

# **SHIVAJI UNIVERSITY, KOLHAPUR.**



**\*\*\*\*\* B+  
Accredited By NAAC**

**New Syllabus For  
M.Sc. Computer Science  
Part - I (Sem. I & II )**

**Syllabus to be implemented from June 2010 onwards.**



**M.Sc Computer Science (Regular)**  
**Semester -I**  
**Paper-MSc1.1: Computer Organization & Architecture**

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**Unit-1: Computer Organization: (15)**

Basic structure of computer, its units, generations, Memory organization, CPU, Input Devices, Output Devices, Language Translators- assembler, interpreter and compiler.

**Number System:**

Number conversion from one number system to another for integers and fractions, Number systems – binary, octal, decimal and hexadecimal. Two's complement, addition/subtraction of numbers in twos complement. Binary codes.

**Unit-2: Digital Logic Circuits (15)**

Various logic gates, Boolean algebra, truth table, solution of Boolean equation, solution using K-map, various flip-flops, excitation table, combinational and sequential circuits

**Basic Computer Organization and Design:** Addressing Modes, Instruction Codes/format, Computer Registers, Computer Instructions, Instruction cycle, Memory Reference Instructions, Input-Output instructions and Interrupts, Design of basic computer.

**Unit-3: Digital Components (15)**

Decoders, Multiplexers, Registers, Shift Registers, Binary Counters

**Micro programmed Control:** Control Memory, Address sequencing, Microprogram example, Design of control unit

**Unit-4: Central Processing Unit (15)**

CPU-General register organization, stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation , Program Control, CISC and RISC Characteristics

**References:-**

1. Mano M.M. Computer System Architecture, PHI Publication.
2. Rajaraman V. Fundamentals of Computers.
3. William Stallings, Computer Organisation & Architecture, Maxwell, Macmillan.
4. V.Carl Hamacher, Zvonko G. Vranesic, Sajwat G. Zaky, Computer Organisation, McGrawHill Publication.
5. P.Pal Choudhari, Computer Organisation & Design, Prentice Hall of India
6. George W. Gorshine, Computer Organisation, BHI.
7. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organisation, McGraw Hill.



**MSc Computer Science (Regular)**  
**Semester -I**  
**Paper-MSc1.2: Object Oriented Software Engineering**

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**Unit-I** **(15)**

Software Engineering – Definition, Principles of SE, Generic View of SE, Characteristics of Software, Mc Call’s Quality Factors, SDLC, Classical , Waterfall Model, Spiral Model, prototyping approach, 4GL approach., System Analysis, Role of System Analyst, Requirement anticipation, investigation and specification.

**Unit-II** **(15)**

Feasibility study, Fact finding techniques, user transaction and design requirements, system requirement specifications, software requirement and analysis, decision trees, decision tables, DFD, Data dictionary, Input output design, structured chart, modules specification, implementation, testing, maintenance, software reverse engineering, software Re-engineering , Case study.

**Unit-III :** **(15)**

Object orientated concepts , class, object, Polymorphism, Inheritance.  
Object oriented system development – function /data methods, object oriented – analysis, construction, testing. Identifying the elements of an object model- classes and objects, indicating attributes and operations.  
Introduction to UML, uses of UML, phases of system development, Overview of UML- views, diagrams, Model elements, Modeling, Basic structure modeling - Classes, Objects and their relationships, Relationships between classes – associations, Generalization, aggregation, dependency and abstraction.

**Unit-IV :** **(15)**

UML Extensions – Stereo type, Constraints etc. Drawing UML diagrams- .Use case diagram ,Class diagram ,Object diagram,. State diagram,. Sequence diagram,. Collaboration Diagram, Activity diagram, Component diagram, Deployment diagram, case studies.

**Reference Books-**

1. Software Engineering By Pressman
2. The Unified Modeling Language User Guide by Grady Booch , James Raumbaugh and Ivar Jacobson.
3. Object Oriented Software Engineering By Ivar Jacobson
4. Applying UML and Patterns By Craig Larman
5. UML toolkit 2 by Errikson



**MSc Computer Science (Regular)**  
**Semester -I**  
**Paper-MSc1.3: Data and File Structure**

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**UNIT 1. Sorting and searching (15)**

Sorting algorithms and complexity comparison: Exchange, Insertion, Selection, merge, radix, heap, quick sort, shell sort.

