



CENTRAL UNIVERSITY OF HARYANA

Mahendergarh

Department of Computer Science

Master of Computer Applications (MCA) (Comprehensive Structure of Syllabi as per CBCS)

CORE COURSE (CC) (Exclusively for MCA Students)

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 01 C 01 4004	Computer Fundamentals and Problem Solving through C	4	0	0	4
2.	SCS CSC 01 01 C 02 3003	Discrete Mathematical Structures	3	0	0	3
3.	SCS CSC 01 01 C 03 4004	Linux and Shell Programming	4	0	0	4
4.	SCS CSC 01 01 C 04 0044	Computer Lab I	0	0	4	4
5.	SCS CSC 01 02 C 05 3003	Object Oriented Systems and C++	3	0	0	3
6.	SCS CSC 01 02 C 06 3003	Digital Design and Computer Organisation	3	0	0	3
7.	SCS CSC 01 02 C 07 4004	Data Structures using C/C++	4	0	0	4
8.	SCS CSC 01 02 C 08 0044	Computer Lab II	0	0	4	4
9.	SCS CSC 01 03 C 09 4004	Database Management Systems	4	0	0	4
10.	SCS CSC 01 03 C 10 4004	Operating Systems	4	0	0	4
11.	SCS CSC 01 03 C 11 4004	Computer Networks	4	0	0	4
12.	SCS CSC 01 03 C 12 0044	Computer Lab III	0	0	4	4
13.	SCS CSC 01 04 C 13 3003	Web Engineering	3	0	0	3
14.	SCS CSC 01 04 C 14 3003	Theory of Computation	3	0	0	3
15.	SCS CSC 01 04 C 15 4004	Programming in JAVA	4	0	0	4
16.	SCS CSC 01 04 C 16 0044	Computer Lab IV	0	0	4	4
17.	SCS CSC 01 05 C 17 4004	Computer Graphics	4	0	0	4
18.	SCS CSC 01 05 C 18 4004	Mobile Communication and Android Application Development	4	0	0	4
19.	SCS CSC 01 05 C 19 4004	Compiler Design	4	0	0	4
20.	SCS CSC 01 05 C 20 0044	Computer Lab V	0	0	4	4

GENERIC ELECTIVE COURSE (GEC)

(Offered to other departments and can be taken also by MCA Students)

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 01 GEC 01 3003	Fundamentals of IT	3	0	0	3
2.	SCS CSC 01 02 GEC 02 3003	Computer Oriented Optimization Techniques	3	0	0	3
3.	SCS CSC 01 02 GEC 03 3003	Internet Fundamentals	3	0	0	3
4.	SCS CSC 01 03 GEC 04 3003	Fundamentals of Web Design	3	0	0	3
5.	SCS CSC 01 04 GEC 05 3003	Emerging Trends and Technologies	3	0	0	3
6.	SCS CSC 01 05 GEC 06 3003	E- Commerce	3	0	0	3
7.	SCS CSC 01 05 GEC 07 3003	Multimedia Technologies	3	0	0	3



DISCIPLINE CENTRIC ELECTIVE COURSES (DCEC)

(Offered to the students of MCA)

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 01 DCEC 01 0022	Seminar I (Compulsory)	0	0	2	2
2.	SCS CSC 01 01 DCEC 02 3003	Computer Oriented Numerical and Statistical Methods	3	0	0	3
3.	SCS CSC 01 01 DCEC 03 3003	Software Engineering	3	0	0	3
4.	SCS CSC 01 02 DCEC 04 3003	System Modeling and Simulation	3	0	0	3
5.	SCS CSC 01 02 DCEC 05 3003	Software Project Management	3	0	0	3
6.	SCS CSC 01 03 DCEC 06 3003	Design and Analysis of Algorithm	3	0	0	3
7.	SCS CSC 01 03 DCEC 07 3003	Cryptography	3	0	0	3
8.	SCS CSC 01 04 DCEC 08 0022	Seminar/ Presentation (Compulsory)	0	0	2	2
9.	SCS CSC 01 04 DCEC 09 3003	Digital Image Processing	3	0	0	3
10.	SCS CSC 01 04 DCEC 10 3003	Advanced Computer Architecture	3	0	0	3
11.	SCS CSC 01 05 DCEC 11 3003	Data Warehousing and Data Mining	3	0	0	3
12.	SCS CSC 01 05 DCEC 12 3003	Artificial Intelligence	3	0	0	3

Skill Enhancement Elective Course (Compulsory and exclusively for MCA students)

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 06 SEEC 01 0066	Project Work	0	0	24	24



CENTRAL UNIVERSITY OF HARYANA

Mahendergarh

Department of Computer Science

Master of Computer Applications (Semester-wise structure as per CBCS)

Total Credit: 130, Semester wise distribution of credits: 20 + 20 + 22 + 22 + 22 + 24

SEMESTER – I

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 01 C 01 4004	Computer Fundamentals and Problem Solving through C	4	0	0	4
2.	SCS CSC 01 01 C 02 3003	Discrete Mathematical Structures	3	0	0	3
3.	SCS CSC 01 01 C 03 4004	Linux and Shell Programming	4	0	0	4
4.	SCS CSC 01 01 C 04 0044	Computer Lab I	0	0	4	4
5.	SCS CSC 01 01 DCEC 01 4004	Seminar I (Compulsory)	0	0	2	2
6.		Any one of the following courses:	3	0	0	3
	SCS CSC 01 01 GEC 01 3003	Fundamentals of IT				
	SCS CSC 01 01 DCEC 02 3003	Computer Oriented Numerical and Statistical Methods				
	SCS CSC 01 01 DCEC 03 3003	Software Engineering				

SEMESTER – II

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 02 C 05 3003	Object Oriented Systems and C++	3	0	0	3
2.	SCS CSC 01 02 C 06 3003	Digital Design and Computer Organisation	3	0	0	3
3.	SCS CSC 01 02 C 07 4004	Data Structures using C/C++	4	0	0	4
4.	SCS CSC 01 02 C 08 0044	Computer Lab II	0	0	4	4
5.		To be taken from other department	3	0	0	3
6.		Any one of the following courses:	3	0	0	3
	SCS CSC 01 02 GEC 02 3003	Computer Oriented Optimization Techniques				
	SCS CSC 01 02 GEC 033003	Internet Fundamentals				
	SCS CSC 01 02 DCEC 04 3003	System Modeling and Simulation				
	SCS CSC 01 02 DCEC 05 3003	Software Project Management				



SEMESTER – III

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 03 C 09 4004	Database Management Systems	4	0	0	4
2.	SCS CSC 01 03 C 10 4004	Operating Systems	4	0	0	4
3.	SCS CSC 01 03 C 11 4004	Computer Networks	4	0	0	4
4.	SCS CSC 01 03 C 12 0044	Computer Lab III	0	0	4	4
5.		<i>To be taken from other department</i>	3	0	0	3
6.		<i>Any one of the following courses</i>				
	SCS CSC 01 03 GEC 04 3003	Fundamentals of Web Design	3	0	0	3
	SCS CSC 01 03 DCEC 06 3003	Design and Analysis of Algorithm				
	SCS CSC 01 03 DCEC 07 3003	Cryptography				

SEMESTER – IV

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 04C 13 3003	Web Engineering	3	0	0	3
2.	SCS CSC 01 04C 14 3003	Theory of Computation	3	0	0	3
3.	SCS CSC 01 04C 15 4004	Programming in JAVA	4	0	0	4
4.	SCS CSC 01 04C 16 0044	Computer Lab IV	0	0	4	4
5.	SCS CSC 01 04 DCEC 08 0022	Seminar/ Presentation (Compulsory)	0	0	2	2
6.		<i>To be taken from other department</i>	3	0	0	3
7.		<i>Any one of the following courses:</i>				
	SCS CSC 01 04GEC 05 3003	Emerging Trends and Technologies	3	0	0	3
	SCS CSC 01 04DCEC 09 3003	Digital Image Processing				
	SCS CSC 01 04DCEC 10 3003	Advanced Computer Architecture				

