



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Applications

### Name of the Program: M.Sc. in Computer Science

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teacher Assessment*	END SEM University Exam	Teacher Assessment*
MCA202	COMPULSORY	Computer Networks	3	0	0	3	60	20	20	0	0

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A – Quiz/Assignment/Attendance, MST - Mid Sem Test.

\***Teacher Assessment** shall be based on following components: Quiz/Assignment/Project/Participation in class (Given that no component shall be exceed 10 Marks)

#### Course Objectives:

- To develop an understanding basics of networking and modern network architecture.
- To introduce students various data link layer protocols and error detection and correction mechanism.
- To describe major concepts involved in local-area networks (LANs), and wireless LANs (WLANs).
- To provide knowledge about wide-area networks (WANs) and TCP/IP.
- To get introduce security features and mechanisms in networking.

#### Course Outcomes:

After completion of the course student would be able to:

- Know and apply basics of networking more efficiently, securely, easier to use, able to transmit several simultaneous messages, and able to interconnect with other networks.
- Define different protocols and analyze what errors might occur and how to control network errors.
- Define and differentiate among various types of LAN configurations and apply them to meet the changing and challenging networking needs of organizations.
- Get familiar with the concept of wide area networks and internet protocols.
- Analyze why networks need security and how to apply control mechanism of security.

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#### UNIT - I

Computer Network: Data Communication, Computer Network, Network Topologies, Layered Network Architecture-ISO-OSI Model, Transmission Media: Guided and Unguided, Telephone System, Multiplexing, Modem & Modem Types

#### UNIT – II

Contention Protocol: Stop-Go-Access Protocol, Carrier sense multiple access with collision detection

(CSMA-CD)

Framing – Flow and error control, Data Security and Integrity: Parity Checking Code, Cyclic redundancy checks (CRC), Hemming Code, Protocols for Noise less and Noise Channels, Concepts, Basic flow control, Sliding window protocol-Go-Back-N protocol and selective repeat protocol. Wired LAN, IEEE Standards: Standard Ethernet, Fast Ethernet, Gigabit Ethernet.

#### UNIT - III

Connecting LANs: Backbone Networks, Virtual LANs, Virtual-Circuit Networks: Architecture and Layers of Frame Relay and Introduction to ATM.

Token Ring : 802.5 IEEE standard, Token Bus : 802.4 IEEE standard, FDDI Protocol, DQDB Protocol, Inter-Networking, Layer 1 connections-Repeater, Hubs, Layer 2 connections-Bridges, Switches, Layer 3 connections-Routers, Gateways.

#### UNIT-IV

Wide Area Network: Introduction, Network routing, Routing Tables, Types of routing, Dijkstra's Algorithm, Open shortest path first, Flooding, Broadcasting, Multicasting, Congestion & Dead Lock, Quality of services (QoS) – Techniques to improve QoS.

Internet Protocols, Overview of TCP/IP, Transport protocols, Elements of Transport Protocol, Transmission control protocol (TCP), User data-gram protocol (UDP).

#### UNIT-V

Network Security: Cryptography – Symmetric key and Public Key algorithms - Digital Signature –Management of Public keys – Communication Security – Authentication Protocols.Virtual

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Terminal Protocol, Firewalls, Fire wall policies and rules, Common Problem with Packet Filtering. Overview of DNS- E-mail – FTP – WWW – HTTP – Multimedia. IP Management Protocol, SNMP: Agents and Managers, Organization, Object identifiers, problems.

#### Text Books:

1. Andrew S. Tanenbaum, “Computer Network”, 5<sup>th</sup> Edition, Pearson Education India, 2013
2. Behrouz A. Forouzan, “Data Communications and Networking” 5<sup>th</sup> Edition, TATA McGraw Hill, 2013

#### Reference Books:

1. Douglas E. Comer, “Internetworking with TCP/IP”, Pearson, 6<sup>th</sup> Edition, 2013
2. William Stallings, “Data and Computer Communications”, Pearson, 10<sup>th</sup> Edition, 2013

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MSCCS201	COMPULSORY	Database Management Systems	3	0	2	4	60	20	20	30	20

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#### Course Objectives:

- To provide students with basic concepts in information system and the benefits of these systems
- To provide the knowledge of systems definition, systems requirements and information needed by the decision maker
- To understand the role, requirement and operations that an analyst needed to analyze, design, and implement the systems
- To identify several methods to enhance and develop information systems and to manage the information system recourses
- To explain several ethical issues in information system
- To provide the knowledge of business data modeling for the designing of efficient information systems
- To explain the various issues related with Data Security.

