2004.
8. Santosh Kumar K, JDBC, Servlets, And Jsp Black Book, Kogent Solutions Inc., 2008.

BCA-UG-504: Software Engineering

Unit I: 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: 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: 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, Programme
Analysis Tools, System Testing, Coding Standards and Guidelines.

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

BCA-UG-505: Computer Networks Laboratory

TCP/IP protocol architecture, user datagram protocol (UDP), multicasting, transmission control protocol (TCP), standard Internet services, and protocol usage by common Internet applications, Sockets programming, client/server, peer-to-peer, Internet addressing, TCP sockets, UDP sockets, raw sockets, Multithreading and exception handling. Finger, DNS, HTTP, Ping clients and servers, Routers and architectures, routing protocols.

BCA-UG-506: Web Technology Laboratory

Familiarization with the basic concepts of HTML, Client Side Programming (JavaScript, CGI, and XML), Preliminary concepts of Servlets and JSP should be given, Internet communication and its applications. Introduction to PHP and Python. Real life problem implementation and case study.

BCA-UG-602E1: Object Oriented System Design

Unit I: Fundamental concepts of object oriented programming

Introduction to the principles of object-oriented programming (classes, objects, messages, encapsulation, inheritance, polymorphism, exception handling, and object- oriented containers).

Unit II: Object design implementation in a programming language C++ or Java
Object oriented analysis, modeling and design: UML may be introduced. Use cases, use case driven analysis. Structural modeling classes, relationships, interfaces, class diagrams, and object diagrams, in UML.

Unit III: Behavioral/Functional modeling use case diagrams, sequence diagrams, in UML
Dynamic modeling: State charts
Architectural modeling
Analysis patterns, Design patterns.

Unit IV: Distributed object model
CORBA and COM / DCOM
Object oriented database systems: Object oriented data model, query languages, storage organization and indexing techniques; object relational databases.

References

1. Bertrand Meyer, Object Oriented Software Construction, Prentice-Hall, 1997.
2. Grady Booch, Object Oriented Analysis and Design, Addison-Wesley, 2009.
3. Grady Booch, James Rumbaugh and Ivar Jacobson, Unified Modeling Language Guide, Addison- Wesley, 2005.
4. Erich Gamma, Design Patterns: Elements of Reusable OO Software, Addison-Wesley, 2004.
5. Michael L. Scott, Programming Language Pragmatics, Morgan-Kaufmann, 2009.
6. Kim Bruce, Foundations of Object Oriented Languages, Prentice-Hall, 2002.
7. Benjamin C. Pierce, Types and Programming Languages, Prentice-Hall, 2002.
8. Bjarne Stroustrup, The Design and Evolution of C++, Addison-Wesley, 2000.
9. Bill Venners, Inside the JAVA 2 Virtual Machine, McGraw Hill, 2000.
10. James E. Smith and Ravi Nair, Virtual Machines, Elsevier/Morgan-Kaufmann, 2005.
11. Saba Zamir, Handbook of Object Technology, CRC Press, 1999.

BCA-UG-602E2: Advanced Web Technology

Unit I: Introduction
Overview and evolution of Internet programming and application tools, searching and browsing tools.
Markup Languages and its application on the web: HTML, XML and related concepts.

Unit II: Java programming
Features of Java Language: brief history of Java, concept of Java VM, basic structure of Java programming; GUI programming: basics of Java Abstract Windowing Toolkit, event handling and swing programming, applet programming; Java Beans and Java IDE; I/O in Java;

Unit III: Network Programming
Client Server programming, Remote Method Invocation; Java database connectivity;
Multi-Thread programming in Java.
Communication protocol: TCP/IP, IP addressing and domain registration and related concepts.
Application level technology: HTTP, Web Server, Browsing, Firewall.

Unit IV: Search Mechanisms
Search Engine, Crawler Technology, Filtering Technology Content based Searching,
Agent Technology, Internet Robot.
Advance Internet applications: Data and Web mining; e-commerce; Distributed Objects – component object model, common object request broker architecture, Web security.