SEMESTER – V

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 05 C 17 4004	Computer Graphics	4	0	0	4
2.	SCS CSC 01 05 C 18 4004	Mobile Communication and Android Application Development	4	0	0	4
3.	SCS CSC 01 05 C 19 4004	Compiler Design	4	0	0	4
4.	SCS CSC 01 05 C 20 0044	Computer Lab V	0	0	4	4
5.		<i>Any two of the following courses:</i>				
	SCS CSC 01 05 GEC 06 3003	E- Commerce	3	0	0	3
	SCS CSC 01 05 GEC 07 3003	Multimedia Technologies				
	SCS CSC 01 05 DCEC 11 3003	Data Warehousing and Data Mining				
	SCS CSC 01 05 DCEC 12 3003	Artificial Intelligence	3	0	0	3

SEMESTER – VI

SKILL ENHANCEMENT ELECTIVE COURSE

(Compulsory and exclusively for MCA students)

SN	Course code	Course title	L	T	P	Credit
1.	SCS CSC 01 06 SEEC 01 0066	Project Work	0	0	24	24



Semester – I

Computer Fundamentals & Problem Solving through C SCS CSC 01 101 C 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks.

Total Credits: 4

Computer fundamentals: Computer components, characteristics & classification of computers, hardware & software, peripheral devices.

Algorithmic Development: Techniques of problems solving, Flowcharting, decision table, structured programming concepts, Modular Programming, Algorithms for searching, sorting and merging, Programming methodologies, top-down and bottom-up programming.

Elements of C: C character set, identifiers and keywords, Data types, declaration and definition

Operators: Arithmetic, relational, logical, bitwise, unary, assignment and conditional operators and their hierarchy & associativity.

Data input/output.

Control statements: Sequencing, Selection: if and switch statement; alteration, Repetition: for, while, and do-while loop; break, continue, goto.

Functions: Definition, prototype, passing parameters, recursion.

Data Structures: arrays, struct, union, string data files.

Pointers: Declaration, operations on pointers, array of pointers, pointers to array.

Suggested Readings:

1. Gottfried, Programming with C, Tata McGraw Hill.
2. Nasib Singh Gill, Computing Fundamentals and Programming in C, Khanna Book publishing Co.(P) Ltd., New Delhi.
3. Yashwant Kanetkar, Let us C, BPB Publications.



Semester – I

Discrete Mathematical Structures SCS CSC 01 102 C 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Set Theory: Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identities on sets, pigeonhole principle.

Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation, Lattices, Hasse diagram.

Algebraic Structure: Binary composition and its properties definition of algebraic structure. Groups: Semi-group, Monoid Groups, Abelian group, properties of groups, Permutation Groups, Sub Group, Cyclic Group, Rings and Fields (definition and standard results).

Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms (conjunctive and disjunctive), modus Ponens and modus Tollens, validity, predicate logic, universal and existential quantification.

Graphs: Graph terminology, types of graph connected graphs, components of graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number.

Tree: Definition, types of tree (rooted, binary), properties of trees, binary search tree, tree traversing (preorder, inorder, postorder).

Suggested Reading:

1. BeranardKolman, Robert C. Busby, Discrete Mathematical Structures, Prentice Hall of India Pvt. Ltd.
2. Kenneth G. Rosen, "Discrete Mathematics and its Applications", McGraw Hill.
3. Seymour Lipchitz, M. Lipson, "Discrete Mathematics", Tata McGraw Hill, 2005.



Semester – I

Linux and Shell Programming SCS CSC 01 01 C 03 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Introduction to Linux: Linux distributions, Linux/Unix operating system, Linux/Unix architecture, Features of Linux/Unix, Accessing Linux system, Starting and shutting down system, Logging in and Logging out.

Commands in Linux: General-Purpose commands, File oriented commands, directory oriented commands, Communication-oriented commands, process oriented commands, etc.

Regular expressions & Filters in Linux: Simple filters viz. more, wc, diff, sort, uniq, etc., grep, sed. introducing regular expressions.

Linux/Unix File System: Linux/Unix files, inodes and structure and file system, file system components, standard file system, file system types, file system mounting and unmounting.

Processes in Linux : starting and stopping processes, initialization Processes, mechanism of process creation, rc and init files, job control - at, batch, cron, time, Signal handling.

Shell Programming: vi editor, shell variables, I/O in shell, control structures, loops, subprograms, creating shell scripts. Basic system administration in Linux/Unix.

The C Environment: The C compiler, compiler options, managing projects, memory management, use of make files, dependency calculations, memory management - dynamic and static memory, building and using static and dynamic libraries, using ldd, soname, dynamic loader, debugging with gdb.

Suggested Readings:

1. John Goerzen, Linux Programming Bible, IDG Books, New Delhi.
2. M. G. Venkateshmurthy, Introduction to Unix & Shell Programming, Pearson Education.
3. Richard Petersen, The Complete Reference – Linux, McGraw-Hill.
4. Stephen Prata, Advanced UNIX-A programmer's Guide, SAMS.
5. Sumitabha Das, Your Unix - The Ultimate Guide, Tata McGraw-Hill.
6. Yashwant Kanetkar, Unix & Shell programming – BPB.



Semester – I

Fundamentals of IT SCS CSC 01 01 GEC 01 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Overview of Computer System: Evolution of Computer Systems, Generations of Computers, Parts of Computer System, Categories of Computers, Computer System Characteristics, Hardware – CPU, Memory, Input, Output & Storage devices, Organization of Secondary storage media. Working of input & output devices: keyboard, mouse, trackball, pen, touch screens, scanner, digital camera, monitor, and printer. Working of storage devices: magnetic tape, magnetic disk, CD, DVD. Software-System & Application.

Operating System: Role of an OS, Types of OS, Features of OS & functions of OS. Booting procedure.

Graphical OS: Fundamentals of windows, types of windows, Anatomy of Windows, Windows explorer, customizing windows, control panel, taskbar setting.

Office Automation Tools:

Word Processing: Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, and equation editors.

Excel/Access

Power Point Slides: Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.

Information Technology Basics: Information, Technology, Information Technology, Role, Information technology and Internet, Applications of Information Technology: Wide range of applications in: Home, Education and Training, Entertainment, Science, Medicine, Engineering etc.

Internet: Internet & its applications, working of search engines, use of e-mail, types, Topologies, major features of internet (www, e-mail, telnet, ftp, IRC, news), structure and types of internet connections, Addressing schemes.

Suggested Readings:

1. B. Ram, "Computer Fundamentals", New Age International Pvt. Ltd.
2. Norton, Peter, "Introduction to Computers, Mc-Graw-Hill.
3. Raja Raman V., "Fundamental of Computers" (4th edition.), Prentice Hall of India, New Delhi.
4. S.Jaiswal, "Fundamental of Computer & IT", Wiley dreamtech India.
5. Sanders, D.H., "Computer Today ", Mc-Graw Hill, 1988.
6. Suresh K. Basandra, "Computers Today", Galgotia Publications Pvt. Ltd.
7. Trainer T., et al, "Computers", McGraw Hill.



Semester – I

Computer Oriented Numerical and Statistical Methods SCS CSC 01 01 DCEC 02 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks.

Total Credits: 3

Computer Arithmetic: Floating point representation of numbers, arithmetic operations with normalized floating point numbers and their consequences, Error in number representation, pitfalls in computing.

Iterative Methods bisection, false position, Newton-Raphson methods, discussion of convergence, polynomial evaluation, solving polynomial equations (Bairstow's method)

Solving of simultaneous linear equations and ordinary differential equations: Gauss elimination method, Ill-conditioned equations, Gauss-Seidal iterative method, Taylors series and Euler methods, runga-kutta methods, predictor corrector methods

Numerical Differentiation and integration: differentiation formulae based on polynomial fit, pitfalls in differentiation, trapezoidal, Simpson's rules and Gaussian Quadrature.

