

# CURRICULUM

For

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POSTGRADUATE DEGREE COURSE IN

## **COMPUTER SCIENCE & ENGINEERING** (Engineering & Technology)

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**[Effective from 2018-19]**



IIMT UNIVERSITY  
MEERUT

# **IIMT University, Meerut**

## Course Structure and Syllabus for M.Tech (Computer Science & Engineering)

### Semester I

S. No.	Course Code	Course Name	Periods			Evaluation Scheme		
			L	T	P	External	Internal	Total
1	MTCS-101	Data Mining And Knowledge Management	3	0	-	70	30	100
2	MTCS-102	Advanced Data Structure And Algorithms	3	0	-	70	30	100
3	MTCS-103	Advanced Operating System	3	0	-	70	30	100
4	MTCS-104	Software Testing & Quality Assurance	3	0	-	70	30	100
5	MTCS-105	Elective I	3	0	-	70	30	100
6	MTCS-106	Seminar I	0	0	2	-	50	50
7	MTCS-191P	Advanced Data Structures And Algorithms Lab	0	0	2	30	20	50
8	MTCS-193P	Advance Operating Systems Laboratory	0	0	2	30	20	50
9	ECC-111	Industrial Visit/ Seminar/ Presentation On The Report Of Visits	-	-	-	-	25	25
10	ECC-112	University Social Responsibility	-	-			25	25
11	ECC-113	Spoken Tutorial Certification	-	-	2		25	25
12	ECC-114	Mooc/ Swayam	-	-	2		25	25
		<b>Total</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>410</b>	<b>340</b>	<b>750</b>

## Semester II

S. No.	Course Code	Course Name	Periods			Evaluation Scheme		
			L	T	P	External	Internal	Total
1	MTCS-201	Big Data Analytics And Business Intelligence	3	0	0	70	30	100
2	MTCS-202	Advanced Computer Architecture	3	0	0	70	30	100
3	MTCS-203	Advanced DBMS	3	0	0	70	30	100
4	MTCS-204	Mobile Ad Hoc Network	3	0	0	70	30	100
5	MTCS-205	Elective II	3	0	0	70	30	100
6	MTCS-206	Seminar II	0	0	2	--	50	50
7	MTCS-297P	Mini Project	0	0	2	30	20	50
8	MTCS-293P	Adbms Laboratory	0	0	2	30	20	50
9	ECC-211	Industrial Visit/ Seminar/ Presentation On The Report Of Visits	-	-	-	-	25	25
10	ECC-212	University Social Responsibility	-	-	-	-	25	25
11	ECC-213	Spoken Tutorial Certification	-	-	2	-	25	25
12	ECC-214	Mooc/ Swayam	-	-	2	-	25	25
		<b>Total</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>410</b>	<b>340</b>	<b>750</b>

## Semester III

S. No.	Course Code	Course Name	Periods			Evaluation Scheme		
			L	T	P	External	Internal	Total
1	MTCS-301	Research Methodology	3	0	-	70	30	100
2	MTCS-302	Elective-III	3	0	-	70	30	100
3	MTCS-303P	Seminar III	-	-	2	--	50	50
4	MTCS-394	Term Paper [Project]	-	-	10		150	150
5	ECC-321	Industrial Visit/ Seminar/ Presentation on the report of visits	-	-	-	-	25	25
6	ECC-322	University Social Responsibility	-	-			25	25
7	ECC-323	Spoken Tutorial Certification	-	-	2		25	25
8	ECC-324	MOOC/ SWAYAM	-	-	2		25	25
		<b>Total</b>	<b>6</b>	<b>0</b>	<b>16</b>	<b>240</b>	<b>360</b>	<b>500</b>