References

1. Jackson, Web Technologies: A Computer Science Perspective, Pearson Education, 2007.
2. S. Holzner, Php: The Complete Reference, TMH, 2007.
3. Kriss Jamsa, Konrad King, HTML & Web Design, TMH Publications, 2002.
4. Jason Hunter, William Crawford, Servlet Programming, O'REILY, 2010.
5. Tom Negrino and Dori Smith, JavaScript for the World Wide Web, 3E, 2011.
6. Joel Murach, Andrea Steelman, Murach's Java Servlets and JSP, Murach's, 2E, 2008.
7. Robert Hoekman Jr., Java Servlet & JSP Cookbook, Schorr Pub, 2004.
8. Santosh Kumar K, JDBC, Servlets, And Jsp Black Book, Kogent Solutions Inc., 2008.
9. Behrouz Forouzan, TCP/IP Protocol Suite 4E, TMH, 2010.
10. Stevens 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.

BCA-UG-602E3: Neural Networks and Applications

Unit I: Introduction to neural networks, **threshold logic, circuit realization**
Introduction to biological neural networks, significance of massive parallelism.
Perceptron, perceptron learning rule and its convergence, multilayered perceptron, learning algorithms, function approximation, generalization, VC-dimension.

Unit II: Regularization networks, **RBF networks**
Recurrent networks; Hopfield model, pattern retrieval process, application to optimization problems, Simulated annealing, mean-field annealing, Boltzman machine and its learning.

Unit III: Self-organizing systems
Hebbian and competitive learning, Kohonen's self-organizing map, learning vector quantization, principal component analysis networks, adaptive resonance theory.
Temporal learning, backpropagation through time, temporal backpropagation, real-time recurrent learning (RTRL).
Architecture optimization; Hardware realization.

Unit IV: Applications in selected topics from pattern recognition, image processing, computer vision, natural language processing, control, forecasting
Advanced/related topics such as cellular neural networks, support vector machine, neuro-fuzzy computing and other hybridization, independent component analysis.

References

1. S. Rajasekaran, Neural Networks, Fuzzy Logic and Genetic Algorithms 1E, PHI, 2003.
2. J. Hertz, A. Krogh, and R. G. Palmer: Introduction to the Theory of Neural Computation, Addison-Wesley, California, 1991.
3. Y. H. Pao: Adaptive Pattern Recognition and Neural Networks, Addison-Wesley, Reading, Mass., 1989.
4. P. D. Wassermann: An Introduction to Neural Computing: Theory and Practice, Van Nostrand Reinhold, New York, 1989.
5. J. M. Zurada: Introduction to Artificial Neural Systems, West Publishing Co., St. Paul, Minnesota, 1992.
6. T. Kohonen: Self-Organization and Associative Memory, Springer-Verlag, Berlin, 1988.
7. J. A. Anderson and E. Rosenfeld: Neuro-Computing: Foundation of Research, MIT Press, Cambridge, 1988,
8. Simon Haykin: Neural Networks: A Comprehensive Foundation, 2nd ed., Prentice Hall, New Jersey, 1999.
9. S. K, Pal and S, Mitra: Neuro-Fuzzy Pattern Recognition: Methods in Soft Computing, John Wiley, New York, 1999.
9. B. Yegnarayana: Artificial Neural Networks, Prentice Hall of India, New Delhi, 1999.

BCA-UG-602E4: Computer Graphics

Unit I: 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: 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: 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: 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.

References

1. Donald D Hearn, M. Pauline 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, New Delhi, 1999.

BCA-UG-602E5: Digital Image Processing

Unit I: 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: 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: 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: 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.

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.

BCA-UG-602E6: Embedded Systems

Unit I: Introduction to Embedded Systems
Definitions and constraints. Hardware and processor requirements.