Searching algorithms : Linear and Binary search. Complexity analysis of algorithms

**UNIT 2. Linear Data structures : (15)**

Abstract data types, Array as a Data structure, Implementations of Data structure Arrays, Stack, Definition, Operations on stack, Application of stack-Recursion, expression solving (infix, prefix, and postfix expression), Definition of queue, Operation on queue, Types of queue-Linear, Circular, Implementation of Linear and Circular queue, Priority queue, Application of queue. Concept of linked list, Implementation of Linked list, Operation on list, Operation on circular linked list, Doubly linked list, Implementation of stack and queue using linked list.

**UNIT 3. Non Linear Data structures (15)**

Tree Terminology, Representation of binary tree, Tree Traversal- (Preorder, inorder, postorder),

Implementation of binary search tree (insertion, deletion, traversal) , threaded binary search tree, Height balanced tree, B-tree, B+ tree, m-way search tree, trie tree, Huffman tree.

Hashing, techniques and functions, collision resolution techniques.

**UNIT 4. Graph and Design and Analysis of Algorithms: (15)**

Graph terminologies, representation of graph, Depth first, Breadth first traversal, topological sort , shortest path method (Dijkstra's method), minimum spanning (Kruskal Algorithm, Prim's algorithm) .

Greedy method, Divide and Conquer, dynamic programming, Backtracking.

Traveling salesman problem, Euler's graph, seven bridge problem.

***Reference Book-***

1. Data Structure using C and C++ by A.M. Tanenbaum, Yecidyan lang
2. Data Structure Through C- By Dr. Sahani.
3. Data Structures using C & C++ By Rajesh K. Shukla ( Wiley India Publications)
4. Classic Data structures By D. Samanta (PHI)
5. Computer Algorithms – By Horowitz Sahani



## MSc Computer Science (Regular)

### Semester -I

#### Paper-MSc1.4: Advanced Database Concepts

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#### Unit –I

(15)

Introduction to RDBMS -Concept and architecture of DBMS and RDBMS , data models, Instances and Schemas, Relational model Concept ,Relational Algebra and Tuple and Domain Calculus, data base System,VS file System, Relational database design Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes , Index data Structures , Hash Based Indexing, Tree base Indexing, Comparison of File Organizations , Indexes and Performance Tuning, Intuitions for tree Indexes , Indexed Sequential Access Methods, B+ Trees , A Dynamic Index Structure ,the Query Processor

#### Unit –II

(15)

Relational Databases Design - Problems Caused by redundancy, Decompositions, Problem related to decomposition, reasoning about Functional Dependencies, FIRST, SECOND, THIRD Normal forms , BCNF , Lossless join Decomposition , Dependency preserving Decomposition, Schema refinement in Data base Design , Multi valued Dependencies FORTH and FIFTH Normal Form. Denormalization.ER Models – Beyond ER Design Entities, Attributes and Entity sets , Relationships and Relationship sets , Additional features of ER Model , Concept Design with the ER Model , Conceptual Design for Large enterprises.

#### Unit-III

(15)

Introduction to SQL-set operation, SQL operators, aggregate function , Introduction to Nested Queries ,Correlated Nested Queries Set, Complex Integrity Constraints in SQL, Triggers and Active Data bases. Introduction to PL/SQL, Environment & Benefits of PL/SQL, Declaring Variable,Block Structure-Block Executing Statements, Block Types, Handling Variables, Scalar Data Types, Writing Executable statement, Identifiers , Dynamic data type declarations like - %Type, %Row type, user defined record, Control statements -IF..ELSE statement, FOR LOOP, WHILE LOOP, Interacting with the oracle server, SQL Cursor, SQL Cursor Attributes - %FOUND, %NOTFOUND, Cursor Types-Implicit, Explicit, cursor handling OPEN, CLOSE, FETCH cursors. Creating function, Executing Functions, Error handling in PL/SQL

**Unit- IV****(15)**

Transaction Management and Concurrency Control- Transaction State, Implementation of ACID Properties, Concurrent, Executions, Serializability, Recoverability, Implementation of Isolation, Lock Based Protocols, Timestamp Based Protocols, Multiple Granularity, Recovery and Atomicity, Log , Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with loss of nonvolatile storage-Advance Recovery systems, Remote Backup systems, Backup Methods Function and Purpose of logical Backup and Recovery, Online vs. Offline Backups, Model based development- ODBC classes and ORDBMS, debugging, object oriented tool for building database application, Introduction to data warehousing, OLAP and data mining

