UNIVERSITY OF MUMBAI

Syllabus for Semester I and II
Program: M.Sc.
Course: Information Technology

(Credit Based Semester and Grading System with effect from the academic year 2013–2014)
Revised syllabus of M.Sc. Information Technology
(Based on Credit and grading system)

Semester I

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Nomenclature</th>
<th>Lectures</th>
<th>Credit</th>
<th>Practical Course</th>
<th>Hrs</th>
<th>Credit</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSIT101</td>
<td>Data Mining</td>
<td>60</td>
<td>04</td>
<td>PSIT1P1</td>
<td>60</td>
<td>02</td>
<td>06</td>
</tr>
<tr>
<td>PSIT102</td>
<td>Distributed System</td>
<td>60</td>
<td>04</td>
<td>PSIT1P2</td>
<td>60</td>
<td>02</td>
<td>06</td>
</tr>
<tr>
<td>PSIT103</td>
<td>Data Analysis Tools</td>
<td>60</td>
<td>04</td>
<td>PSIT1P3</td>
<td>60</td>
<td>02</td>
<td>06</td>
</tr>
<tr>
<td>PSIT104</td>
<td>Software Testing</td>
<td>60</td>
<td>04</td>
<td>PSIT1P4</td>
<td>60</td>
<td>02</td>
<td>06</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
</tbody>
</table>

Semester II

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Nomenclature</th>
<th>Lectures</th>
<th>Credit</th>
<th>Practical Course</th>
<th>Hrs</th>
<th>Credit</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSIT201</td>
<td>Mobile Computing</td>
<td>60</td>
<td>04</td>
<td>PSIT2P1</td>
<td>60</td>
<td>02</td>
<td>06</td>
</tr>
<tr>
<td>PSIT202</td>
<td>Advanced Computer Networks</td>
<td>60</td>
<td>04</td>
<td>PSIT2P2</td>
<td>60</td>
<td>02</td>
<td>06</td>
</tr>
<tr>
<td>PSIT203</td>
<td>Cloud Computing and Ubiquitous System</td>
<td>60</td>
<td>04</td>
<td>PSIT2P3</td>
<td>60</td>
<td>02</td>
<td>06</td>
</tr>
<tr>
<td>PSIT204</td>
<td>Advanced Database Systems</td>
<td>60</td>
<td>04</td>
<td>PSIT2P4</td>
<td>60</td>
<td>02</td>
<td>06</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
</tbody>
</table>

Total credits for M.Sc. Sem I and II: Sem I- 24 and sem II-24 = 48

Evaluation: The students will be evaluated externally. The external evaluation will be done by the committee appointed by the University norms. Standard of passing and scale as per the university norms.

Information Technology Syllabus
Restructured for Credit Based and Grading System

SEM: I
Course I: Data Mining PSIT101
Course II: Distributed System PSIT102
Course III: Data Analysis Tools PSIT103
Course IV: Software Testing PSIT104

SEM: IV
Course IV: Mobile Computing PSIT201
Course V: Advanced Computer Networks PSIT202
Course VI: Cloud Computing and Ubiquitous System PSIT203
Course VIII: Advanced Database Systems PSIT204
### Course 1: Data Mining

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSIT101</td>
<td>I</td>
<td><strong>Introduction</strong>: Basics of data mining, related concepts, Data mining techniques. <strong>Data</strong>: Introduction, Attributes, Data Sets, and Data Storage, Issues Concerning the Amount and Quality of Data, <strong>Knowledge Representation</strong>: Data Representation and their Categories: General Insights, Categories of Knowledge Representation, Granularity of Data and Knowledge Representation Schemes, Sets and Interval Analysis, Fuzzy Sets as Human-Centric Information Granules, Shadowed Sets, Rough Sets, Characterization of Knowledge Representation Schemes, Levels of Granularity and Perception Perspectives, The Concept of Granularity in Rules.</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td><strong>Data Preprocessing</strong>: Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation. <strong>Mining Frequent Patterns, Associations, and Correlations</strong>: Basic Concepts, Efficient and Scalable Frequent Itemset Mining Methods, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td><strong>Classification and Prediction</strong>: What Is Classification?, What Is Prediction?, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back-propagation, Support Vector Machines, Associative Classification: Classification by Association Rule Analysis, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods Increasing the Accuracy, Model Selection.</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td><strong>Cluster Analysis</strong>: What Is Cluster Analysis?, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td><strong>Graph Mining, Social Network Analysis, and Multirelational Data Mining</strong>: Graph Mining, Social Network Analysis, Multirelational Data Mining. <strong>Mining Object, Spatial, Multimedia, Text, and Web Data</strong>: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.</td>
</tr>
</tbody>
</table>

