HIGHER SECONDARY SCHOOL TEACHER – COMPUTER SCIENCE / COMPUTERAPPLICATION (JUNIOR)&HIGHER SECONDARY SCHOOL TEACHER – COMPUTER SCIENCE /COMPUTER APPLICATION (NCA NOTIFICATION)

HIGHER SECONDARY EDUCATION

CATEGORY NO. 111/2010 & 69/2010 (NCA- LC)

1. Discrete Structures

Sets, Relations, Functions. Pigeonhole Principle, Inclusion-Exclusion principle, Equivalence andPartial Orderings. Elementary Counting Techniques.Computability : Models of computation - Finite Automata, Pushdown Automata, Non-determinismand NFA, DPDA and PDA s and Languages accepted by these structures. Grammars - types ofgrammars - type 0 , type I, type 2 and type 3. The relationship between types of grammars, Languages, Non-computability, Non-computable problems.Groups : Finite fields and Error correcting / detecting codes.Pr
Propositional logic. Predicate logic. Well-formed formulae (WFF). Satisfiability and Tautology.

2. Computer Arithmetic

Logic families : TTL, ECL and C-MOS gates. Boolean algebra and Minimization of Boolean functions, Flip-flops- types, race condition and comparison, Design of combinational and sequentialcircuits.Representation of Integers : Octal. Hex. Decimal and Binary 2's complement and 1's complementarithmetic. Floating point representation.

3 .

Programming in C and C++

Programming in
C

: Elements of C - Tokens, identifiers, data types in C, Control constructs in C,Sequence, selection and iteration. Structured data types in C - arrays, structs, unions, strings andpointers.Object-Oriented programming Concepts : Class - object, instantiation, Inheritance - polymorphismand overloading, aggregation, abstract classes, generalization as extension and restriction. Objectoriented design. Multiple inheritanceC++ - programming : Elements of C++ - Tokens, Identifiers, Variables and constants. Data types,Operators. Control statements, Functions, parameter passing, Class and objects, Constructors anddestructors, Overloading, Inheritance, Templates, Exception handling.

4. Relational Database Design and Query Languages

E-R diagrams, Transformation of E-R models to relational design, Normalization - INF, 2NF, 3NF,BCNF and 4NF.SQL : Data Definition Language (DDL), Data Manipulation Language (DML), Data ControlLanguage (CDL) Commands. Database objects like- Views, indexes, sequences, synonyms, datadictionary, Embedded SQL,
QBEQuery Processing and Optimisation, Centralised and Distributed Database, Security, Concurrency and Recovery in Centralised and Distributed Database Systems, Object OrientedDatabase Management Systems – Concepts, Composite objects, Integration with RDBMSapplications
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5. Data Structures and Algorithms

Data, Information. Definition of data structure, Arrays, stacks, queues,
linked lists, trees, graphs, priority queues and heaps.File Structures : Fields, records and files. Sequential, direct, index-sequential and relativefiles. Hashing, inverted list and multi-lists, B-trees and B+ trees.Graphs : Definition, walks, paths, connected graphs, regular and bipartite graphs, cycles andcircuits. Tree and rooted tree, Spanning trees, Eccentricity of a vertex radius and diameter ofa graph, Hamiltonian and Eulerian graphs. Planar graphs.Sorting and Searching Algorithms, Analysis of Algorithms, Interpolation and Binary Search.Asymptotic notations - big oh. omega and theta. Average case analysis of simple programslike finding of a maximum of n elements. Recursion. Quick sort.Design of Algorithms (Divide and Conquer. Greedy method. Dynamic programming. Backtracking. Branch and Bound).

6. Data Communication and Computer Networks

Data Communication : Analog and Digital transmission. Asynchronous and Synchronoustransmission. Transmission media. Multiplexing and Concentration, Switching techniques.Polling. Channel capacity. Transmission media - twisted pair, coaxial cables, fibre-opticcables, wireless transmission- radio, microwave and infrared waves. Light wavetransmission. Telephones - local loop, trunks, multiplexing, switching, narrowband
ISDN,broadband ISDN. ATM, High speed LANs. Cellular Radio, Communication sa

tellites-geosynchronous and low-orbit.Reference Models : The OSI model, TCP/IP model.Topologies, Networking Devices. Protocols for - (i) Data link layer (ii) Network layer, and(iii) Transport layer, TCP/IP protocols, Networks security, Network administration.Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks(WAN). Wireless Networks, Inter
Networks.Internetworking : Switch/Hub. Bridge. Router. Gateways. Concentrated virtual circuit s.Tunnelling, Fragmentation. Firewalls.
Routing : Virtual circuits and datagrams. Routing Algorithms. Congestion control.Network Security : Cryptography - public key, secret key, Domain Name System (DNS) -
ElectronicMail and World Wide Web {WWW). The DNS, Resource Records. Name servers. E-mail architecture and E-mail Servers.