Unit II: 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: Formal approach to specification
Specification languages. Specification refinement and design.

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

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.

MCA-PG-101: Graph Theory

Unit I: Fundamental concepts

Basic definitions, operations, properties, proof styles; Trees (properties, distances and centroids, spanning trees, enumeration).

Unit II: Matchings
Bipartite graphs, general graphs, weighted matching; Connectivity (vertex and edge connectivity, cuts, blocks, k-connected graphs, network flows).

Unit III: Traversibility
Eulerian tours, Hamiltonian cycles; Coloring (vertex and edge coloring, chromatic number, chordal graphs).

Unit IV: Planarity
Duality, Euler's formula, characterization, 4-color theorem; Advanced topics (perfect graphs, matroids, Ramsay theory, extremal graphs, random graphs); Applications.

References

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India, 1996.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall, 1974.
3. Frank Harary, Graph Theory, Narosa, 1994.
4. R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice-Hall, 1988.

MCA-PG-102: Artificial Intelligence

Unit I: Introduction
Intelligent Agents: Agents and Environments, The concept of rationality, Nature of Environments, Structure of Environments.
Problem Solving: Solving Problems by Searching: Problem solving agents, Uninformed Search strategies, Avoiding repeated states, Informed Searches and Exploration, Informed search strategies, Heuristic functions, Local search algorithms and optimization problems.

Unit II: Adversarial Searches
Games, Optimal decision in games, Alpha beta pruning, and Imperfect real-time decisions.
Knowledge and Reasoning: Logical Agents: Knowledge based agents, Propositional logic, Resolution, Effective propositional inference, Agents based on propositional logic.

Unit III: First-Order Logic
Syntax and semantics of First order logic, Using FOPL.
Learning: Learning from Observations: Form of learning, Inductive learning, Learning decision tree, Ensemble learning, Computational learning theory.

Unit IV: Expert Systems

Introduction (characteristic features of expert systems, Background History, Applications, importance of expert systems); Rule based system architectures (the knowledge base, the inference process, explaining how or why, building a knowledge base, the I/O interface).

References

1. S. Russel, & P Norvig, Artificial Intelligence: A Modern Approach, Pearson education, 2003.
2. Luger, Artificial Intelligence, Pearson education, 2003.
3. Nills J. Nillson, Morgan Kauffman, Artificial Intelligence: A new Synthesis, 2003.

MCA-PG-103: Cryptography & Network Security

Unit I: 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: 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: 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: 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.

References

1. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2010.
2. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India, 2006.
3. Neal Koblitz, A course in number theory and cryptography, Springer, 2007.
4. Johannes A. Buchmann, Introduction to Cryptography, Undergraduate Text in Mathematics, Springer, 2000.
5. Doug 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-104: Design and Analysis of Algorithm

Unit I: Introduction and basic concepts
Complexity measures, worst-case and average-case complexity functions, problem complexity, quick review of basic data structures and algorithm design principles.
Sorting and selection: Finding maximum and minimum, k largest elements in order; Sorting by selection, tournament and heap sort methods, lower bound for sorting, other sorting algorithms - radix sort, quick sort, merge sort; Selection of k-th largest element.

Unit II: Searching and set manipulation
Searching in static table – binary search, path lengths in binary trees and applications, optimality of binary search in worst cast and average-case, binary search trees, construction of optimal weighted binary search trees; Searching in dynamic table – randomly grown binary search trees, AVL and (a,b) trees.
Hashing: Basic ingredients, analysis of hashing with chaining and with open addressing.
Union-Find problem: Tree representation of a set, weighted union and path compression-analysis and applications.

Unit III: Graph problems
Graph searching – BFS, DFS, shortest first search, topological sort; connected and biconnected components; Minimum spanning trees – Kruskal's and Prim's algorithms – Johnson's implementation of Prim's algorithm using priority queue data structures.
Algebraic problems: Evaluation of polynomials with or without preprocessing. Winograd's and Strassen's matrix multiplication algorithms and applications to related problems, FFT, simple lower bound results.