### References:

4. Dr. Carolyn K. Hamm, "Oracle Data Mining", RampantTechPress, SPD.
5. C. Ballard, Dynamic Warehousing and Data Mining Made Easy, ReddBkoks, IBM (SPD)
8. Z. Tang and J MacLennan, “Data Mining with SQL Server 2005”, Wiley
Course Code: PSIT1P1
1. Show the design and implementation of data mining model using Java API
2. Design the data mining model using SQL server / Oracle.
3. Show the implementation of Naïve Bayes algorithm.
4. Show the implementation of Decision Tree.
5. Show the implementation of Time Series Algorithm.
6. Show the implementation of Clustering Algorithm.
7. Show the implementation of k-nearest neighbor.
8. Show the implementation of Apriori Algorithm
9. Show the implementation of Association Algorithm.
10. Show the implementation of Text Mining.
11. Show the implementation of Multimedia Mining.
12. Show the implementation of Spatial Mining.

Course 2 :Distributed System

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Unit</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>III</td>
<td>Remote Invocation: Request-Reply Protocols, Remote Procedure Call, Remote Method Invocation, Case Study: Java RMI Indirect Communication: Group communication, Publish-subscribe systems, Message queues, Shared memory approaches Web Services: Web services, Service descriptions and IDL for web services, A directory service for use with web services, XML security, Coordination of web services, applications of web services.</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>Coordination And Agreement: Distributed mutual exclusion Elections Coordination and agreement in group communication, Consensus and related problems Name Services: Name services and the Domain Name System, Directory services, Case study: The Global Name Service, Case study: The X.500 Directory Service. Time And Global States: Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, Distributed debugging</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>Distributed Transactions: Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks. Replication: System model and the role of group communication, Fault-tolerant services, Case studies of highly available services: The gossip architecture, Bayou and Coda, Transactions with replicated data Mobile And Ubiquitous Computing: Association, Interoperation, Sensing and context awareness, Security and privacy, Adaptation, Case</td>
<td>4</td>
</tr>
</tbody>
</table>
References:

1. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, Distributed Systems - Concepts and Design (Unit I-Unit VI)

Course Code: PSIT1P2

1. Implement the concept for sharing the resources using distributed system.
2. Write a program for implementing Client Server communication model.
3. Write a program to show the object communication using RMI.
4. Show the implementation of Remote Procedure Call.
5. Show the implementation of web services.
6. Write a program to execute any one mutual exclusion algorithm.
7. Write a program to implement any one election algorithm.
8. Show the implementation of any one clock synchronization algorithm.
9. Write a program to implement two phase commit protocol.
10. Implement the concept of distributed file system architecture.

Course 3: Data Analysis Tools

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSIT103</td>
<td>I</td>
<td><strong>PART I: COMPUTING</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics in Modern day, C : Lines, Variables and their declarations, Functions, The debugger, Compiling and running, Pointers, Arrays and other pointer tricks, Strings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Databases : Basic queries, Doing more with queries, Joins and subqueries, On database design, Folding queries into C code</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td><strong>Matrices and models</strong> : The GSL's matrices and vectors, Shunting data, Linear algebra, Numbers, gsl_matrix and gsl_vector internals, Models, Graphics: plot, Some common settings, From arrays to plots, A sampling of special plots, Animation, On producing good plots, Graphs--nodes and flowcharts, Printing and LATEX</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td><strong>More coding tools</strong> : Function pointers, Data structures, Parameters, Syntactic sugar, More tools</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td><strong>PART II : STATISTICS</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distributions for description : Moments, Sample distributions, Using the sample distributions, Non-parametric description</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td><strong>Linear projections</strong> : Principal component analysis, OLS and friends, Discrete variables, Multilevel modeling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypothesis testing with the CLT: The Central Limit Theorem, Meet the Gaussian family, Testing a hypothesis, ANOVA, Regression, Goodness of fit</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Maximum likelihood estimation</strong> : Log likelihood and friends, Description: Maximum likelihood estimators, Missing data, Testing with likelihoods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monte Carlo : Random number generation, Description: Finding</td>
</tr>
</tbody>
</table>