Interpolation and Approximation: polynomial interpolation, difference tables, inverse interpolation, polynomial fitting and other curve fitting, approximation of functions by Taylor series and chebyshev polynomials.

Statistical methods: sample distributions, test of significance, n_2 , t and F test.

Time Series Analysis: Components and Analysis of Time Series, Measurement of Trend, seasonal fluctuations and cyclic movement.

Suggested Readings:

1. Graybill, Introduction to Statistics, McGraw Hill.
2. Gupta S.P. and Kapoor, V.K., Fundamentals of Applied Statistics, Sultan Chand & Sons.
3. Rajaraman V., Computer Oriented Numerical Methods, Prentice Hall, India.



Semester – I

Software Engineering SCS CSC 01 01 DCEC 03 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Software and Software Engineering: software characteristics, software crisis, software engineering paradigms.

Planning a Software Project: software cost estimation, project scheduling, personal planning, team structure

Software Configuration Management: quality assurance, project monitoring, risk management.

Software Requirement Analysis: structured analysis, object oriented analysis and data modeling, software requirement specification, validation.

Design and Implementing of Software: software design fundamentals, design methodology (structured design and object oriented design), design verification, monitoring and control, coding.

Software Reliability: metric and specification, fault avoidance and tolerance, exception handling, defensive programming.

Testing: testing fundamentals, while box and black box testing, software testing strategies; unit testing, integration testing, validation testing, system testing, debugging

Software Maintenance: maintenance characteristics, maintainability, maintenance side effects, CASE tools

Suggested Readings:

1. Fairley Richard, Software Engineering Concepts, Tata McGraw Hill.
2. Nasib Singh Gill, Software Engineering, Khanna Book Publishing Pvt. Ltd., New Delhi.
3. Pressmann S. Roger, Software Engineering, Tata McGraw Hill.



Semester – II

Object Oriented Systems and C++ SCS CSC 01 02 C 05 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Object-Oriented Concepts: Data abstraction, encapsulation, classes and objects, modularity, hierarchy, typing, concurrency, persistence.

Object-Oriented Methodology: Advantages and disadvantages of OO methodologies. Modeling, domain analysis, OMT methodology – object model, links and associations, multiplicity, link attributes, role names, ordering qualification, aggregation.

Generalization and inheritance, abstract class, meta data, object diagram, dynamic model events, states, scenarios, event, traces, state diagram, and functional model-data flow diagram. Analysis, system design and object design.

Programming in C++: data types, structs classes, static data & member function, constant parameters & member functions, friend functions & friend classes, role of constructors & destructors, dynamic objects, operator overloading, function overloading, inheritance, virtual functions, abstract class, virtual class, template functions & template classes, exception handling, file stream classes, ASCII & binary files, sequential & random access to a file.

Suggested Readings:

1. Balaguruswami, E., Object Oriented Programming IN C++, TMH.
2. Rumbaugh, J.et, al., Object-oriented Modeling and Design, PHI
3. Schildt, Herbet, C++ : The Complete Reference, 2/e, TMH
4. Stroustrup, B., The C++ Programming Language, Addison Wesley.



Semester – II

Digital Design and Computer Organisation SCS CSC 01 02 C 06 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Information Representation: Number systems, BCD codes, character codes, error detecting and correcting codes, fixed-point and floating point representation of information. Binary arithmetic operations, Booths multiplication.

Binary Logic: Boolean algebra, Boolean functions, truth tables, canonical and standard forms, simplification of Boolean functions, digital logic gates.

Combinational Logic: design procedure, adders, subtractors, encoders, decoders, multiplexers, de-multiplexers and comparators.

Sequential Logic: flip-flops, shift registers and counters.

Memory System: memory parameters, semiconductor RAMs, ROMs, magnetic and optical storage devices.

CPU Organizations: Processor organization, machine instructions, instruction cycles, instruction formats and addressing modes, microprogramming concepts, micro-program sequencer.

I/O organization: I/O interface, interrupt structure, transfer of information between CPU/memory and I/O devices and IOPs.

Suggested Readings:

1. Hayes, J.P., computer Architecture and Organization, TMH.
2. Mano, M. Morris, Digital Logic and Computer Design, PHI.



Semester – II

Data Structures using C/C++ SCS CSC 01 02 C 07 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks.

Total Credits: 4

Introduction: Basic Terminology, Elementary Data Organization, Structure operations, Algorithm, Complexity and Time-Space trade-off.

Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays.

Stacks: Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack.

Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues.

Linked list: Representation and Implementation of Singly Linked Lists, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly Linked List, Linked List in Array

Trees: Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.

Searching and Hashing: Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.

Sorting: Insertion Sort, Bubble Sorting, Selection Sort, Quick Sort, Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting and External Sorting

Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees.

Graphs: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.



Suggested Readings:

1. A. M. Tenenbaum, “Data Structures using C & C++”, Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Adam Drozdek, “Data Structures and Algorithms in C++”, Thomson Asia Pvt.Ltd.(Singapore).
3. Bruno R Preiss, “Data Structures and Algorithms with Object Oriented Design Pattern in C++”, Jhon Wiley & Sons, Inc.
4. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication Pvt. Ltd., New Delhi.
5. K Loudon, “Mastering Algorithms with C”, Shroff Publisher & Distributors Pvt. Ltd.
6. R. Kruse et. al, “Data Structures and Program Design in C”, Pearson Education Asia, Delhi.
7. Trembley, J.P. and Sorensin P.G., An Introduction to Data Structures with Applications, TMH.



Semester – II

Computer Oriented Optimization Techniques SCS CSC 01 02 GEC 02 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Introduction: Historical development, nature, meaning and management application of Operations research, modeling, It's principal and approximation of O.R.models, main characteristics and phases, general methods of solving models, scientific methods, scope, rule on decision making and development of operation research in India.

Linear Programming: Formulation, Graphical solution, standard and matrix forms of linear programming problems, simplex method and its flow char, two phase simplex method, degeneracy.

Duality: introduction, definition, general rule for converting any primal into its dual, dual simplex method and its flow chart.

Integer Programming: importance and applications, Gomarg's allinteger programming problem technique, branch and bound method.

Queuing Models: introduction, applications, characteristic waiting and ideal time costs, transient and steady states, Kendall's notations, M/M/1, M/M/C, M/Ek/1 and deterministic models. (No mathematical derivations included)

Pert and CPM: Basic steps in PERT and CPM, Forward and Backward computation, Representation in Tabular form, slack and critical path, difference between CPM and PERT, float.

Suggested Readings:

1. Averill M. Law, Modelling and Simulation.
2. Gupta P.K., Hira and D.S., operation Research, Sultan Chand & Sons, New Delhi
3. Kanti Swarup, Gupta P.K. & Man Mohan, Operation Reasearch, Sultand Chand & Sons, New Delhi.
4. Sharma, S.D., Operations Research, Kedar Nath and Ram Nath, Meerut.



Semester – II

Internet Fundamentals SCS CSC 01 02 GEC 03 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks.

Total Credits: 3

Electronic Mail: Introduction, advantages and disadvantages, Userids, Pass words, e-mail addresses, message components, message composition, mailer features, E-mail inner workings, E-mail management, Mime types, Newsgroups, mailing lists, chat rooms.

The Internet: Introduction to networks and internet, history, Working of Internet, Internet Congestion, Modes of Connecting to Internet, Internet Service Providers(ISPs), Internet addressing, comparison of IPv4 and IPv6.

Languages and Servers: Basic and advanced HTML, XML basics. Introduction to Web Servers: PWS, IIS, Apache; Microsoft Personal Web Server. Accessing & using these servers.

Privacy and Security Topics: Introduction, Encryption schemes, Secure Web document, Digital Signatures, Firewalls.