## Semester IV

S. No.	Course Code	Course Name	Periods			Evaluation Scheme		
			L	T	P	External	Internal	Total
1	MTCS-494	Final Project presentation with VIVA	0	0	18	200	100	300
2	MTCS-495	Comprehensive Viva	0	0	0	100	100	200
3	ECC-241	Industrial Visit/ Seminar/ Presentation on the report of visits	-	-	-	-	25	25
4	ECC-242	University Social Responsibility	-	-			25	25
5	ECC-243	Spoken Tutorial Certification	-	-	2		25	25
6	ECC-244	MOOC/ SWAYAM	-	-	2		25	25
		<b>Total</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>300</b>	<b>300</b>	<b>600</b>

**\* Electives to be selected from the following list**

**\*\*\* Seminar should be presented on a very recent topic on any technological domain.**

**Elective -I**

- i. MTCS-011 Forensics and Cyber Law
- ii. MTCS-012 Information Retrieval
- iii. MTCS-013 Modelling and Simulation
- iv. MTCS-014 Web Technology
- v. MTCS-015 Software Process and Project Management

**Elective –II**

- i. MTCS-021 Soft Computing
- ii. MTCS-022 XML and Web Services
- iii. MTCS-023 Digital Image Processing
- iv. MTCS-024 Software Engineering Methodologies
- v. MTCS-025 Natural Language Processing

**Elective-III**

- i. MTCS-031 Parallel and Distributed Computing
- ii. MTCS-032 Advanced computer network
- iii. MTCS-033 Web Programming Paradigm
- iv. MTCS-034 Linux Kernel Programming
- v. MTCS-034 Wireless and Mobile Networks

<b>MTCS-101</b>	<b>DATA MINING AND KNOWLEDGE MANAGEMENT</b>	<b>L T P</b> <b>3 0 0</b>
<b>Objectives</b> To have an advanced level of knowledge to extract latent, potentially useful information from stored data, display it to the final user in a comprehensible manner and corporate it into an intelligent decision-making system		

**Unit-1**

**Data mining:** Introduction, association rules mining, Naive algorithm, A priori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation (FP, growth), performance evaluation of algorithms, Mining Customer values: From Association rule to direct mining: A case study.

**Unit-2**

**Classification:** Introduction, decision tree, tree induction algorithm – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method; classification software, software for association rule mining; case study; KDD Insurance Risk Assessment: A Case study.

**Unit-3**

**Cluster analysis:** Introduction, partitional methods, hierrarchical methods, density based methods, dealing with large databases, cluster software; Efficient Clustering of Very Large Document Collections: A case study.

**Unit-4**

**Web data mining:** Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.

**Search engines:** Characteristics of Search engines, Search Engine Functionality, Search Engine Architecture, Ranking of web pages, The search engine history, Enterprise Search, Enterprise Search Engine Software.

**Unit-5**

**Data warehousing:** Introduction, Operational data stores, ETL, Data warehouses – design guidelines for data warehouse implementation, Data warehouse metadata; OLAP – introduction, Characteristics, Multidimensional view and data cube, Data cube operations, Data Warehouse Governance: Best Practices at Blue Cross and Blue Shield of North Carolina: A Case Study.

**REFERENCES**

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 2002.
2. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata Mcgraw Hill, 2004.
3. Usama M.Fayyad, Gregory Piatetsky-Shapiro, Padhraí Smyth and Ramasamy Uthurusamy, "Advances In Knowledge Discovery And Data Mining", The M.I.T Press, 1996.
4. Ralph Kimball, "The Data Warehouse Life Cycle Toolkit", John Wiley & Sons Inc., 1998.
5. Sean Kelly, "Data Warehousing In Action", John Wiley & Sons Inc., 1997.

<b>MTCS-102</b>	<b>ADVANCED DATA STRUCTURES AND ALGORITHMS</b>	<b>L T P</b> <b>3 0 0</b>
<b>Objectives</b> The fundamental design, analysis, and implementation of basic data structures. Basic concepts in the specification and analysis of programs. Principles for good program design, especially the uses of data abstraction. Significance of algorithms in the computer field Various aspects of algorithm development Qualities of a good solution		

**UNIT I**

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Complexity Analysis Examples.