**References:**

1. Database System Concepts, Silberschatz, Korth, McGraw hill, V edition
2. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill
3. Data base System Concepts, Silberschatz, Korth, McGraw hill, V edition
4. Structured Query Language(SQL) by Osborne MC-Graw Hill
5. Oracle 9i oracle press
6. SQL and PL/SQL programming by Ivan Bay Ross



**MSc Computer Science (Regular)**  
**Semester -I**  
**Paper-MSc Lab I- Laboratory course**  
**(based on Paper-MSc1.3: Data and File Structure)**

Based on unit I, II , III and graphs of unit IV of **Paper-MSc1.3 Data and File Structure**



**MSc Computer Science (Regular)**  
**Semester -I**  
**Paper-MSc Lab II- Laboratory course**  
**(based on Paper-MSc1.4: Advanced Database Concepts)**

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**Assignments**

Assignments should be based on unit III of **Advanced Database Concepts**





**MSc Computer Science (Regular)**  
**Semester -II**  
**Paper-MSc2.1: Data Communication and Networks**

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**Unit I** **(15)**

**Introduction to Computer Networks:** Use of Computer networks, network hardware(LAN,MAN,WAN,wireless n/w, home n/w,internetworks), Network software(protocol hierarchies, design issues for the layers, connection oriented and connectionless services), Reference models- OSI,TCP/IP , comparison OSI and TCP/IP, **Physical Layer:** Guided transmission media, public switched telephone network( structure of telephone system,local loop(Modem, ADSL, wireless) FDM,TDM,WDM, Switching( circuit, message, packet).

**Unit II** **(15)**

**Data link layer :** Design issues, error detection and correction , simplex stop and wait protocol, protocol for noisy channel, sliding window protocol, HDLC, Data link layer in the internet.

**Medium Access Control Sublayer:** channel allocation problems, multiple access protocol ( ALOHA, CSMA, Collision free protocols, limited contention protocols, wireless LAN protocols), Ethernet( Ethernet cabling, Manchester encoding, Ethernet MAC sublayer protocol) IEEE 802.2, 802.3,802.4,802.5, wireless LAN IEEE 802.11(physical layer , protocol stack), Bluetooth architecture.

**Unit III** **(15)**

**Network layer:** Design issues, store and forward packet switching, implementation of connection oriented and connectionless service, comparison of virtual and datagram circuit. Routing algorithm( optimality principle, shortest path routing , flooding, distance vector,link state) congestion control- prevention policies, in virtual and datagram subnets, load shedding , jitter control. Internet working ( concatenated virtual circuit, connectionless internet working, tunneling, fragmentation)

**Transport Layer:** Transport services, IP protocol, IP addresses, IPV4,IPV6, Internet Transport protocol(UDP, RPC, RTTP) TCP( TCP service model, TCP protocol, TCP segment Header, TCP connection establishment , TCP connection release) Berkeley sockets, Unix sockets.

**Unit IV :** **(15)**

**Application layer :** Reserved ports, DNS,E-Mail,WWW, HTTP, SMTP,FTP.

**Network security :** cryptography, Symmetric key algorithm, (DES, cipher modes) cryptanalysis, digital signature,(symmetric key, public key signature, message digest, birthday attack)

**References :**

1. Tannenbaum A.S. -"Computer Networks" (Pearson - 4th Edition)
2. Block C. -"Computer Networks Protocols ,Standards and Interface"
3. Stalling A.S. -"Computer Networks" (PHI-93 4th ed.)
4. Data Communications and Networking - Behrouz A. Forouzan.
5. Steven W.R. - "UNIX Network Programming" (PHI-94)



**Unit - I** **(15)**

Introduction to the theory of computation: Symbol, alphabet, sets, relations and functions, strings and languages. Finite state machines: Finite automata definition & description, transition system, DFA, NFA, equivalence of DFA and NFA, finite automata with outputs, Moore machine, Melay machine, equivalence between Moore and Melay machines.

**Unit – II** **(15)**

Regular expressions and regular grammars: Regular expressions, equivalence of regular expressions and FA. Regular sets and properties: Pumping lemma for regular sets, closure properties of regular sets.

**Unit - III** **(15)**

Context free languages: Introduction, context free grammars, derivation trees, leftmost and rightmost derivations, ambiguity in CFG, simplification of CFG, normal forms-Chomsky normal form CNF, Greibach normal form GNF

**Unit - IV** **(15)**

Pushdown automata: Definition of PDA, deterministic PDA, nondeterministic PDA, the pumping lemma for CFL's, closure properties of CFL's, A context-Free Grammar corresponding to a given context free grammar, Turing machines: Turing machine model, representation of TM, design of TM, types of TM, Universal Turing machine.