Suggested Readings:

1. Deitel, Deitel, and Nieto, Internet & World Wide Web How to Program", Third Edition
2. Douglas E.Comer, Computer Networks and Internets with Internet Applications 3rd Edition, Prentice Hall, 2001, ISBN: 0-13-091449-5
3. Elizabeth Castro, HTML for the World Wide Web with XHTML and CSS: Visual QuickStart Guide, 5th Edition, Peachpit Press, ISBN: 0321130073
4. Preston Gralla, How the Internet Works, Que, Paperback, 8th edition, ISBN 0789736260
5. Robert W. Sebesta, Programming the World Wide Web, 2/e, Addison-Wesley, ISBN: 0-321-14945-9



Semester – II

System Modeling and Simulation SCS CSC 01 02 DCEC 04 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Systems and Environment: Concept of model and model building, model classification and representation, Use of simulation as a tool, steps in simulation study.

Continuous-time and Discrete-time Systems: Laplace transform, transfer functions, state space models, order of systems, z-transform, feedback systems, stability, observability, controllability. **Statistical Models in Simulation:** Common discrete and continuous distributions, Poisson process, empirical distributions

Random Numbers: Properties of random numbers, generation of pseudo random numbers, techniques of random number generation, tests for randomness, random variate generation using inverse transformation, direct transformation, convolution method, acceptance-rejection

Design and Analysis of Simulation Experiments: Data collection, identifying distributions with data, parameter estimation, goodness of fit tests, selecting input models without data, multivariate an time series input models, verification and validation of models, static and dynamic simulation output analysis, steady-state simulation, terminating simulation, confidence interval estimation, Output analysis for steady state simulation, variance reduction techniques

Queuing Models: Characteristics of queuing systems, notation, transient and steady-state behaviour, performance, network of queues

Large Scale Systems: Model reduction, hierarchical control, decentralized control, structural properties of large scale systems

Suggested Readings:

1. A.F. Seila, V. Ceric and P. Tadikamalla, Applied Simulation Modeling (International Student Edition), Thomson Learning, 2004.
2. Averill Law, Simulation Modeling and Analysis (3rd ed.), Tata McGraw-Hill, 2007.
3. B.P. Zeigler, T.G. Kim, and H. Praehofer, Theory of Modeling and Simulation (2nd ed.), Academic Press, 2000.
4. G. Gordan, System Simulation (2nd ed.), Pearson Education, 2007.
5. J. Banks, J.S. Carson, B.L. Nelson, Discrete Event System Simulation (4th ed.), Prentice-Hall of India, , 2004.
6. Jerry Banks, Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice, Wiley Inter Science, 1998.
7. N.A. Kheir, Systems Modeling and Computer Simulation, Marcel Dekker, 1988.
8. Narsingh Deo, System Simulation with Digital Computer, Prentice Hall of India, 1999.



Semester – II

Software Project Management SCS CSC 01 02 DCEC 05 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Conventional Software management: Evolution of software economics. Improving software economics: reducing product size, software processes, team effectiveness, automation through. Software environments. Principles of modern software management.

Software management Process: Framework: Life cycle phases- inception, elaboration, construction and training phase. Artifacts of the process- artifact sets, management artifacts, engineering artifacts, and pragmatics artifacts. Model based software architectures. Workflows of the process. Checkpoints of the process.

Software Management Disciplines: Iterative process planning. Project organizations and responsibilities. Process automation.

Project control and process instrumentation: core metrics, management indicators, life cycle expectations. Process discriminants.

Suggested Readings:

1. Humphrey, Managing the Software Process.
2. Maylor, Project management 2/e.
3. Ramesh, Managing Global Software Projects, TMH, 2001.
4. Walker Royce, Software Project Management, Addison Wesley, 1998.



Semester – III

Database Management Systems SCS CSC 01 03 C 09 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Basic Concepts: File Systems vs. DMBS, Characteristics of the Data Base Approach, Abstraction and Data Integration, Database users, Advantages and Disadvantages of a DBMS.

Data Base Systems Concepts and Architecture: Data Models, Schema and Instances, DBMS architecture and Data Independence, Data Base languages and Interfaces, DBMS functions and component modules.

Entity Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships, Relationships Types, Roles and Structural Constraints, Design issues, E-R Diagrams, Design of an E-R Database Schema, Reduction of an E-R schema to Tables.

Relational Data Model: Relational model concepts, Integrity constraints over Relations, Relational Algebra – Basic Operations.

SQL: DDL, DML, and DCL, views & Queries in SQL, Specifying Constraints & Indexes in SQL.

Relational Data Base Design: Functional Dependencies, Decomposition, Normal forms based on primary keys (1 NF, 2 NF, 3 NF, & BCNF)

Transaction Processing Concepts: Introduction to Transaction Processing, Transaction & System Concepts, Properties of Transaction, Schedules and Recoverability, Serializability of Schedules.

Concurrency Control Techniques: Locking Techniques, Time stamp ordering, Multi-version Techniques, Optimistic Techniques, Granularity of Data items.

Recovery Techniques: Recovery concepts, Recovery Techniques in centralized DBMS.

Suggested Readings:

1. C.J. Date: An Introduction to Data Bases Systems 7th Edition, Addison Wesley N. Delhi.
2. Database Systems: A practical Approach to Design, Implementation and Management, Pearson Education- 3ed.
3. Elmasri & Navathe: Fundamentals of Database systems, Pearson Education.
4. Ivan Bayross: SQL, PL/SQL- The Program Language of ORACLE, BPB Publication.
5. Korth & Silberschatz, Sudarshan: Database System Concept, McGraw Hill International Edition, 6th edition.



Semester – III

Operating Systems SCS CSC 01 03 C 10 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Operating System Introduction: function, characteristics, structures – simple batch, multiprogrammed, timeshared, personal computer, parallel, distributed systems, real-time systems, system components, operating system services, system calls, virtual machines.

Process and CPU Scheduling: Process concepts and scheduling, operation on processes, cooperating processes, threads and interposes communication scheduling criteria, scheduling algorithm, multiple-processor scheduling, real time scheduling.

Memory Management and Virtual memory: logical versus physical address space, swapping, contiguous allocation, paging, segmentation, segmentation with paging. Demand paging, performance of denuding paging, page replacement, page replacement algorithm, allocation of frames, thrashing.

File System Interface and Implementation: access methods, directory, structure, protection, file system structure, allocation methods, free space management, directory management, directory implementation, efficiency and performance.

Process Management and Synchronization: Critical section problem, synchronization, critical regions, monitors.

Deadlocks: system model, dead locks characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection and recovery from deadlock.

I/O Management: I/O software and its types, disk scheduling.

Case Study: UNIX, Linux and Windows NT

Suggested Readings:

1. A.S. Tanenbaum: Modern Operating Systems, Latest Edition PHI.
2. Silberschatz & Galvin: Operating System Concept, Wiley, Latest Edition.
3. William Stallings: Operating systems. PHI, Latest Edition



Semester – III

Computer Networks SCS CSC 01 03 C 11 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Network Concepts: goals and applications of computer networks; topologies; categories of networks – LAN, MAN, WAN, internetworks; point-to-point and broadcast network; introduction to SMDS, X.25 Networks, ISDN, frame relay and ATM networks

Networks Architecture: concept of protocols & services, OSI model and Functions of its layers; TCP-IP reference model.

Data Communication Concepts: components of a data communication system; transmission models transmission media – guided and wireless media; introduction to switching (circuit, message and packet) and multiplexing (frequency division and time division), concept of modems

Framing and Error Control: framing techniques, Error control – error detection & correction

Data Link Control: Acknowledgment; elementary data link protocols, automatic repeat request, sliding window protocols

Medium Access Control and LANs: Multiple Access protocols of MAC sublayer – ALOHA, 1-persistent, p-persistent and non-persistent CSMA, CSMA/CD, Collision free protocols, Limited contention protocols, Wavelength Division Multiple Access, MACA GSM, CDPD, CDMA, IEEE standard 802 for LANs and MANs –Ethernet, token bus, token ring, DQDB, Logical Link Control.