#### Course Outcomes:

After completing this course the student will be able to:

- To differentiate between data, information, and knowledge
- Create, maintain and manipulate a relational database using SQL
- Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing an information system

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- Describe the characteristics of database transactions
- Understand the transaction processing system and functional area information system
- To design the efficient database system using normalization
- Define the information systems and differentiate information systems Identify the threats to information security and to protect information resources
- Analyze the basic concepts and architecture associated with DBMS
- To analyze any environment to determine their tables to construct database
- Information systems that support organization, management, Decision making
- To plan, acquire, and maintain information systems.

#### UNIT-I

**Introduction:** Introduction to Databases and Transactions, Purpose of Database System- Database System, Database system Vs file system, Database System concepts and architecture, Advantage of DBMS approach, various view of data, data independence, schema and subschema and instances, primary Database languages, Database administrator and users, data dictionary, Concepts of data models,

#### UNIT-II

**ER model:** basic concepts, notation for ER diagram, design issues, mapping constraint, Concepts of keys: super, candidate, primary, alternate, foreign, weak and strong entity sets, specialization and generalization, aggregation, inheritance, design of ER schema, reduction of ER schema to tables, reduction of ER diagrams to tables, extended ER model, relationships of higher degree.

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#### Unit III

**SQL:** Introduction, basic structure of SQL, Characteristics and Advantage of SQL set operations, aggregate functions, null values, SQL data types and literals. SQL operators, Types of SQL commands. Nested sub queries, derived relations, modification of Database, Aggregate functions. Insert, update and delete operations. Triggers in SQL.

**Views:** Introduction to views, data independence, security, updates on views, comparison between tables and views

#### Unit IV

**Transaction, concurrency and Recovery:** basic concepts, ACID properties, Transaction states, Implementation of atomicity and durability, concurrent executions.

**Relational Algebra:** concepts, domains, relations, kind of relations, relational database, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, The structure, relational algebra with extended operations, modifications of Database.

**Relational Calculus:** idea of relational calculus, tuple and domain calculus, Domain relational Calculus, calculus Vs algebra, computational capabilities.

#### UNIT-V

**Relational Database Design:** basic concepts and definitions, trivial and non-trivial dependencies,

**Normalization:** Introduction, non-loss decomposition, FD diagram, first, second, third Normal forms, dependency preservation, BCNF, multi valued dependencies and fourth normal form, Join dependency and fifth normal form. Codd's rules, Relational Schemas, Introduction to UML, Alternative approaches to database design.

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**Distributed Database:** Basic idea, distributed data storage, data replication, data fragmentation horizontal, vertical and mixed fragmentation.

#### List of Experiments:

1. To study Basic SQL commands (create database, create table, use, drop, insert) and execute the following queries using these commands:

- Create a database named 'Employee'.
- Use the database 'Employee' and create a table 'Emp' with attributes 'ename', 'ecity', 'salary', 'enumber', 'eaddress', 'deptname'.
- Create another table 'Company' with attributes 'cname', 'ccity', 'empnumber' in the database 'Employee'.

2 To study the viewing commands (select , update) and execute the following queries using these commands:

- Find the names of all employees who live in Delhi.
- Increase the salary of all employees by Rs. 5,000.
- Find the company names where the number of employees is greater than 10,000.
- Change the Company City to Gurgaon where the Company name is 'TCS'.

3. To study the commands to modify the structure of table (alter, delete) and execute the following queries using these commands:

- Add an attribute named ' Designation' to the table 'Emp'.
- Modify the table 'Emp', Change the datatype of 'salary' attribute to float.
- Drop the attribute 'deptname' from the table 'emp'.
- Delete the entries from the table ' Company' where the number of employees are less than 500.