Reference:

- 1) Hopcroft, J., and Ullman, J., *Introduction to Automata Theory, Languages and Computation*, Addison-Wesley,
- 2) Introduction to Languages and the theory of Computation  
John C. Martin, Tata McGraw-Hill-Edition
- 3) Introduction to Formal Languages, Automata theory and Computation  
Kamala Krithivasan, Rama R. Pearson Education
- 4) Theory of Computer Science – K.L.P. Mishra, N. Chandra Sekaran, PHI



**MSc Computer Science (Regular)**  
**Semester -II**  
**Paper-MSc2.3: Unix internals**

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**Unit-1** (15)  
Introduction to open source software , History of Linux ,Linux Architecture ,shell types, keranl architecture ,system concept ,buffer cache ,buffer header structure of buffer port getblock, reading and writing Disk block, advantages and disadvantages of disk block

**Unit-2** (15)  
Unix file system layout, Internal representation of files, structure of inode, accessing and releasing inodes, structure of regular files, directories, namei algorithm, super block (ialloc algorithm, ifree alloc algorithm), System calls: open, read, write, seek create, close, mknod, chdir, cdown, Pipes: Names unnamed pipe, DUP, mounting, unmounting, link, unlink Process, process states and transition, context of a process, context switch, sleep, wake up fork, signals, booting process(init), mice

**Unit-3** (15)  
Memory management (swapping allocation of swap space, fork swap, expansion swap, swapper algorithm, demand paging, I/O sub system, open, close. File listing, ownership and access permissions, file and directory types, managing files, user and its home directory, booting and shutting down (LILO GRUB), user administration adding, deleting, disabling users

**Unit-4** (15)  
Basic unix commands, banner, cal, date, calendar, who, tty, uname, password, lock, echo, tput, bc etc. Basic file attributes, Navigating the file system, Handling ordinary files. The Vi-editor, Simple filters (pr, head, tail, cut, paste, sort, uniq, nl, tr.), Regular expression and gerp (grep, egrep, fgrep), The process (sh, ps, kill, nice, at and batch), Shell programming.

**References :**

Maurice Bach, Design of UNIX Operationg System (PHI - 94).  
Unix Concepts and Applications : Sumitbha Das  
Banerjee R. Architecture and conceptual design of the UNIX system  
Kanetkar Yashwant ., UNIX Shell Programming  
Kernighan and Pike, The UNIX Programming Environment  
Morgan and Mcbiton, Introduction to UNIX system (McGrawHill - 87).  
Rebecca Thomas, Rogers and Yates, Advanced Programmer's Guide to UNIX



**MSc Computer Science (Regular)**  
**Semester -II**  
**Paper-MSc2.4: Advanced Java Programming**

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**Unit 1 :** (15)  
**Windows based applications in Java.** Building GUI using AWT and Swing. Light weight and heavy weight components. Components, containers and top-level windows. Layout

managers. Various components for GUI. Working with menus and menu bars, working with dialog boxes, AWT frames. Event handling mechanism, Delegation event model, various events, event listener interfaces, adapter classes, anonymous inner classes. Pluggable look and feel, layered panes, tabbed panes, editor panes, split panes, scroll panes, JTree, JTable, JColorChooser, JFileChooser, BorderLayout manager, Overlay layout manager, Model View Controller (MVC) architecture.

**Unit 2 :**

(15)

**Server-side Java : RMI, Servlet and JSP.** Introduction to JDBC. Classification of JDBC drivers. Java.sql package, Driver, DriverManager, Connection, Statement, PreparedStatement, CallableStatement, ResultSet and ResultSetMetadata classes. Execution of stored procedures Connection to MS-Access, Oracle, SQL Server and MySQL databases. Introduction to RMI. RMI architecture. Developing a client-server application using RMI. Introduction to Servlets. Life cycle of a servlet. Servlet API, javax.servlet and javax.servlet.http packages, using cookies, session tracking, security issues. Structure and execution of a JSP page. JSP tags, writing scriptlet JSPs, JSTL, custom tags, Web application architecture, deployment of web application, WAR files, popular JSP servers, various services provided by the container, deployment descriptors, MVC architecture using controller servlet.