Routing: Deterministic and Adaptive routing; centralized and distributed routing, shortest-path, flooding, flow base, optimal distance vector, link state, hierarchical, routing for mobile hosts, broadcast and multicast routing,

Congestion Control: principles of congestion control; traffic shaping, choke packets, load shedding, RSVP,

TCP/IP: Elements of transport protocols, transmission control protocol (TCP), user datagram protocol (UDP), Internet protocol (IP).

Suggested Readings:

1. Andrew S. Tanenbaum, Computer Networks –PHI
2. Behrouz, Frozen, Introduction to Data Communications and Networking –TMH
3. William Stallings, Data and Computer Communications, fifth edition- PHI



Semester – III

Fundamentals of Web Design SCS CSC 01 03 GEC 04 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Web Design Principles: Basic principles involved in developing a web site, Planning process, Five Golden rules of web designing, Designing navigation bar, Page design, Home Page Layout, Design Concept.

Basics in Web Design: Brief History of Internet, What is World Wide Web, Why create a web site, Web Standards, Audience requirement.

Introduction to HTML: What is HTML, HTML Documents, Basic structure of an HTML document, creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, and HTML Tags.

Elements of HTML: Introduction to elements of HTML, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.

Introduction to Cascading Style Sheets: Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties), CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute selector), CSS Color, Creating page Layout and Site Designs.

Introduction to Web Publishing or Hosting: Creating the Web Site, Saving the site, working on the web site, Creating web site structure, Creating Titles for web pages, Themes- Publishing web sites.

Suggested Readings:

1. A beginner's guide to HTML NCSA, 14th May, 2003
2. Ian Pouncey, Richard York Beginning CSS: Cascading Style Sheets for Web Design Wiley India
3. John Duckett Beginning HTML, XHTML, CSS, and JavaScript Wiley India
4. Kogent Learning Solutions Inc. HTML 5 in simple steps Dreamtech Press
5. Kogent Learning Web Technologies: HTML, Javascript Wiley India
6. Murray, Tom/Lynchburg Creating a Web Page and Web Site College, 2002
7. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, Internet & World Wide Web How to Program, 5/e
8. Steven M. Schafer HTML, XHTML, and CSS Bible, 5ed Wiley India



Semester – III

Design and Analysis of Algorithm SCS CSC 01 03 DCEC 06 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Introductory Concepts: Review of important data structures like Array, Lists, Stack, Queues, Priority queues, Binary trees, B-Tree, Heaps, and Graphs. Analysis of algorithms, asymptotic notation-Big-O, Omega and Theta notations, recurrence relations, solving recurrences, introductory concepts in program verification and testing, Structured design methodology.

Design Structures: General Method, Algorithm Design strategies : Divide & Conquer, Greedy Method, Dynamic Programming, Basic Sorting, Searching and Traversal Techniques, Basic Tracking, Branch and Bound.

Lower Bound Theory: Non-deterministic algorithm, Non-deterministic programming constructs, Simple Non-Deterministic programs, Comparison trees, oracles and adversary arguments, techniques for algebraic problems, lower bounds on parallel computation. Divide and conquer (recursion) versus dynamic programming. Fibonacci numbers and binomial coefficients. All pairs shortest path. Matrix-chain multiplication.

NP-Hard and NP-Complete Problems: P, NP, NP-Hard & NP-Complete Classes, Reductions: Vertex cover, Simple Max Cut, Hamiltonian Circuit, Traveling salesman problem, kernel, 3-dimensional matching, and other NP-Complete Problems, Satisfiability and variations, Cook's theorem, examples of NP-Hard problems, approximation algorithms : Traveling salesman problem and others.

Suggested Readings:

1. Aho, Hopcroft, and Ullman The Design and Analysis of Computer Algorithms, Addison Wesley
2. Goodman, S.E., and Hetedniemi, S.T. Introduction to the Design and Analysis of Algorithms, McGraw Hill.
3. Horowitz, E. and Sahni, S. Fundamentals of Data Structure Galgotia Publications.
4. Horowitz, Ellis and Fundamentals of Computer Sahni, Sartaj Algorithms, Galgotia Publications, 1/e
5. Trembley and Sorenson, An Introduction of Data Structures, with Applications, McGraw Hill.
6. Voll, Knuth, D.E., The Art of Computer Programming: Fundamental Algorithms (Volume - 1) 3rd Edition, 1985, Narosa Publications.



Semester – III

Cryptography SCS CSC 01 03 DCEC 07 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Elementary number theory: Prime numbers, Fermat's and Euler's theorems, testing for primality, Chinese remainder theorem, discrete logarithms.

Finite fields: Review of groups, rings and fields; Modular Arithmetic, Euclidean Algorithms, Finite fields of the form $GF(p)$, Polynomial Arithmetic, Finite fields of the form $GF(2^n)$.

Data Encryption Techniques: Algorithms for block and stream ciphers, private key encryption – DES, AES, RC4; Algorithms for public key encryption – RSA, DH Keyexchange, KERBEROS, elliptic curve cryptosystems.

Message authentication and hash functions, Digital Signatures and authentication protocols, Public key infrastructure, Cryptanalysis of block and stream ciphers.

Suggested Readings:

1. C. Pfleeger and S.L. Pfleeger, Security in Computing (3rd ed.), Prentice-Hall of India, 2007.
2. M Y Rhee, Network Security, John Wiley and Sons, NY, 2002.
3. W. Stallings, Cryptography and Network Security Principles and Practices (4th ed.), Prentice-Hall of India, 2006.



Semester – IV

Web Engineering SCS CSC 01 04C 13 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Role of Information Architect, Collaboration and Communication, Organizing Web Site parameters, Navigation Systems, Designing Search Interface for web-site, Conceptual Design, High-Level Design, Architectural Page Mockups, Design Sketches, good & bad web design, Process of Web Publishing, Phases of Web Site development, enhancing your web-site, web security.

HTML 5.0, Static and dynamic HTML, Structure of HTML documents, HTML Elements, Linking in HTML, Anchor Attributes, Image Maps, Meta Information, Image Preliminaries, Layouts, Backgrounds, Colors and Text, Fonts, Tables, Frames and layers, Audio and Video Support with HTML, Database integration with HTML, CSS, Positioning with Style sheets. Forms Control, Form Elements.

Introduction to CGI, PYTHON, URL, HTTP, Browser Requests, Server Responses, Proxies, Firewalls, CGI Environment Variables, Forms and CGI, Sending Data to the Server,

Introduction to ASP: Objects — Components; **JSP:** Objects — Components, Client (JavaScript) and Server side scripting (JSP/ASP/PHP)

PHP, PHP variables, PHP - Database Management, ASP .NET, Cookies, Creating and Reading Cookies, XML: Comparison with HTML — DTD — XML Elements — Content Creation — Attributes — Entities — XSL — XLINK — XPATH — XPOINTER — Namespaces — Applications — integrating XML with other applications, Middleware Technologies: CORBA, COM, DCOM — Ecommerce: Introduction, Types — Architectures — Applications — Security

Suggested Readings:

1. Chris Bates- "Web Programming – Building Internet Application", 2nd Edition, Wiley Dreamtech India Pvt. Ltd.,2002.
2. H.M. Deitel, P.J. Deitel, A.B. Goldberg.-Internet & World Wide Web How to Program, Pearson education, 3rd edition
3. McGraw-Hill -Web- Technologies, TCP/IP and Java Programming, 2/e
4. Scott Guelich, Shishir Gundavaram, Gunther Birzniek; CGI Programming with Perl 2/e.
5. SheIly Powers et al- "Dynamic Web Publishing", Techmedia, 1998.
6. Thomas A Powell, HTML-The Complete Reference, Tata McGraw Hill.