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4. To use (and, or, in, not in, between, not between, like, not like) in compound conditions and execute the following queries using them:

- Find the names of all employees who live in 'Gurgaon' and whose salary is between Rs. 20,000 and Rs. 30,000.
- Find the names of all employees whose names begin with either letter 'A' or 'B'.
- Find the company names where the company city is 'Delhi' and the number of employees is not between 5000 and 10,000.
- Find the names of all companies that do not end with letter 'A'.

5. Using aggregate functions execute the following queries:

- Find the sum and average of salaries of all employees in computer science department.
- Find the number of all employees who live in Delhi.
- Find the maximum and the minimum salary in the HR department.

6. To execute the following queries using study the grouping commands (group by, order by)

List all employee names in descending order.

- Find number of employees in each department where number of employees is greater than 5.
- List all the department names where average salary of a department is Rs.10,000.

7. To write SQL queries

Alter table 'Emp' and make 'enumber' as the primary key.

- Alter table 'Company' and add the foreign key constraint.
- Add a check constraint in the table 'Emp' such that salary has the value between 0 and Rs.1,00,000.
- Alter table 'Company' and add unique constraint to column cname.
- Add a default constraint to column ccity of table company with the value 'Delhi'.

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- Rename the name of database to 'Employee1'.
- Rename the name of table 'Emp' to 'Emp1'.
- Change the name of the attribute 'ename' to 'empname'.

8. To execute following queries using appropriate

Retrieve the complete record of an employee and its company from both the table using joins.

- List all the employees working in the company 'TCS'.

9. To study the various set operations and execute the following queries using these commands:

- List the number of all employees who live in Delhi and whose company is in Gurgaon or if both conditions are true.
- List the number of all employees who live in Delhi but whose company is not in Gurgaon.

10. To study the various scalar functions and string functions ( power, square, substring, reverse, upper, lower, concatenation) and execute the following queries using these commands:

- Reverse the names of all employees.
- Change the names of company cities to uppercase.
- Concatenate name and city of the employee.

11. To study the commands for views and execute the following queries using these commands:

- Create a view having ename and ecity.
- In the above view change the ecity to 'Delhi' where ename is 'John'.
- Create a view having attributes from both the tables.
- Update the above view and increase the salary of all employees of IT department by Rs.1000.

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12. To study the commands involving indexes and executes the following queries:

- Create an index with attribute ename on the table employee.
- Create a composite index with attributes cname and ccity on table, company.
- Drop all indexes created on table,company.

#### Text Books:

1. A Silberschatz, H.F Korth, Sudersan, “Database System Concepts”, 6th Edition, MGH Publication 2013.
2. C.J. Date, “An introduction to Database Systems”, 6th Edition, Pearson 2003.
3. Elmasri & Navathe, “Fundamentals of Database systems”, 7<sup>th</sup> Edition, Pearson 2015.
4. B.C. Desai, “An introduction to Database systems”, BPB.
5. Raghu Ramakrishnan, “Database Management Systems”, 3<sup>rd</sup> Edition, TMH 2014.

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MSCCS202	COMPULSORY	Principles of Operating System	3	0	0	3	60	20	20	--	--

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#### Course Educational Objectives (CEOs):-

1. To provide knowledge of the underlying principles, techniques and approaches of designing an operating systems.
2. To provide the knowledge of inherent functionality and processing of program execution.
3. To emphasize on how the various elements that underlie operating system interact and provides services for execution of application software
4. To make the students aware with the different Operating Systems.

#### Course Outcomes (COs): After the completion of the course student will be able to

1. Understand the functions, structures and history of operating systems.
2. Understand the design issues associated with operating systems.
3. Understand and apply various process management concepts including scheduling, synchronization, deadlocks and multithreading.
4. Demonstrate the concepts of memory management including virtual memory.
5. Master system resources sharing among the users.
6. Apply the knowledge related to file system interface and implementation, disk management.
7. Be familiar with protection and security mechanisms.
8. Be familiar with various types of operating systems including Unix.

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MSCCS202	COMPULSORY	Principles of Operating System	3	0	0	3	60	20	20	--	--

9. Students will demonstrate knowledge of process control, threads, concurrency, memory management scheduling, I/O and files, distributed systems, security, networking.
10. Enumerate and explain the function of the common operating system kernel routines that are provided by an operating system.