Unit IV: String processing
String searching and Pattern matching, Knuth-Morris-Pratt algorithm and its analysis.
NP-completeness: Informal concepts of deterministic and nondeterministic algorithms, P and NP, NP-completeness, statement of Cook's theorem, some standard NP-complete problems, approximation algorithms.

References

1. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press, 2003.
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, 1988.
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-105: Algorithm Laboratory

Basic Artificial and Cryptographic algorithms should be practiced along with core algorithms using C, C++ or Java.
Relevant advance algorithms should be studied.

MCA-PG-201: Operation Research

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

MCA-PG-202: Mobile & Wireless Communication

Unit I: 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: 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: 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: 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.

References

1. Theodore, S. Rappaport, Wireless Communications, Principles, Practice, 2nd Ed, PHI, 2002.
2. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005.
3. Gottapu Sasibhushana Rao, Mobile Cellular Communication, Pearson Education, 2012.

MCA-PG-203: Compiler Design

Unit I: 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: Syntax Analysis (Parser)

Context-free language and grammar, push-down automata, LL(1) grammar and top- down parsing, operator grammar, LR(0), 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: 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: 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.

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-204E1: Mobile Computing

Unit I: 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: 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: 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: 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.

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-204E2: Document Processing and Retrieval

Unit I: 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: 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: Applications

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

Unit IV: Information retrieval (IR)

Indexing, text-based information retrieval techniques, content based information retrieval (CBIR), multimedia information retrieval, multimodal query formulation/decom-position, 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, Reading MA, 1999.

6. W. Frakes, R. Baeza-Yates , Information Retrieval: Data Structures and Algorithms, Prentice Hall, New Jersey, 1992.

MCA-PG-204E3: VLSI System Design

Unit I: Overview of VLSI system design
MOS devices and circuits: physics of MOS transistors, n MOS, CMOS, MOS fabrication and scaling.
Delay and power consumption: driving high capacitive loads, superbuffers. Inverters.

Unit II: Logic gates
Design rules and layouts, stick diagrams, transistor sizing,
Logic design: static nMOS and CMOS, Combinational networks, steering logic.
Dynamic CMOS and clocking: static versus dynamic CMOS designs, domino CMOS structures, charge sharing, clock generation and distribution, MOS memory devices.

Unit III: Special circuit layouts
Multiplexers, general-purpose functional blocks, barrel shifter, and regular arrays of logic**:** PLA (generation and folding), Weinberger array, gate array, etc.
Layout representation: CIF, symbolic layouts, corner stitching, etc. Introduction to hardware description language: Verilog/VHDL.

Unit IV: VLSI design tools
Placement, floor planning, routing, design-rule checking, circuit extraction and simulation, Modeling and simulation of MOS circuit modules using SPICE.

References

1. N. Weste and D. Harris, CMOS VLSI Design, A Circuits and Systems Perspective, Addison- Wesley, 2006.
2. W. Wolf, Modern VLSI Design: Systems on Silicon, Pearson Education, 1998.
3. S Kang and Y Leblebici, CMOS Digital Integrated Circuits Analysis and Design, McGraw Hill, 2003.
4. D. A. Pucknell, K. Eshraghian, Basic VLSI Design, Prentice Hall, 2003.
5. M. Sarafzadeh and C. K. Wong, An Introduction to VLSI Physical Design, McGraw-Hill, 2003.
6. S. Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Pearson, 2002.
7. N. M. Botros, HDL Programming VHDL and Verilog, Dreamtech Press, 2006.

MCA-PG-204E4 : Data Mining

Unit I: Introduction
Introduction to data mining and knowledge discovery from databases. Scalability issues of data

mining algorithms.
Introduction to Data warehousing: General principles, modeling, design, implementation, and optimization.
Data preparation: Preprocessing, sub-sampling, feature selection.

