

UNIVERSITY OF MUMBAI



Syllabus of Bridge Course for M.Sc. Computer Science (CBGS)

(Effect from the academic year 2013–2014)

COURSE CODE: (PSBCCS1)
COURSE I
FUNDAMENTALS OF COMPUTER SCIENCE – I
[ALGORITHMS, PROGRAMMING USING C, OOP USING JAVA]
NUMBER OF CREDITS: 6

UNIT I

Introduction to Algorithms and fundamentals of C

- (a) **Fundamentals of algorithms:** Notion of an algorithm. Pseudo-code conventions like assignment statements and basic control structures.
- (b) **Algorithmic problems:** Develop fundamental algorithms for (i) Exchange the values of two variables with and without temporary variable, (ii) Counting positive numbers from a set of integers, (iii) Summation of set of numbers, (iv) Reversing the digits of an integer, (v) Find smallest positive divisor of an integer other than 1, (vi) Find G.C.D. and L.C.M. of two as well as three positive integers, (vii) Generating prime numbers.
- (c) **Analysis of algorithms:** Running time of an algorithm, worst and average case analysis.
- (d) **Different approaches in programming:** Procedural approach, Object Oriented approach, Event Driven approach.
- (e) **Structure of C:** Header and body, Use of comments, Compilation of a program.
- (f) **Data Concepts:** Variables, Constants, data types like: int, float char, double and void.
Qualifiers: short and long size qualifiers, signed and unsigned qualifiers. Declaring variables, Scope of the variables according to block, Hierarchy of data types.

UNIT II

C programming

- (a) **Types of operators:** Arithmetic, Relational, Logical, Compound Assignment, Increment and decrement, Conditional or ternary, Bitwise and Comma operators. Precedence and order of evaluation. Statements and Expressions.
- (b) **Type conversions:** Automatic and Explicit type conversion.
- (c) **Data Input and Output functions:** Formatted I/O: printf(), scanf(). Character I/O format: getchar(), putchar().
- (d) **Iterations:** Control statements for decision making: (i) Branching: if statement, else... if statement, switch statement. (ii) Looping: while loop, do.. while, for loop. (iii) Jump statements: break, continue and goto.
- (e) **Arrays:** (One and multidimensional), declaring array variables, initialization of arrays, accessing array elements.
- (f) **Strings:** Declaring and initializing String variables, Character and string handling functions.
- (g) **Sorting Algorithms:** Bubble, Selection, Insertion and Merge sort, Efficiency of algorithms, Implement using C.

UNIT III

Concept of OOP and Introduction to Java

- (a) **Concept of OOP:** Procedure Oriented Programming, Object Oriented Programming (OOP), Basic Concept of OOP, Benefits of OOP.
- (b) **Introduction to JAVA:** History of Java, Java features, different types of Java programs, Differentiate Java with C. JVM, JIT and JRE.

- (c) **Java Basics:** Variables and data types, declaring variables, literals: numeric, Boolean, character and string literals, keywords, type conversion and casting. Standard default values.
- (d) **Java Operators:** Arithmetic, relational, logical, assignment, increment and decrement, conditional, bitwise, precedence and order of evaluation, statement and expressions, string arithmetic.
- (e) **Loops and Controls:** Control statements for decision making: select statements (if statement, if ...else... statement, if ... else ... if ...statement, switch statement), looping (while loop, do ... while loop and for loop), nested loops, breaking out of loops(break and continue statements), labeled loops.
- (f) **Arrays and Strings:** one and two-dimensional array, creating an array.

UNIT IV

Classes, Inheritance, Interface and Packages

- (a) **Introduction to Classes:** Defining a class, creating instance and class members, creating object of a class, accessing instance variables of a class, creating methods, naming methods of a class, accessing methods of a class, constructor, parameterized constructor, 'this' keyword, garbage collection, finalize() method, methods overloading, constructor overloading, nested and inner classes, static member.
- (b) **Visibility control:** public access, friendly access, protected access, private access, private protected access.
- (c) **Inheritance:** Various types of inheritance, super and subclasses, keywords- 'extends', 'super', constructor chaining, method overriding, final variables and methods, final classes, abstract method and classes.
- (d) **Interface:** Defining interfaces, extending interfaces, implementing interfaces
- (e) **Packages:** Using system package, naming conventions, creating packages, accessing a package, using a package, adding a class to a package
- (f) **Applets:** Difference of applet and application, creating applets, applet life cycle, passing parameters to applets.
- (g) **Graphics, Fonts and Color:** The graphics class, painting, repainting and updating an applet, sizing graphics. Font class, draw graphical figures - lines and rectangle, circle and ellipse, drawing arcs. Working with Colors: Color methods, setting the paint mode.