#### UNIT - I

**Introduction:** Evolution of OS with the generations of computers. Goals, Objectives, Functions of Operating System, Types of operating systems: Batch Processing, Multitasking, Multithreading, Multiprogramming and Real time operating systems etc. Different views of the operating system, System Programmer's view, User's view, Operating System structure: Layered Operating Systems, Monolithic Systems.

#### UNIT – II

**CPU Scheduling: Processes:** The Process concept, the process control block, Operating system services for process management. Types of Schedulers, Scheduling Criteria. Scheduling Algorithms.

**Deadlocks:** Deadlock, Condition for deadlock, Deadlock Prevention, Deadlock detection, Deadlock avoidance, Deadlock Avoidance algorithms, Starvation, Banker's algorithm

#### UNIT – III

**Memory Management :** Memory management without swapping or paging, Concept benefits of Virtual memory, Concepts of swapping and paging, Fragmentation, Page replacement algorithms, Belady's anomaly and the category of Stack algorithms, Modeling paging algorithms, Design issues for paging system, Segmentation.

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**Disks:** Disk hardware, Disk I/O & Disk performance parameters and Disk scheduling policies (First come first serve, shortest seek time first, SCAN, C-SCAN, LOOK and C-LOOK algorithms)

#### UNIT - IV

**Concurrency and Synchronization:** The need for inter-process synchronization, Principles of concurrency, Process interaction, Requirement for Mutual Exclusion, Mutual Exclusion Software Applications, Decker's algorithms, Mutual Exclusion Hardware support, Semaphore, Classical problems in concurrent programming, Dining Philosopher's problem, Bounded Buffer Problem, Sleeping Barber Problem, Readers and Writers problem, Critical section, critical region and conditional critical region, Monitors and messages.

#### UNIT-V

**LINUX:** History & Features of Linux, Linux Architecture, File System of Linux, Hardware Requirements of Linux, Various flavors of Linux, Linux Standard Directories, Functions of Profile and Login Files in Linux, Linux Kernel.

#### Suggested Readings:

1. Deitel, H.M. "An Introduction to Operating Systems". Addison Wesley Publishing, 1984.
2. Milenkovic, M., "Operating Systems - concepts and Design" McGraw Hill International Edition- 1992.
3. Galvin P., J.L. Abraham Silberschatz. "Operating System Concepts". John Wiley & Sons, 1989.
4. Tanenbaum, A.S. "Modern Operating System", Prentice Hall of India Pvt. Ltd. 1995.
5. William Stallings "Operating Systems", Prentice Hall of India Pvt. Ltd.

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MSCCS203	Compulsory	Data Structures and Algorithms	3	0	2	4	60	20	20	30	20

#### [A] Course educational Objectives (CEOs):

- To develop the understanding among the students with the applications of Standard data structure in real world problems.
- To get a good understanding of applications of Data Structures.
- The analysis and evaluation of the data structure needs of particular problems;
- To provide knowledge of the fundamental design, analysis and implementation of data structures and algorithms;
- creation of new data structures.
- To familiarize the students with the analysis and design a particular problem.

#### [B] Course Outcomes(COs):Students should be able to

- Demonstrate familiarity with major algorithms and use of appropriate data structures.
- Analyze performance of algorithms.
- Determine which algorithm or data structure to use in different scenarios
- Be familiar with writing recursive methods.
- Apply programming techniques such as pointers, dynamic memory allocation, structures to developing solutions for particular problems
- Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs
- Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.
- Understand and apply fundamental algorithmic problems including Tree traversals, Graph traversals, and shortest paths.
- Demonstrate understanding of various searching algorithms.
- Program multiple file programs in a manner that allows for reusability of code.
- Compare different implementations of data structures and to recognize the advantages and disadvantages of the different implementations.
- Design and implement C programs that apply abstract data types.

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MSCCS203	Compulsory	Data Structures and Algorithms	3	0	2	4	60	20	20	30	20

**Unit –I:**Data Structure: Introduction, Linear and Non Linear data Structure, Abstract Data Type, Concept of List and Array, Stack, Stack as an ADT, Stack operations and applications. Queues, Queue as an ADT, operations of Queues, Types of queues- Circular Queue, Dequeue, Priority Queue, Applications of Queue.