Unit II: Classification and prediction
Bayes learning, discriminant analysis, decision trees, CART, C4.5 etc, neural learning, support vector machines, active learning. Combination of classifiers/ ensemble learning. Associations, dependence analysis, correlation, rule generation – apriori algorithm, FP Trees etc. and evaluation.

Unit III: Cluster analysis and deviation detection
Partitioning algorithms, density based algorithms, hierarchical algorithms, model based algorithms, grid based algorithms, graph theoretic clustering etc.
Temporal and spatial data mining: Mining complex types of data. Visualization of data mining results.

Unit IV: Advanced topics
High performance computing for data mining, distributed data mining, soft-computing tools for data mining.
Applications of data mining in bioinformatics, information retrieval, web mining, image and text mining.

References

1. J. Han, M. Kamber, J. Pei, Data Mining: Concepts and Techniques 3E, Elsevier, 2011.
2. J. Han, M. Kamber: Data Mining: Concepts and Techniques, Morgan Kaufmann, 2000.
3. D. J. Hand, H. Mannila and P. Smyth: Principles of Data Mining, MIT Press, 2000.
4. M. Berry and G. Linoff: Mastering Data Mining, John Wiley & Sons, 2000.
5. A. K. Pujari: Data Mining Techniques, Sangam Books Ltd., 2001.

MCA-PG-204E5 : Computer Vision

Unit I: Introduction
Machine vision systems, optics and lenses, image sensors, human vision and Neuro-visual model; Marr's paradigm; Imaging geometry – world co-ordinate system and camera co-ordinate system, co-ordinate transformations, projection geometry, camera calibration, radiometry.
Early processing and image filtering: Noise removal, region segmentation, concept of primal sketch, scale space, edge detection and localization, edge linking,, Hough transform, corner and junction detection.

Unit II: Reflectance map and photometric stereo
Image brightness and radiometry, image formation and surface reflectance under different conditions, reflectance map and bidirectional reflectance distribution function, photometric stereo recovering albedo and surface orientation, shape from shading.

Range measurement and recovering scene geometry: Binocular technique – stereo pair, epipolar line and plane, Stereo matching, photogrammetry, monocular technique – texture processing and shape from texture, depth from focusing and symmetry, different range finder (active) – laser range finder, light-stripe method.

Unit II: Motion estimation

Motion field, optical flow – smoothness, boundary conditions, discontinuities of optical flow, block based method, pre-recursive method, Bayesian method, motion segmentation method, motion from points and lines, token tracking, stereo and motion tracking, use of Kalman filter, focus of expansion, structure from motion, motion compensated filtering and restoration, video compression, active and passive survelliance.

Unit III: Representation and analysis of polyhedral scene

Understanding line drawings, gradient and dual space, generalized cylinder, volumetric representation, edge and junction labelling; Labelling and recognition of scene objects; Construction of model-base and visual learning, model based recognition system – Acronym, model based recognition from sparse range data, 3D model based vision system, scene understanding.

Unit IV: Special systems for computer vision

Visual information processing architecture, language and control, Some applications (but not restricted to): (i) Automated guided vehicle, (ii) Face and gesture recognition, (iii) Vision based inspection system, (iv) Grasping system, (v) Automated visual inspection.

References

1. D. H. Ballard and C. M. Brown: Computer Vision, Prentice Hall, New York, 1986.
2. R. M. Haralick, L. G. Shapiro: Computer and Robot Vision, Addison-Wesley Pub Co, reading, Mass., 1992.
3. Y. Shirai: Three-Dimensional Computer Vision, Springer-Verlag, Berlin, 1988.
4. B. K. P. Horn: Robot Vision, MIT Press, Cambridge, 1986.
5. O. Faugeras: Three-Dimensional Computer Vision: A Geometric Viewpoint, MIT Press, Cambridge, 1993.
6. B. K. P. Horn and M. J. Brooks: Shape from Shading, M.I.T. Press, Cambridge, 1989.
7. R. Jain, R. kasturi and B. Schuck: Machine Vision, McGraw Hill Higher Education, New York, 1995.
8. E. R. Davis: Machine Vision: Theory, Algorithms and Practicalities, Academic Press, New York, 1996.
9. M. Sonka, V. Hlavac and R. Boyle, Image Processing: Analysis and Machine Vision, PWS Pub. Co., London, 1998.