Course Code: PSIT103

I

PART I: COMPUTING

Statistics in Modern day, C: Lines, Variables and their declarations, Functions, The debugger, Compiling and running, Pointers, Arrays and other pointer tricks, Strings
Databases: Basic queries, Doing more with queries, Joins and subqueries, On database design, Folding queries into C code

II

Matrices and models: The GSL's matrices and vectors, Shunting data, Linear algebra, Numbers, gsl_matrix and gsl_vector internals, Models, Graphics: plot, Some common settings, From arrays to plots, A sampling of special plots, Animation, On producing good plots, Graphs--nodes and flowcharts, Printing and LATEX

III

More coding tools: Function pointers, Data structures, Parameters, Syntactic sugar, More tools

PART II: STATISTICS

Distributions for description: Moments, Sample distributions, Using the sample distributions, Non-parametric description

IV

Linear projections: Principal component analysis, OLS and friends, Discrete variables, Multilevel modeling
Hypothesis testing with the CLT: The Central Limit Theorem, Meet the Gaussian family, Testing a hypothesis, ANOVA, Regression, Goodness of fit

V

Maximum likelihood estimation: Log likelihood and friends, Description: Maximum likelihood estimators, Missing data, Testing with likelihoods
Monte Carlo: Random number generation, Description: Finding
Course Code: PSIT1P3

1. Some SQL queries based on the 1st Unit.
2. Implementing GSL matrix and vectors
3. Graph Plotting
4. Implement the statistical distributions
5. Implement regression and goodness of fit
6. Implement testing with likelyhood
7. Generate random numbers using Monte Carlo method
8. Implementing Non-Parametric testing
9. Drawing an Inference
10. Implement Non-parametric Testing

Course 4: Software Testing

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Unit</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>II</td>
<td>Test Management: Introduction, Test Management Documentation, Test Plan Documentation Templates, Test Estimation, Scheduling and Test Planning, Test Progress Monitoring and Control, Business Value of Testing, Distributed, Outsourced, and Insourced Testing, Risk-Based Testing, Risk Management, Risk Identification, Risk Analysis or Risk Assessment, Risk Mitigation or Risk Control, Risk Identification and Assessment Results, Risk-Based Testing throughout the Lifecycle, Risk-Aware Testing Standards, Risk-</td>
<td></td>
</tr>
</tbody>
</table>
Based Testing Exercise, Project Risk By-Products, Requirements Defect By-Products, Test Case Sequencing Guidelines, Failure Mode and Effects Analysis, Test Management Issues

III

Test Techniques

IV

Tests of Software Characteristics
Introduction, Quality Attributes for Domain Testing, Accuracy, Suitability, Interoperability, Usability, Usability Test Exercise, Usability Test Exercise Debrief, Quality Attributes for Technical Testing, Technical Security, Security Issues, Timely Information, Reliability, Efficiency, Multiple Flavours of Efficiency Testing, Modelling the System, Efficiency Measurements, Examples of
<table>
<thead>
<tr>
<th>Course Code: PSIT1P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Evaluating Test Exit Criteria and Reporting</td>
</tr>
<tr>
<td>2. Static and Dynamic Analysis</td>
</tr>
<tr>
<td>3. Rate Quality Attributes for Domain and Technical Testing</td>
</tr>
<tr>
<td>4. Perform Review</td>
</tr>
<tr>
<td>5. Incident Management</td>
</tr>
</tbody>
</table>