Semester – IV

Theory of Computation SCS CSC 01 04C 14 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Recursive Languages: Recursive definition, Alphabets, Language, Regular expression, definitions of Finite state machine, Transition graphs, Deterministic & non-deterministic finite state machines, Regular grammar, Left-linear and right linear, Thomson's construction to convert regular Expression to N DFA & subset algorithm to convert N DFA to DFA. Minimization of DFA, Finite state machine with output (Moore machine and Mealy Machine), conversion of Moore machine to Mealy machine & vice-versa.

Properties of Regular Languages: Conversion of DFA to regular expression, Pumping lemma, Properties and limitations of finite state machine, Decision properties of regular languages, Application of finite automata.

Context Free Grammar: Context free grammar, Writing context free grammar for problems, Derivation tree and ambiguity, Application of context free grammars, Chomsky and Greibach Normal form, Conversion of CFG to CNF and GNF. Properties of context free grammar, CYK algorithm

PDA: Push down stack machine, Design of deterministic and non-deterministic push-down stack, Parser design.

Turing Machine: Turing machine definition and design of Turing Machine, Church-Turing Thesis, Variations of Turing Machines, combining Turing machine, Universal Turing Machine, Post Machine, Chomsky Hierarchy.

Incommutability: Halting problem, Turing enumerability, Turing acceptability and Turing decidabilities, Unsolvable problems about Turing machines.

Computation Complexity: P, NP and NP Complete Problems.

Suggested Readings:

1. Kamla Kirtheivshan & Rama R, Automata theory & Computation, PEARSON, 1/e.
2. Peter Linz, An introduction to formal language & automata, Jones & Bartle pub. 5/e.
3. Hopcroft, J.E. & Ullman, J.D. Formal languages and their relation to Automata, Addison-Wesley.
4. E.V. Krishnamurthy, Introductory Theory of Computer Science Ease-West press Pvt. Ltd.
5. Salomma, A.K. Formal languages, Academic press.
6. Lewis, H.R. & Papadimitriou, C.H. Elements of the Theory of Computation, PHI.
7. Zohar Manna, Mathematical Theory of Computation, Wiley Inter-science.



Semester – IV

Programming in JAVA SCS CSC 01 04C 15 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Introduction: Java's Byte-code, Java Virtual Machine. Java's Class Library, Data Types, Variables, and Operators, Operator Precedence. Selection Statements, Scope of Variable. Defining Classes, Methods, Constructors, Creating Objects of a Class, Assigning Object Reference Variables, variable this, Defining and Using a Class, Automatic Garbage Collection. *Arrays and Strings:* Arrays, String Handling Using String Class, String Buffer Class. *Extending Classes and Inheritance:* Class Inheritance, Access Attributes, Polymorphism, Multiple Levels of Inheritance, Abstraction through Abstract Classes, Using Final Modifier, The Universal Super class-Object Class.

Packages & Interfaces: Defining a Package, Adding Classes from a Package, CLASSPATH, Standard Packages, Access Protection in Packages, Concept of Interface. Exception Handling: The concept of Exceptions, Types of Exceptions, Dealing with Exceptions, Exception Objects, Defining Exceptions. Multithreading Programming: The Java Thread Model, Creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization, Deadlocks Inter-thread communication, Deadlocks.

Input/output in Java: I/O Basic, Byte and Character Structures, I/O Classes, Reading Console Input Writing Console Output, Reading and Writing on Files, Random Access Files, Storing and Retrieving Objects from File, Stream Benefits. Creating Applets in Java: Applet Basics, Applet Architecture, Applet Life Cycle, Simple Applet Display Methods, Requesting Repainting, Using the Status Window, the HTML APPLET Tag Passing Parameters to Applets.

Working with Windows: AWT Classes, Window Fundamentals, Working with Frame, Creating a Frame Window in an Applet, Displaying Information within a Window. Working with Graphics and Texts: Working with Graphics, Working with Color, Setting the Paint Mode, Working with Fonts, Managing Text Output Using Font Metrics, Exploring Text and Graphics. Working with AWT Controls, Layout Managers and Menus. Introduction to Swing classes.

Suggested Readings:

1. E. Balaguruswami, Programming with Java, Second Edition, Tata McGraw Hill.
2. Herbert Schildt: The Complete Reference Java 2, Fourth Edition, Tata McGraw Hill-2001.
3. Liang Y. Daniel: Introduction to Java Programming (7th Edition), 2009, Pearson Education.
4. Mughal K.A., Rasmussen R.W, A Programmer's Guide to Java Certification, Addison-Wesley, 2000.



Semester – IV

Emerging Trends and Technologies SCS CSC 01 04GEC 05 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Mobile Computing and the “Post-PC” Era: Smartphones & Tablets: Why now? Mobile Platforms (e.g. iOS, Android, BB, Windows), Applications Markets

Cloud Computing: What does “X as a Service” mean (X=Platform, Infrastructure or Software), Service Models, Scalability and Reliability, Development frameworks (e.g. AWS, Azure App Engine) Business Benefits, Cloud Security & Privacy, Regulation, Consumerization of IT

Mobile Computing (MC): Introduction to MC, novel applications, limitations, and architecture. GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

Medium Access Control (Wireless): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA. Mobile Network Layer, Mobile Transport Layer

Audio and Video Conferencing: Technology & Applications, Application to information technology to various function areas such as education, banking, communication etc.

Suggested Readings:

1. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, “Fundamentals of Mobile and Pervasive Computing”, ISBN: 0071412379, McGraw-Hill Professional, 2005.
2. Hansmann, Merk, Nicklous, Stober, “Principles of Mobile Computing”, Springer, second edition, 2003.
3. Jochen Schiller, “Mobile Communications”, Addison-Wesley. (Chapters 4, 7, 9, 10, 11), second edition, 2004.
4. Martyn Mallick, “Mobile and Wireless Design Essentials”, Wiley DreamTech, 2003.
5. Reza Behravanfar, “Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML”, ISBN: 0521817331, Cambridge University Press, October 2004,
6. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002, ISBN 0471419028. (Chapters 11, 15, 17, 26 and 27)



Semester – IV

Digital Image Processing SCS CSC 01 04DCEC 09 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Digital Image Fundamentals: Elements of digital image processing systems, Elements of visual perception, brightness, contrast, hue, saturation, Mach band effect, Color image Fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

Image Enhancement: Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorphic filtering, Color image enhancement.

Image Restoration: degradation model, Unconstrained restoration - Lagrange multiplier and Constrained restoration, Inverse filtering removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations.

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

Image compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG

Suggested Readings:

1. Anil K. Jain, Fundamentals of digital image processing
2. Richard E. Woods, Rafael C. Gonzalez, Digital Image Processing, 3rd Edition



Semester – IV

Advanced Computer Architecture SCS CSC 01 04DCEC 10 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Computational Models: Concept and Interpretation, Basic Computational Models, Von Neumann Computational Model Computer Architecture: Evolution & Interpretation, Multilevel Hierarchical Framework of Computer Architecture. Parallel Processing: Types & Levels of Parallelism, Granularity, Classification of Parallel Architectures, Relationships between Languages and Parallel Architectures. ILP Processors: Evolution and Overview of ILP Processors, Dependencies among Instructions, Principle of Pipelining, General Structure of Pipeline, Performance Measures, Types of Pipelines, RISC vs CISC architectures.

VLIW Architecture: Overview of Proposed & Commercial VLIW Architectures, Code Scheduling in ILP Processors: Basic Block Scheduling – List Schedulers, Loop Scheduling – Loop Unrolling, Software Pipelining; Global Scheduling, Superscalar Processors – Emergence of Superscalar Processors, Parallel Decoding, Superscalar Instruction Issue, Shelving, Register Renaming, Parallel Execution, Preserving the Sequential Consistency of Instruction Execution and Exception Processing.