References:

1. Introduction to Algorithms (Second Edition): Cormen, Leiserson, Rivest, Stein PHI
2. Data Structures (Schaum's outline series in computers): Seymour Lipschutz McGraw-Hill book Company.
3. Programming in ANSI C (Third Edition) : E Balagurusamy, TMH.
4. Java2: The Complete Reference – Tata McGraw Hill, Fifth edition
5. Programming with JavaA primer, by E. Balagurusamy 3rd Edition

Additional References:

1. Fundamental Algorithms (Art of Computer Programming Vol 1): Knuth , Narosa Publishing House.
2. Algorithms in C (Third Edition): Robert Sedgewick , Pearson Education Asia.
3. Let us C by Yashwant Kanetkar, BPB.
4. Programming in ANSI C by Ram Kumar, Rakesh Agrawal, TMH.
5. Unix and C : M.P. Bhawe and S.A. Pateker, Nandu printers and publishers private limited.
6. Programming in Java, Schaum Series.
7. Java2 Programming – Black Book,Dreamtech Press.

COURSE CODE: (PSBCCS2)

**COURSE II
FUNDAMENTALS OF COMPUTER SCIENCE – II
[OPERATING SYSTEM, NETWORKING, DATABASE MANAGEMENT SYSTEMS
AND SOFTWARE ENGINEERING]**

NUMBER OF CREDITS: 6

**UNIT I
OPERATING SYSTEM**

- (a) Introduction:** Overview of Operating System, Evolution of Operating System, Different types of operating systems, Understanding Multiprogramming, Multiprocessing and Multitasking, Operating System for Multiprocessor Systems and Distributed Systems, Operating System for Client Server & Peer-to-Peer Systems, Clustered Systems, Real time Operating System.
- (b) Components of Operating System:** Process Management, Main memory Management, Secondary storage Management, File Management, I/O Management. Operating System Services, Command Interpreter, Interface between user and Operating System. Introduction to System calls: Types of system calls.
- (c) Process Management:** Introduction to Process. Process states: two state and five state model, processes & resources, concurrent processes, process description, process control block and its role, Direct & indirect communication, message passing, synchronization, buffering. Threads, single & multithreaded processes, Process scheduling, scheduler and its types, switching, process synchronization, Critical Section Problem, Mutual Exclusion, Semaphores, Binary semaphores, monitors.
- (d) Memory management:** Memory Management and its need, swapping technique, Contiguous memory allocation. Paging and Segmentation, Introduction to Virtual memory, Demand paging technique.
- (e) File System:** File Concept: attributes, operations, types, structure. File access methods, Different directory structure, File system structures, File system implementations, Allocation methods, Free space management.

UNIT II NETWORKING

- (a) **Introduction:** Data Communication, Networks, Internet, Intranet, Protocols, OSI & TCP/IP Models, Addressing. Physical Layer – Signals, Analog, Digital, Analog VS Digital, Transmission Impairment, Data Rate Limits, Performance, Introduction to Multiplexing and FDM.
- (b) **Switching** – Switching, Circuit-Switched Networks, Datagram networks.
- (c) **Data Link Layer** – Error correction & detection, Types of errors, Detection VS Correction, Block Coding.
- (d) **Multiple Access** – Random (CSMA), Controlled (Reservation, Polling, Token Passing).
- (e) **Wired LAN** – LLC, MAC, Ethernet, Connecting Devices – Repeaters, Hubs, Bridges, Two & Three layer Switches, Routers, Gateways, Backbone networks.
- (f) **Network Layer** – Logical addressing, IPv4 Addresses, Classful addresses, IPv6 Addressing Internetworking, Address Resolution protocol, Introduction to routing.
- (g) **Transport Layer** - Process to process delivery, Role of UDP & TCP.