---

### Reference Books

- Boris Beizer, “Software Testing Techniques”, Dreamtech
6. Path Testing and Equivalence Partitioning  
7. Performance Testing  
8. Using Testing Tool Selenium  
9. Using Testing Tool QTP  
10. Using Testing Tool WAPT  
11. Using Testing Tool VTTEST  
12. Using Testing Tool AutoIT

**SEMESTER II**

**Course 5: Mobile Computing**  
**PSIT201**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Unit</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSIT201</td>
<td>I</td>
<td><strong>Introduction:</strong> Applications, A short history of wireless communication. <strong>Wireless Transmission:</strong> Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems. <strong>Medium Access Control:</strong> Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td><strong>Telecommunication Systems:</strong> GSM: Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, Security, New data services; DECT: System architecture, Protocol architecture; TETRA, UMTS and IMT-2000: UMTS Basic architecture, UTRA FDD mode, UTRA TDD mode <strong>Satellite Systems:</strong> History, Applications, Basics: GEO, LEO, MEO; Routing, Localization, Handover, Examples</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III</td>
<td><strong>Broadcast Systems:</strong> Overview, Cyclic repetition of data, Digital audio broadcasting: Multimedia object transfer protocol; Digital video broadcasting <strong>Wireless LAN:</strong> Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control. Sublayer, Medium access control Sublayer, Information bases And Networking; Bluetooth: User scenarios, Physical layer, MAC layer, Networking, Security, Link management</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td><strong>Wireless ATM:</strong> Motivation for WATM, Wireless ATM working group, WATM services, Reference model: Example configurations, Generic reference model; Functions: Wireless mobile terminal side, Mobility supporting network side; Radio access layer: Requirements, BRAN: Handover: Handover reference model, Handover requirements, Types of handover, Handover scenarios, Backward handover, Forward handover; Location management: Requirements for location management, Procedures and Entities; Addressing, Mobile quality of service, Access point control protocol. <strong>Mobile Network Layer:</strong> Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol.</td>
<td></td>
</tr>
</tbody>
</table>
Ad hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Hierarchical algorithms, Alternative metrics


References:
Jochen Schiller, “Mobile communications”, Addison wisely, Pearson Education
William Stallings, “Wireless Communications and Networks”
Rappaort, “Wireless Communications Principals and Practices”
P. Nicopolitidis, “Wireless Networks”, John Wiley
K Pahlavan, P. Krishnamurthy, “Principles of Wireless Networks”
M. Richharia, “Mobile Satellite Communication: Principles and Trends”, Pearson Education

Course Code: PSIT2P1
1. Develop UI with different controls on Mobile using Android.
2. Develop UI with different controls on Mobile using Windows.
4. Create a simple temperature converter application using Android.
5. Design a simple calculator using Windows / Android.
6. Program for simple quiz competition.
7. Program to insert and display data from database Windows / Android.
8. Program to generate Calendar using Windows / Android.
10. Program to demonstrate simple Animation.

Course 6: Advanced Computer Networks

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Unit</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>II</td>
<td>OSPF Overview and Neighbour Relationships, OSPF Topology, Routes and Convergence, OSPF Route Summarization, Filtering and Default Routing OSPF Virtual Links and Frame Relay Operations</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>Policy-Based Routing and IP Service Level Agreement Internet Connectivity and BGP, External BGP, BGP Path Control Network Address Translation, IP Multicast Routing, IP Version 6 IPv6 overview, IPv4 and IPv6 Coexistence, Static</td>
<td></td>
</tr>
</tbody>
</table>
Point-to-Point IPv6 Tunnels, Dynamic Multipoint IPv6 Tunnels,

IV
- Enterprise Campus Network Design
- Developing an Optimum Design for Layer 3
- Advanced WAN Services Design Considerations

V
- IPsec and SSL VPN Design
- Enterprise Data Center Design
- SAN Design Considerations

References:
CCIE Professional Development Routing TCP/IP: Volume I by Jeff Doyle, Jennifer DeHaven Carroll, Cisco Press
CCIE Professional Development Routing TCP/IP: Volume II by Jeff Doyle, Jennifer DeHaven Carroll, Cisco Press