MCA-PG-205: Compiler Design Laboratory

This lab deals with construction of compiler using Lex and Yacc.
It shall also focus on design of any programming language and a compiler for the same.

MCA-PG-206: Operation Research Laboratory

This lab deals with problems related to Linear Programming, Game Theory, Transportation, Assignment and Project Management using C Programming Language.

MCA-PG-301E1: Fuzzy Logic and Applications

Unit I: 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: 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: 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: 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.

MCA-PG-301E2: Advanced Programming Language

This subject will cover up the advanced programming languages such as Haskell, Scala, Python, Perl, Ruby as per the Specialization of concerned faculty.

MCA-PG-301E3: Soft Computing

Unit I: Fuzzy Logic
Crisp set and Fuzzy set, Basic concepts of fuzzy sets, membership functions, Basic operations on fuzzy sets, Properties of fuzzy sets, Fuzzy relations.
Propositional logic and Predicate logic: fuzzy If – Then rules, fuzzy mapping rules and fuzzy implication functions, Applications.

Unit II: Neural Networks
Basic concepts of neural networks, Neural network architectures, Learning methods, Architecture of a back propagation network, Applications.

Unit III: Genetic Algorithms
Basic concepts of genetic algorithms, encoding, genetic modeling.

Unit IV: Hybrid Systems
Integration of neural networks, fuzzy logic and genetic algorithms.

References

1. S. Rajasekaran and G.A.Vijaylakshmi Pai, Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.
2. K.H.Lee, First Course on Fuzzy Theory and Applications, Springer-Verlag.
3. J. Yen and R. Langari, Fuzzy Logic, Intelligence, Control and Information, Pearson Education.

MCA-PG-301E4: Semantic Web Technology

Unit I: Introduction
Overview and evolution of Internet programming and application tools, searching and browsing tools. Markup Languages and its application on the web: HTML, XML and related concepts.

Unit II: Java programming
Features of Java Language: brief history of Java, concept of Java VM, basic structure of Java programming; GUI programming: basics of Java Abstract Windowing Toolkit, event handling and swing programming, applet programming; Java Beans and Java IDE; I/O in Java;

Unit III: Network Programming
Client Server programming, Remote Method Invocation; Java database connectivity;

Multi-Thread programming in Java.
Communication protocol: TCP/IP, IP addressing and domain registration and related concepts.
Application level technology: HTTP, Web Server, Browsing, Firewall.

Unit IV: Search Mechanisms
Search Engine, Crawler Technology, Filtering Technology Content based Searching, Agent Technology, Internet Robot.
Advance Internet applications: Data and Web mining; e-commerce; Distributed Objects – component object model, common object request broker architecture, Web security.

References

1. Jackson, Web Technologies: A Computer Science Perspective, Pearson Education, 2007.
2. S. Holzner, Php: The Complete Reference, TMH, 2007.
3. Kriss Jamsa, Konrad King, HTML & Web Design, TMH Publications, 2002.
4. Jason Hunter, William Crawford, Servlet Programming, O'REILY, 2010.
5. Tom Negrino and Dori Smith, JavaScript for the World Wide Web, 3E, 2011.
6. Joel Murach, Andrea Steelman, Murach's Java Servlets and JSP, Murach's, 2E, 2008.
7. Robert Hoekman Jr., Java Servlet & JSP Cookbook, Schorr Pub, 2004.
8. Santosh Kumar K, JDBC, Servlets, And Jsp Black Book, Kogent Solutions Inc., 2008.
9. Behrouz Forouzan, TCP/IP Protocol Suite 4E, TMH, 2010.
10. Stevens 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.