UNIT III DATABASE MANAGEMENT SYSTEMS

- (a) **Overview:** Overview of database management system, limitations of data processing environment, database approach, data independence, three level of abstraction, DBMS structure.
- (b) **Entity Relation Model:** Entity, attributes, keys, relations, cardinality, participation, weak entities, ER diagram, Generalization, Specialization and aggregation, conceptual design with ER model, entity versus attribute, entity versus relationship, binary versus ternary relationship, aggregate versus ternary relationship.
- (c) **Relational Structure:** Introduction to relational model, integrity constraints over relations.
- (d) **Schema refinement and Normal forms:** Functional dependencies, first, second, third, and BCNF normal forms based on primary keys, lossless join decomposition.
- (e) **Decomposition:** Functional dependency, Closure of a set of functional dependency, Lossless-Join decomposition, Multi valued dependency and fourth normal form, Join dependency, Fifth normal form.
- (f) **Concurrency Control:** Concept of a transaction, ACID properties, Serial and serializable schedules, Conflict and View serializability, Precedence graphs and test for conflict serializability.
- (g) **Enforcing serializability by locks:** Concept of locks, the locking scheduler, Two phase Locking, upgrading and down grading locks, Concept of dead locks, Concurrency control by time stamps, The Thomas Write rule.

UNIT IV

SOFTWARE ENGINEERING

- (a) What is software? Types of software, Software Quality factors, what is software engineering? Introduction to Soft Eng & its objectives, The general systems approach to problem solving. The three approaches to software systems development - The Structured approach, the Object Oriented Approach and the Information Engineering Approach.
- (b) **Software Process:** SDLC -Requirement Analysis, Software design, coding, testing, maintenance etc.
- (c) **Software Development Life Cycle Models** - Waterfall Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Component Based Model, Their features, strengths, weaknesses and differences between them, Fourth Generation Techniques.
- (d) Project Management Process, Role of metrics & models in project management.
- (e) **Project Feasibility Study** - Operational, Technical, Economic, Organizational and Cultural feasibility. Defining project costs and project benefits. Cost/Benefit Analysis for a project

References:

1. Operating System Concepts, 6e, Silberschatz, Galvin and Gagne, Wiley.
2. Operating Systems 5th Edition, William Stallings
3. Data Communication & Networking; Forouzan– IV Edition; Tata McGraw-Hill.
4. Computer Networks (4th Edition) - Andrew Tanenbaum.
5. Networking Complete by Sybex Inc. and Sybex Inc.
6. Database Management Systems- Ramakrishnam, Gehrke , McGraw- Hill.
7. Introduction to database Systems, C.J.Date, Longman, *Pearson Education*.
8. Software Engineering- A Practitioner's Approach, 7th Edition, McGraw Hill Int.
9. Software Testing – Concepts & Practices, Narosa.
10. Integrated Approach to Software Engineering - Pankaj Jalote (Narosa)

Additional References -

1. Operating Systems - Nutt, Gary J. Addison-Wesley.
2. Operating Systems - Deitel, Harvey M., Deitel, Paul J., Choffnes, David R. Prentice Hall.
3. Operating Systems A Systematic View- Davis, William S., Rajkumar, T. M. Addison-Wesley.
4. Computer Networks and Internets (5th Edition) - Douglas Comer.
5. Computer Networks : A Top down Approach - Forouzan, Behrouz A., Mosharraf, Firouz. McGraw-Hill Higher Education.
6. Computer Networks : A Systems Approach - Peterson, Larry L., Davie, Bruce S. Elsevier Science & Technology Books.
7. Fundamentals of Database Systems, Elmasri and Navathe, Pearson Education.
8. Database Systems, Design, Implementation and Management, Peter Rob and Coronel, Thomson Learning.
9. Software Engineering: Waman Jawadekar, TMH.
10. Software Engineering: Sommerville, VIIIth Edition, Pearson Education.