**Unit 3 :**

(15)

**Enterprise Application Development using Java :** Introduction to distributed computing. Two-tier and three-tier architecture. Introduction to Java Beans. Introspection, Java Bean API, design patterns, bound and constrained properties, property descriptors, property editors, bean customization, deploying beans in JAR files, manifest, signing JAR files, BDK folder structure, testing Java Beans using BDK

**Unit 4 :**

(15)

**Introduction to EJBs :** Architecture of EJB. EJB's role in middle-tier. Locating resources using JNDI. Services offered by application server. Entity beans, stateless and stateful session beans, message driven beans, life-cycle and deployment descriptor for EJBs, security in EJB, EAR files, popular application servers. Brief overview of struts, hibernate and spring. Study of any one application server and IDE in detail.

**Text Book :**

1. Java Server Programming – Java EE5 (J2EE 1.5) Black Book. Kogent Solutions Inc.

**References:**

1. Core Java Vol II (Addison Wesley) Sun Press ISBN – 981 – 4058 – 50 – 5.
2. Java 2 Programming – Black Book by Steven Holzner, Dream Tech Publishers.
3. Orfalli – The essential Distributed Object Survival Guide



**MSc Computer Science (Regular)**  
**Semester -II**  
**Paper-MSc LabIII- Laboratory course**  
**(based on paper MSc. 2.4 Advanced Java Programming)**

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**Assignments**

1. Write a program in Java to simulate a moving text using Canvas using AWT.
2. Write a program in Java to simulate a traffic signal using AWT.'
3. Develop a calculator in Java for basic arithmetic operations using AWT.
4. Write a program in Java to display different images using CardLayout manager class.
5. Write a program in Java to brighten the image using PixelGrabber and MemoryImageSource classes present in java.awt.image package.
6. Write a multithreaded program in Java to display a clock in a frame window using AWT.
7. Write a program in Java to display the contents of a file in a TextArea control. Use an open dialog box to select a file.
8. Write a program in Java to display the contents of a table using JTable control using Swing.
9. Write a program in Java using swing to draw different shapes in different colors. The shape and color should be selected using a menu.
10. Write a program in Java to display the contents of a current folder hierarchically in a JTree control. Use recursion to read the contents of the current folder.

11. Write a program in Java to display the information of students belonging to the selected division in a TextArea control using stored procedure. Assume the following structure for a student table. Division should be selected using combo box control.  
Student(Rollno, Name, Division)
  12. Write a program in Java to display the structure of a selected table in a TextArea control using ResultSetMetaData class.
  13. Write a program in Java to display the marks of a student in a given subject using parameterized queries. Both the roll no. and the subject code should be selected using combo box control.  
Assume the following structure for the tables.  
Student(Rollno, Name, Division)  
Subject(SubCode, SubName)  
Marks\_Details(Examno, Rollno, SubCode, Marks)
  
  14. Design an RMI application where the server accepts an integer from the client, computes its factorial and sends the result back to the client.
  15. Design an RMI application which accepts employee data from a client and stores it in a file on the server. Implement necessary security requirements.
  16. Develop a servlet for displaying a message on a browser window. Test the servlet using both Tomcat server and JBoss server.
  17. Design a servlet which accepts registration information from an HTML file and stores it in a database. Perform the necessary validation.
  18. Design on-line book store using 2-tier architecture. The user should be able to place order for multiple copies of books. Add shopping cart facility using which user will be able to add and remove items and checkout.
  19. Design a J2EE application in MVC architecture using controller servlet, JSP pages and beans for movie ticket booking.
  20. Design a J2EE application in 3-tier architecture using stateless, stateful and entity beans for sales order processing.
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**MSc Computer Science (Regular)**  
**Semester -II**  
**Paper-MSc LabIV- Project and Viva**

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Equivalence subject for MSc (Computer Science) (Under Credit System)

Sr.No.	Old Subject	New Subject
<b>Semester-I</b>		
1	Computer Organization and Architecture	Computer Organization and Architecture
2	Advanced Database Concepts	Advanced Database Concepts
3	Object Oriented Data Structures	Data and File Structure
4	Theory of Computer Science	Theory of Computer Science (Sem-II)
5	Laboratory Course – Oracle	Lab II- Laboratory course
6	Laboratory Course – C++ and Data Structure	Lab I- Laboratory course
<b>Semester-II</b>		
7	Unix	Unix internals
8	Computer Networks	Data Communication and Networks
9	Operating System	<b>Two more chances should be given to old candidates</b>
10	Java Programming	Advanced Java Programming
11	Laboratory Course – Unix	<b>Two more chances should be given to old candidates</b>
12	Laboratory Course – Java	Lab III- Laboratory course