MCA-PG-301E5: Cryptology

Unit I: Introduction
Brief introduction to number theory, Euclidean algorithm, Euler's totient function, Fermat's theorem and Euler's generalization, Chinese Remainder Theorem, primitive roots and discrete logarithms, Quadratic residues, Legendre and Jacobi symbols.

Unit II: Basic Concepts of Cryptology
Cryptography and cryptanalysis, classical cryptosystems, concept of block and stream ciphers, private and public key cryptography.
Information theoretic ideas: Entropy, equivocation, perfect secrecy and unicity distance.

Unit III: Encryption Standard
DES and differential and linear cryptanalysis, Advanced encryption standards.
RSA Public Key Cryptosystems: RSA system, primality testing, survey of factoring algorithms.
Other Public Key Cryptosystems: El Gamal public key cryptosystem, algorithms for discrete log problem, Knapsack public key cryptosystems, cryptanalysis of Knapsack PKC – Shamir's attack and Lenstra, Lenstra and Lovasz algorithm.

Unit IV: Digital Signature and Hash Functions
El Gamal signature scheme, digital signature standard, one-time undeniable and fail-stop signatures, computationally collision-free hash functions, extending hash functions, examples of hash functions.
Security of Practical Systems: Database, operating system and network security.

References

1. D. E. R. Denning, Cryptography and Data Security, Addison-Wesley, Reading, Mass., 1982.
2. D. M. Bressoud, Factorization and Primality Testing, Springer-Verlag, New York, 1989.
3. R. A. De Millo, Foundations of Secure Computations, Academic Press, New York, 1978.
4. E. Kranakis, Primality and Cryptography, B G Teubner, Chichester, 1986.
5. W. Patterson, Mathematical Cryptography for Computer Scientists and Mathematicians, Rowman and Littlefield, 1987.
6. D. Stinson, Cryptography: Theory and Practice, CRC Press, Boca Raton, 1995.
7. W. Leveque, Topics in Number Theory, Vol. 1, Addison-Wesley, Mass, 1956.
8. G. A. Jones and J.M. Jones, Elementary Number Theory, Springer-Verlag, London, 1998.
9. B. S. Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, 2nd Edition, John Wiley and Sons, 1995.

MCA-PG-301E6: Information and Coding Theory

Unit I: Information Theory
Entropy, its characterization and related properties, Huffman codes, Shannon-Fano coding, robustness of coding techniques, Information measure-noiseless coding, discrete memoryless channel – channel capacity, fundamental theorem of information theory.

Unit II: Error Correcting Codes
Minimum distance principles, Hamming bound, general binary code, group code, linear group code

Unit III: Convolution Encoding
Algebraic structure, Gilbert bound

Unit IV: Threshold Decoding
Threshold decoding for block codes
Cyclic Binary Codes: BCH codes, generalized BCH code and decoding, optimum codes, concepts of non-cyclic codes.

References

1. R. Ash: Information Theory, Interscience Publ., Singapore, 1965.
2. E. R. Berlekamp: Algebraic Coding Theory, McGraw Hill, New York, 1986.
3. S. Lin: An Introduction to Error-Correcting Codes, Prentice Hall, Englewood Cliffs, 1970.
4. W. W. Peterson et al: Error Correcting Codes, Wiley, London, 1961.
5. R. W. Hamming: Coding and Information Theory, Prentice Hall, Englewood Cliffs, 1980.
6. A. Khinchin, Mathematical Foundations of Information Theory, Dover Publn., London, 1957.
7. F. J. MacWilliams and N.J. Sloane: Theory of Error Correcting Codes, Parts I and II, 1977.
8. V. Pless: Introduction to the Theory of Error Correcting Codes, 3rd ed., John Wiley, New York, 1982.