Branch Processing: Branch Problem, Performance Measures, Delayed Branching, Branch Detection, Branch Predictions, Multiway Branching, Guarded Execution, Distributed MIMD Architectures: Architectural Concepts, Direct Interconnection Networks – Measures, Linear Array, Ring, Star, tree, 2D mesh, Hypercube; Switching Techniques – Packet switching, Circuit Switching, Virtual Cut Through, Wormhole Routing.

Shared Memory MIMD Architectures: Architectural Concepts, Comparison with Distributed MIMD Architecture, NUMA, COMA and CC-NUMA Architectures, Interconnection Networks - Single Shared Bus (Locked, Pended, Split Transaction Buses); Arbiter Logics, Crossbar, Multistage Networks, Cache Coherence Problem – Snoopy Protocol & Directory Based Protocols

Suggested Readings:

1. David E. Culler, Jaswinder Pal Singh, “Parallel computing architecture: A hardware/software approach”, Morgan Kaufmann /Elsevier Publishers, 1999.
1. Dezso Sima, Terence Fountain, Peter Kacsuk, Advanced Computer Architecture, Pearson, 2000, 1/e
2. John L. Hennessy and David A. Patterson, “Computer architecture – A quantitative approach”, Morgan Kaufmann / Elsevier Publishers, 4th. edition, 2007
3. Kai Hwang and Zhi.Wei Xu, “Scalable Parallel Computing”, Tata McGraw Hill, New Delhi, 2003
4. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability and Programmability, McGraw Hill, 1993.



Semester – V

Computer Graphics SCS CSC 01 05 C 17 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Introduction: Survey of computer Graphics and its applications; Interactive and passive graphics; display processors; Graphic Devices: Display systems-refresh CRTs, raster scan and random scan monitors, Grey shades, Interlacing, beam penetration shadow mask monitors, look up tables, plasma panel, LED and LCD monitors, VGA and SVGA resolutions; Hard copy Devices-printers, plotters; Interactive Input Devices.

Drawing Geometry: Coordinate system; resolution; use of homogeneous coordinate system; scan conversion: symmetrical DDA, simple DDA, Bresenham's line drawing algorithm, Circle drawing using DDA and polar coordinates, Bresenham's circle drawing algorithm, generation of ellipse. Curve Drawing

2-D Transformations: Translation; rotation; scaling; mirror reflection; shearing; zooming; panning; input techniques-pointing, positioning, rubber band methods and dragging; tweening, Morphing. Graphic operations: Clipping-line clipping using Sutherland-Cohen and midpoint sub-division algorithm, Liang Barsky Line clippers algorithm, polygon clipping; window and viewport; windowing transformation; Filling algorithms.

4-D Graphics: 3D modelling of objects; 3D display techniques; coordinate system; 3D transformation matrices for translation, scaling and rotation; parallel projection; perspective projection; Hidden-surface removal - Z-buffer, back face, scan-line, depth-sorting, area subdivision; Shading - modelling light intensities, gouraud shading, phong shading.

Suggested Readings:

1. D.P. Mukherjee, Fundamentals of Computer Graphics and Multimedia, PHI.
2. Foley etc.: Computer Graphics Principles & Practice, Addison Wesley.
3. John F. Koegel Buford: Multimedia Systems, Addison Wesley.
4. M. Pauline Baker: Computer Graphics - Donald Hearn, PHI.
5. Newman & Sproull: Principles of Interactive Computer Graphics, McGraw Hill.
6. Rogers: Procedural elements of Computer Graphics, McGraw Hill.



Semester – V

Mobile Communication and Android Application Development SCS CSC 01 05 C 18 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Mobile Communication: Definition, Guided Transmission, Unguided Transmission; Mobile computing architecture, Mobile Devices, Mobile System Networks: Cellular, WLAN, Ad hoc networks; GSM: Services and System Architecture, Radio Interfaces, Localization, Calling, Handover, Security; CDMA: Architecture, Spread Spectrum, Coding Methods; GPRS: Introduction, system Architecture; Introduction to EDGE

Mobile Database: Database hoarding techniques, Data Caching, Client Server computing: 2 tier and 3 tier client server architecture; Transactional models, Query processing, Data Recovery process; Data Dissemination; Communication Asymmetry, Classification of Data delivery mechanism: Push based, pull based, Hybrid; Selective tuning and indexing technique, Mobile Application Languages, Mobile Operating system: Palm OS, Symbian, Android.

Android Application Development: Android Application Development: Getting started with Android, Mastering Android Development tools: Using Android Documentation, Debugging Applications with DDMS, Working with Android Emulator; Building Android Applications: Designing typical Android Application, Using the Application Context, Working with Activities, Working with intents, Dialogs, Fragments, Logging application information.

Android Application Development: Managing Application Resources: Working with Simple Resource values, Draw able Resources, Layouts, Files; Configuring the Android Manifest file and basic application Settings, registering activities, Designating the launch activity, Managing Application permissions, Designing an application framework.

Suggested Readings:

1. Kamal, Raj, Mobile Computing, Oxford Higher Education.
2. Jochen Schiller, "Mobile Communications", PHI/Pearson Education, Second Edition.
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, New York, 2003.
4. Reto Meier, Professional Android 2 Application Development, Wrox Publications.
5. Hazysztof Wesolowshi, "Mobile Communication Systems", John Wiley and Sons Ltd.
6. Shane Conder, Lauren Darcey: Sams Teach Yourself Android™ Application Development in 24Hours.



Semester – V

Compiler Design SCS CSC 01 05 C 19 4004

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 4**

Introduction: Compilation and Interpretation, Bootstrap compilers, Phases of Compilation process, Lexical Analysis, Lex package on UNIX systems. Process of Lexical Analysis, Recognition of Regular Expressions
Context free grammars, Derivation and parse trees, Capabilities of CFG, Rightmost and Leftmost derivations. Formal Grammars and their application to Syntax Analysis, BNF notation, Ambiguity, YACC. The syntactic specification of Programming Languages

Parsing Techniques: Top down & Bottom-up parsing, Shift Reduce parsing, Operator Precedence parsing, Predictive Parsers. Left Recursion and its removal, Recursive Descent parser, Automatic Construction of efficient Parsers: LR parsers, the Canonical Collection of LR(0) items, Constructing SLR parsing tables, Constructing Canonical LR parsing tables, Constructing LALR parsing tables, Using Ambiguous Grammars, an Automatic Parser Generator, Implementation of LR parsing tables, Constructing LALR sets of items. YACC package on UNIX systems.

Intermediate Code Generation: Issues in the design of a code generator, Intermediate languages, Quadruples, Generating intermediate code for declarative statement, Assignment statement, Boolean expression, and case statement.

Code Optimization: potential cases of code optimization, optimization of basic blocks, loops in flow graphs, code improving transformation.

Suggested Readings:

1. Aho, Sethi, & Ullman, Compilers Principles, Techniques and Tools, Addison Wesley.
2. Alfred V Aho and Jeffery D Ullman, Principles of Compiler Design, Narosa/Addison Wesley.
3. Beck L. Leland, System Software, 3/e, Addison Wesley.
4. Dhamdhare D.M, System programming and operating system,(Tata Mc-grawHill).
5. Jean Paul Tremblay and Sorenson, The Theory and Practice of Compiler Writing, McGraw Hill.,2/e.



Semester – V

E- Commerce SCS CSC 01 05 GEC 06 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Basic Concepts: Introduction, Definition, Objectives, Advantages and Disadvantages, Forces driving E- Commerce, Traditional commerce Vs. E-Commerce, E-Commerce opportunities for industries, Growth of E-Commerce, Electronic data Interchange: Concepts of EDI and Limitations, Applications of EDI, Disadvantages of EDI, EDI Models, EDI Implementation, MIME and Value Added Networks, Internet based EDI.

E-Commerce Models: B2C, B2B, C2C, C2B, other models- Brokerage model, aggregator Model, Info-mediary model, community model and value chain model, Advertise model. Electronic payment system: Special Features required in payment systems, Types of E-payment systems, E-cash, E-cheque, credit card, smart card, electronic purses, e-billing, E-e-Micropayments, Point of sales systems (POS) - Meaning, uses, structure.