**Unit- II:** Linked List - Introduction, Memory Representations of Linked List, comparison; Primitive operations on Linked List, Linked Representation of Stack and Queue, Header Nodes. Types of Linked List: Doubly Linked List, Circular Linked List, Application of Linked List, Self Referential Structures.

**Unit –III:** Trees: Definition, Basic Terminology of Trees, Array and Linked Representations. Binary Trees, Binary Tree Operations. Binary Trees Traversals - Inorder, Preorder & Postorder, complete binary tree, almost complete binary tree; Application of Binary Tree, Threaded Binary tree, Height Balanced tree, B-tree. Forests, conversion of forest into tree. Heap: definition and applications.

**Unit–IV:** Complexity: concept and notations. Significance of different asymptotic notations. Searching Techniques and their comparison. Sorting - External and Internal Sorting, Insertion Sort, Selection Sort, Quick Sort, Bubble Sort, Heap Sort, Merge sort, Comparison of Sorting Methods. Hashing;

**UNIT-V Graphs** - Introduction, Basic Terminology, Directed, Undirected and Weighted graphs, Representation of Graphs, Graph Traversals - Depth First and Breadth First Search. Applications of Graphs: Spanning Trees, Minimum Cost Spanning Tree, Shortest Path Problem: Kruskal's and Dijkstra algorithms.

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MSCCS203	Compulsory	Data Structures and Algorithms	3	0	2	4	60	20	20	30	20

#### Suggested Readings:

1. Kruse R.L. "Data Structures and Program Design in C", PHI
2. Aho "Data Structure & Algorithms".
3. Trembly & Sorrenson, "Introduction to Data Structure with Applications".
4. Tennenbaum A.M. & others, "Data Structures using C & C++"; PHI
5. Horowitz & Sahney, "Fundamentals of Data Structures", Galgotia Publishers.
6. Yashwant Kanetkar, "Understanding Pointers in C", BPB.
7. Data structure: by Lipschultz (schaum 's outline series McGraw hill publication)
8. Ellis Horowitz and Sartaj Sahney, "Fundamentals of Computer Algorithm:"

#### List of Experiments:

1. Write a program to create a two dimensional array and perform add, subtract and multiplication operations.
2. Write a program to create a two dimensional array using dynamic memory allocation.
3. Write a program to implement stack.
4. Write a program to convert infix expression into postfix expression.
5. Write a program to check balanced parentheses for a given infix expression.
6. Write a program to evaluate postfix expression.
7. Write a program to implement queue.
8. Write a program to implement circular queue.
9. Write a program to implement link list with insert, delete, search, view, and delete function.
10. Write a program to implement ordered link list.
11. Write a program to add two polynomials.
12. Write a program to create doubly link list.

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13. Write a program to implement tree with insert, delete and search function.
14. Write a program for in order, post order and preorder traversal of tree.
15. Write a program for binary search and sequential search using recursion.
16. Write a program for bubble sort and sequential search.
17. Write a program for insertion sort and quick sort.

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MSCCS204	Compulsory	Object Oriented Programming with Core Java	3	0	2	4	60	20	20	30	20

#### Course Education Objectives (CEOs):

- Students must be able to understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Students must be able to understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Students must have the ability to write a computer program to solve specified problems.
- Students must be able to use the Java SDK environment to create, debug and run simple Java programs.

#### Course Outcomes (COs):

After the successful completion of the course students will be able to perform the following tasks:

- Write, compile, and execute Java programs that may include basic data types and control flow constructs using Integrated Development Environments (IDEs) such as Eclipse, NetBeans, and JDeveloper.
- Write, compile and execute Java programs using object oriented class structures with parameters, constructors, and utility and calculations methods, including inheritance, test classes and exception handling.
- Write, compile, and execute Java programs using arrays and recursion, manipulating Strings and text documents.
- Write, compile, and execute Java programs that include GUIs and event driven programming.
- Write a final project that may be selected from among the following: applets for inclusion in web pages; applets to access enterprise data bases in robust, enterprise three level applications; secure communications over the internet; or an approved project chosen by the student.