7. System software and Compilers

.Assembly language fundamentals (8085 and 8088 based assembly language progra mming). Assemblers - 2-pass and single-pass. Macros and macro
processors.Loading, linking, relocation, program relocatability. Linkage editing.Text editors, Programming Environments. Debuggers and program generators.Compilation and Interpretation. Bootstrapping. Phases of compilation. Lexical analysis. LEX.Context free grammars. Parsing
and parse trees. Representation of parse trees and rightmost andleftmost derivations, Bottom up parsers - shift-reduce. operator precedence and LR. YACC.Top down parsers - left recursion and its removal. Recursive descent parser. Predictive parser.Intermediate codes - Quadruples, Triples. Indirect Triples. Intermediate code generation, Codegeneration, Code optimization.

8. Operating Systems

Main functions
of
operating systems. Multiprogramming, multiprocessing and multitasking.Memory management ; Virtual memory, paging, fragmentation.Concurrent processing : Mutual exclusion. Critical regions, lock and unlock.Scheduling : CPU scheduling. I/O Scheduling. Resource scheduling. Deadlock
and schedulingalgorithms. Banker's algorithm for deadlock handling.The Unix system : File system, process management. Bourne shell, shell variables, command lineprogramming.Systems Calls : Creat, open, close, read, write. Iseek, link, unlink, stat, fstat, umask, chmod, exec,fork, wait, system.

9. Software Engineering

System Development Life Cycle (SDLC) : Steps, Water fall model. Prototypes, Spiral model.Software Metrics ; Software Project Management.Software Design : System design. detailed design. function oriented design, object-oriented design,user interface design. Design level metrics.Coding and Testing : Testing level metrics. Software quality and reliability. Clean room approach,software engineering

10. Computer Graphics

Display systems. Input devices, 2D Geometry - .Algorithms for drawing primitives, clipping andwindowing, windows, view ports, Graphic operations for transformations ,
3D
Graphics. Animation,Graphics standard. Applications.Storage Devices, Input Tools. Authoring Tools, Application, Files.

11. Programming Language Theory

Programming language concepts, paradigms, models.Data. Data types, Operators, Expressions. Assignment. Flow of Control - Control structures, I/Ostructures. I/O statements, User-Defined and built-in functions. Parameter
passing.Principles, classes, inheritance, class hierarchies, polymorphism, dynamic binding, referencesemantics and their
implementation.Principles, functions, lists, types and polymorphism, higher order fun ctions, lazy evaluation, equations and pattern matching.Principles, horn clauses and their execution, logical variables, relations, data structures, controllingthe search order, program development in Prolog, implementation of Prolog, example programs inProlog.

12. Current Trends and Technologies

The topics of current interest in Computer Science and Computer Applications shall be covered. Theexperts shall use their judgement from time to time to include the topics of popular interest which areexpected to be known by an ardent follower of the field. Currently, they include :

Parallel computing

Parallel virtual Machine (PVM) and message passing interface (MPI) libraries
and calls. Advancedarchitectures. Today's fastest computers

Mobile Computing

Mobile connectivity - Cells. Framework, wireless delivery technology and switching methods, mobileinformation access devices, mobile data internetworking standards, cellular data communicationprotocols, mobile computing applications. Mobile databases - protocols, scope, tools and technology.

E-Technologies

Electronic Commerce : Framework, Media convergence of Applications, Consumer Applications,Organisation applications.Electronic Payment Systems : Digital Token, Smart Cards, Credit Cards. Risks in Electronic PaymentSystem, Designing Electronic Payment Systems.Electronic Data Interchange (EDI) : Concepts, Applications, (Legal, Security and Privacy) issues.EDI and Electronic Commerce. Standardisation and EDI. EDI Software Implementation. EDIEnvelope for Message Transport, internet-based EDI.Data Warehousing : Data Warehouse environment, architecture of a data warehouse methodology,analysis, design, construction and administration.Data Mining : Extracting models and patterns from large databases, data mining techniques,classification, regression, clustering, summarization, dependency modelling, link analysis, sequencing analysis, mining scientific and business data.Principles of parallelism, co routines, communication and execution, Parallel Virtual Machine (PVM)and Message Passing Interface (MPI) routines and calls. Parallel programs in PVM paradigm as wellas MPl paradigm for simple problems like matrix multiplication