Customer Relationship Management & Technologies: E-Transition Challenges in Indian Corporate, E-Commerce and WWW, e- marketing, E- Customer Relationship Management, E- CRM problems and solutions, CRM capabilities and customer life cycle, E- supply chain management. E- Strategy: Planning the E-commerce Project, E-commerce strategy and Knowledge management, E- business Strategy and Data Warehousing & Mining. ERP for E-commerce. Customer effective Web design – Requirement, Strategy and Model.

M- Commerce: Overview of mobile-commerce, Mobile delivery technology & Switching Methods, Attributes of m- Commerce, Drivers of m- commerce, m-commerce Security issues, Mobile ATM(ICICI Bank Case Study). Applications of m-commerce: Mobile Financial Applications, m-wallet, Mobile shopping, Advertising and Content provision.

Security Issues in E-Commerce: Security Risk of E- commerce, Types of Threats. Security tools and risk management approach.

Suggested Readings:

1. Agarwala Kamlesh, N and Agarwala Deeksha: Business on the Net Introduction to the E-Com., Macmillan India.
2. Bharat Bhaskar: Electronic Commerce- Framework Technologies and Applications, Tata McGraw Hill.
3. P.T. Joseph: E- Commerce: A Managerial Perspective, PHI 2002.
4. Ravi Kalakota & A.B. Whinston : Electronic Commerce – A Manager's Guide, Pearson Education.
5. Ravi Kalakota & A.B. Whinston: Frontiers of Electronic Commerce, Pearson Education



Semester – V

Multimedia Technologies SCS CSC 01 05 GEC 07 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Basics of Multimedia Technology: Computers, communication and entertainment; multimedia an introduction; framework for multimedia systems; multimedia devices; CD-Audio, CD-ROM, CD-I, presentation devices and the user interface; multimedia presentation and authoring; professional development tools; LANs and multimedia; multimedia servers & databases; video on demand.

Image Compression & Standards: Making still images; editing and capturing images; scanning images; computer color models; color palettes; vector drawing; 3D drawing and rendering; JPEG-objectives and architecture; JPEG-DCT encoding and quantization, JPEG statistical coding, JPEG predictive lossless coding; JPEG performance; overview of other image file formats as GIF, TIFF, BMP, PNG etc.

Audio & Video: Digital representation of sound; time domain sampled representation; method of encoding the analog signals; subband coding; fourier method; transmission of digital sound; digital audio signal processing; stereophonic & quadraphonic signal processing; editing sampled sound; MPEG Audio; audio compression & decompression; brief survey of speech recognition and generation; audio synthesis; musical instrument digital interface; digital video and image compression; MPEG motion video compression standard;

Virtual Reality: Applications of multimedia, intelligent multimedia system, desktop virtual reality, VR operating system, virtual environment displays and orientation making; visually coupled system requirements.

Suggested Readings:

1. Halsall & Fred, Multimedia Communications 2001,AW.
2. James E Shuman, Multimedia in Action 1997, Wadsworth Publ.,
3. Jeff coate Judith, Multimedia in Practice 1995,PHI.
4. John .F. Koegel, Multimedia Systems, 2001, Buford.
5. Koegel, Multimedia Systems, AWL
6. Lozano, Multimedia: Sound & Video, 1997, PHI, (Que)
7. Sinclair, Multimedia on the PC, BPB
8. Tay Vaughan, Multimedia: Making it work, fifth edition, 1994, TMH.
9. Vaughar, etl. Multimedia Making it Work
10. Villamil & Molina, Multimedia: Production, planning and delivery, Que, 1997



Semester – V

Data Warehousing and Data Mining SCS CSC 01 05 DCEC 11 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks. **Total Credits: 3**

Introduction: The Evolution of Data Warehousing (The Historical Context), The Data Warehouse - A Brief History, Characteristics, Operational Database Systems and Data Warehouse (OLTP & OLAP), today's Development Environment, Data Marts, and Metadata. Multidimensional Data Models: Types of Data and their Uses, from Tables and Spreadsheets to Data Cubes, Identifying Facts and Dimensions, Designing Fact Tables, Designing Dimension Tables, Data Warehouse Schemas, OLAP Operations.

Principles of Data Warehousing (Architecture and Design Techniques): System Processes, Data Warehousing Components, Architecture for a Data Warehouse, Three-tier Data Warehouse Architecture, Steps for the Design and Construction of Data Warehouses. Implementation: Methods for the Implementation of Data Warehouse Systems.

Data Mining: Introduction, Motivation, Importance, Knowledge Discovery Process, KDD and Data Mining, Data Mining vs. Query Tools, Kind of Data, Functionalities, Interesting Patterns, Classification of Data Mining Systems, Major issues, From Data Warehousing to Data Mining.

Data Preparation: Pre-process, Data Cleaning, Data Integration and Transformation, Data Reduction. Data Mining Primitives, Languages, and System Architectures.

Concept Description: An Overview of Descriptive Data Mining, Predictive Data Mining, Methods for Concept Description. Mining Association Rules: Association Rule Mining, Market Basket Analysis, Types of Association Rules, Methods for Mining Association Rules in Transaction Databases, Relational Databases and Data Warehouses. Classification and Prediction: Methods for Data Classification and Prediction. Cluster Analysis Introduction: Types of data in Cluster Analysis, A categorization of major Clustering Methods, Density-based methods, Grid-based methods, Model-based clustering methods, Outlier Analysis. Applications of Data Mining. Tools for Data Mining.

Suggested Readings:

1. Adriaans, Data Mining, Pearson Education.
2. Glenn J. Myatt, Making Sense of Data, Wiley 2007.
3. J Hanes, M. Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann Publishers, 2002.
4. Paolo Giudici, Applied Data Mining – Statistical Methods for Business and Industry, Wiley 2003.



Semester – V

Artificial Intelligence SCS CSC 01 05 DCEC 12 3003

Note: Total 8 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions. All questions shall carry equal marks.

Total Credits: 3

Basic Concepts: AI and its importance, history of AI, applications areas, AI approach for solving problems. Problem representation: State space representation, problem reduction representation, bounding functions. Propositional logic: syntax and semantics. First order predicate logic (FOPL): syntax and semantics, conversion to clausal form, inference rules, unification, resolution principle, proof procedure, refutation.

Structured Knowledge: Associative networks, Frame structures, Conceptual dependencies and scripts, semantic nets, production system: commutative and non-commutative production systems, Decomposable and non-decomposable production systems, Procedural and declarative knowledge, forward and backward reasoning, matching, control knowledge.

Search and Control Strategies: Strategies for state space search, data driven and goal driven search; Search algorithms- uninformed search (depth first, breadth first, depth first with iterative deepening) and informed search (Hill climbing, best first, A, A*, AO algorithm, mini-max etc.), computational complexity, Properties of search algorithms- Admissibility, Monotonicity, Optimality, Dominance, etc., genetic algorithms.

Expert System Architecture: Rule based architecture, Non-production system architecture. Components of Expert Systems, Stages of expert system development, Expert systems applications, Building Expert System and Shell. Knowledge acquisition and validation. managing uncertainty in expert systems - Bayesian probability theory, Stanford certainty factor algebra, Nonmonotonic logic and reasoning with beliefs, Fuzzy logic, Dempster/Shaffer theory.

Suggested Readings:

1. Dan W. Patterson Introduction to Artificial Intelligence and Expert system PHI, 1/e
2. George F. Luger, William A. Stubblefield Artificial Intelligence, The Benjamin/Cummings Publishing Company, Inc.
3. Nils J. Nilsson Principles of Artificial Intelligence Narosa publishing house



Semester – VI

**Project Work
SCS CSC 01 06 SEEC 01 0066**

Total Credit: 24