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#### UNIT – I

Importance and features of Java, *Language Construct of java including* Keywords, constants, variables and looping and decision making construct, Classes and their implementation, Introduction to JVM and its architecture including set of instructions. Overview of JVM Programming. Internal and detailed explanation of a valid .class file format. Instrumentation of a .class file.

#### UNIT - II

**Introducing classes, objects and methods:** defining a class, adding variables and methods, creating objects, constructors.

class inheritance: super class, sub class, this and super operator, method overriding, use of final, packages, abstract class, interface.

Arrays and String: Creating an array, one and two dimensional arrays, string array and methods, Classes: String and String Buffer classes.

Wrapper classes: Basics types, using super, Multilevel hierarchy abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages.

**Polymorphism:** Method overloading, constructor overloading.

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### UNIT – III

**Exception Handling:** Exception Class, built in checked and unchecked exceptions, user defined exceptions, use of try, catch, throw, throws, finally.

**Multi threaded programming:** Overview, comparison with multiprocessing, Thread class and runnable interface, life cycle, creation of single and multiple threads, thread priorities, overview of Synchronization.

**Java Library:** String handling (only main functions). Elementary concepts of Input/Output: byte and character streams, System.in and System.out, print and println, reading from a file and writing in a file.

### UNIT – IV

#### Software Development using Java:

**Applets: Introduction,** Life cycle, creation and implementation.

AWT controls: Button, Label, Text Field, Text Area, Choice lists, list, scrollbars, check boxes, Layout managers.

Elementary concepts of Event Handling: Delegation Event Model, Event classes and listeners, Adapter classes, Inner classes.

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#### UNIT – V

**JDBC:** JDBC Architecture, JDBC Drivers, Connecting to the Database

**Introduction to Java Servlets:** Life cycle, Interfaces and classes in javax.servlet package(only description) Creating a simple servlet.

#### Suggested Readings:

1. Patrick Naughton and Herbert Schildt, “Java-2: The Complete Reference”, TMH, 5<sup>th</sup> edition, 2002.
2. Bill Venner, “Inside Java Virtual Machine”, TMH, 2<sup>nd</sup> edition.
3. Rick Darnell, “HTML 4 unleashed”, Techmedia Publication, 2000
4. Shelley Powers, “Dynamic Web Publishing”, 2<sup>nd</sup> edition, Techmedia, 1998.
5. Paul Dietel and Harvey Deitel, “Java How to Program”, PHI, 8<sup>th</sup> edition, 2010.
6. E. Balagurusamy, “Programming with Java: A Primer”, TMH, 1998.
7. Horstmann, “Computing Concepts with Java 2 Essentials”, John Wiley.
8. Decker and Hirshfield, “Programming Java: A Introduction to Programming Using JAVA”, Vikas Publication, 2000.
9. N.P. Gopalan and J. Akilandeswari, “Web Technology- A Developer’s Perspective”, PHI, 2<sup>nd</sup> edition
10. Eric Jendrock, Jennifer Ball, Debbi Carson, “The Java EE5 Tutorial”, Pearson, 3<sup>rd</sup> edition, 2007.
11. Daniel Liang, “Introduction to Java Programming”, Pearson, 7<sup>th</sup> edition, 2010.

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#### List of Experiments:

1. Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that. Integer.
2. Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome.
3. Write a Java program for sorting a given list of names in ascending order.
4. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (use StringTokenizer class).
5. Write a Java program that reads a file and displays the file on the screen, with a line number before each line.
6. Write a Java program that displays the number of characters, lines and words in a text file.
7. Write a Java program for creating multiple threads
  - a) Using Thread class.
  - b) Using Runnable interface.
8. Write a Java program that illustrates how run time polymorphism is achieved.
9. Write a java program that illustrates the following
  - a) Creation of simple package.
  - b) Accessing a package.
  - c) Implementing interfaces.
10. Write a java program that illustrates the following
  - a) Handling predefined exceptions.
  - b) Handling user defined exceptions.

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#### 11. APPLETS

- Working with Frames and various controls.
- Working with Dialogs and Menus.
- Working with Panel and Layout.
- Incorporating Graphics.
- Working with colours and fonts.

#### 12. SWINGS

Jpanel- JFrame – Jtoolbar—JwindowFramework

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