Course Code: PSIT2P2

1) Simulationg RIP
2) Simulating OSPF
3) Simulating OSPF with STUB AREA,NSSA, Restricting LSA’s
4) Simulating BGP
5) Simulating Routing Redistributions
6) Simulating IBGP
7) Simulating EBGP
8) Configuring IP Multicast Routing
9) Design Data Centre
10) Design Remote Access VPNs

Course 7: Cloud Computing and Ubiquitous System PSIT203

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Unit</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSIT203</td>
<td>II</td>
<td><strong>Computer Clusters for scalable parallel computing:</strong> Clustering for massive parallelism: Cluster Development Trends, Design Objective of Computer Clusters, Fundamental Cluster Design issues. Virtual machines and Virtualization of clusters and Data centers: Implementation levels of virtualization: levels of virtualization Implementation, VMM Design</td>
<td></td>
</tr>
</tbody>
</table>

| IV | **Programming Support of Google App Engine**: Programming the Google App Engine, Google File System (GFS), Bigtable, Google’s NoSQL system, Chubby, Google’s Distributed Lock service. Programming on Amazon AWS and Microsoft Azure: Programming on Amazon EC2, Amazon Simple Storage Service S3, Amazon Elastic Block Store EBS and SimpleDB, Microsoft Azure programming support. Emerging Cloud Software Environments: Open Source Eucalyptus and Nimbus, OpenNebula, Sector/Sphere, and OpenStack, Manjrasoft Aneka Cloud and Appliances. |

**BOOKS**

References:
Course Code: PSIT2P3
1. Implement Distributed System on Windows and Linux
2. Implement application on Azure
3. Implement private cloud
4. Implement Search engine
5. Implement Server Cluster
6. Implement MapReduce and Hadoop
7. Implement Social Networking Site
8. Implement Blogging site
9. Implement Grid Computing
10. Implement IaaS (Eucalyptus, Nimbus)
11. Implement PaaS
12. Implement SaaS
13. Implement OpenNebula

Course 8: Advanced Database Systems

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Unit</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSIT204</td>
<td>I</td>
<td>The Extended Entity Relationship Model and Object Model: The ER model revisited, Motivation for complex data types, User defined abstract data types and structured types, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Relationship types of degree higher than two.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>Object-Oriented Databases: Overview of Object-Oriented concepts, Object identity, Object structure, and type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Type extents and queries, Complex objects; Database schema design for OODBMS; OQL, Persistent programming languages; OODBMS architecture and storage issues; Transactions and Concurrency control, Example of ODBMS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>Object Relational and Extended Relational Databases: Database design for an ORDBMS - Nested relations and collections; Storage and access methods, Query processing and Optimization; An overview of SQL3, Implementation issues for extended type; Systems comparison of RDBMS, OODBMS, ORDBMS</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>Parallel and Distributed Databases and Client-Server Architecture: Architectures for parallel databases, Parallel query evaluation; Parallelizing individual operations, Sorting, Joins; Distributed database concepts, Data fragmentation, Replication, and allocation techniques for distributed database design; Query processing in distributed databases; Concurrency control and Recovery in distributed databases. An overview of Client-Server architecture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>Databases on the Web and Semi Structured Data: Web interfaces to the Web, Overview of XML; Structure of XML data, DTD, XML Schema, XQuery, XSLT, Storage of XML data, XML applications, XML DOM, The semi structured data model, Implementation</td>
<td></td>
</tr>
</tbody>
</table>
**Enhanced Data Models for Advanced Applications:** Active database concepts. Temporal database concepts.; Spatial databases, Concepts and architecture; Deductive databases and Query processing; Mobile databases, Geographic information systems.

**References:**

   C.J.Date, Longman, “Introduction To Database Systems”, Pearson Education

**Course Code: PSIT2P4**

1. Horizontal fragmentation of database.  
2. Vertical fragmentation of database  
3. Creating Replica of database.  
4. Create Temporal Database.  
5. Inserting and retrieving multimedia objects in database (Image / Audio /Video).  
6. Implement Active database using Triggers  
7. Create ORDBMS Application  
8. Implement and retrieve records from a Spatial Database  
9. Create XML Parser  
12. Prolog programming.