Data structures-Linear and non linear data structures, ADT concept, Linear List ADT, Array representation, Linked representation, Vector representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations, circular lists. Representation of single, two dimensional arrays, Sparse matrices and their representation.

**UNIT II**

Stack and Queue ADTs, array and linked list representations, infix to postfix conversion using stack, implementation of recursion, Circular queue-insertion and deletion, Dequeue ADT, array and linked list representations, Priority queue ADT, implementation using Heaps, Insertion into a Max Heap, Deletion from a Max Heap, java.util package-Array List, Linked List, Vector classes, Stacks and Queues in java.util, Iterators in java.util.

**UNIT III**

Searching-Linear and binary search methods, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining, Hashing in java.util-HashMap, Hash Set, Hash table.

Sorting -Bubble sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort, comparison of sorting methods.

**UNIT IV**

Trees- Ordinary and Binary trees terminology, Properties of Binary trees, Binary tree ADT, representations, recursive and non recursive traversals, Java code for traversals, Threaded binary trees. Graphs- Graphs terminology, Graph ADT, representations, graph traversals/search methods-DFS and BFS, Java code for graph traversals, Applications of Graphs-Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem.

**UNIT V**

Search trees- Binary search tree-Binary search tree ADT, insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition and examples only, Red Black trees - Definition and examples only, B-Trees-definition, insertion and searching operations, Trees in java.util- Tree Set, Tree Map Classes, Tries(examples only),Comparison of Search trees.

Text compression-Huffman coding and decoding, Pattern matching-KMP algorithm.

**TEXT BOOKS:**

1. Data structures, Algorithms and Applications in Java, S.Sahni, Universities Press.
2. Data structures and Algorithms in Java, Adam Drozdek, 3<sup>rd</sup> edition, Cengage Learning.
3. Data structures and Algorithm Analysis in Java, M.A.Weiss, 2nd edition, Addison-Wesley (Pearson Education).

**REFERENCE BOOKS:**

1. Java for Programmers, Deitel and Deitel, Pearson education.
2. Data structures and Algorithms in Java, R.Lafore, Pearson education.
3. Java: The Complete Reference, 8<sup>th</sup> editon, Herbert Schildt, TMH.
4. Data structures and Algorithms in Java, M.T.Goodrich, R.Tomassia, 3<sup>rd</sup> edition,

Wiley India Edition.

5. Data structures and the Java Collection Frame work,W.J.Collins, Mc Graw Hill.
6. Classic Data structures in Java, T.Budd, Addison-Wesley (Pearson Education).
7. Data structures with Java, Ford and Topp, Pearson Education.
8. Data structures using Java, D.S.Malik and P.S.Nair, Cengage learning.
9. Data structures with Java, J.R.Hubbard and A.Huray, PHI Pvt. Ltd.
10. Data structures and Software Development in an Object-Oriented Domain,
11. J.P.Tremblay and G.A.Cheston, Java edition, Pearson Education.



<b>MTCS-103</b>	<b>ADVANCED OPERATING SYSTEMS</b>	<b>L T P</b> <b>3 0 0</b>
<b>Objectives</b> To understand main components of Real time Operating system and their working To study the operations performed by OS as a resource manager. To understand the scheduling policies of DOS To implement the working principles of OS. To study different OS and compare their features.		

**UNIT I**

Introduction: Overview, Functions of an Operating System, Design Approaches, Types of Advanced Operating System - Synchronization Mechanisms, Concept of a Process, Concurrent Processes, The Critical Section Problem, Other Synchronization Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Programs - Process Deadlocks - Preliminaries, Models of Deadlocks, Resources, System State, Necessary and Sufficient conditions for a Deadlock, Systems with Single-Unit Requests, Consumable Resources, Reusable Resources.

**UNIT II**

Distributed Operating Systems: Introduction, Issues, Communication Primitives, Inherent Limitations Lamport's Logical Clock; Vector Clock; Causal Ordering; Global State; Cuts; Termination Detection. Distributed Mutual Exclusion, Non-Token Based Algorithms, Lamport's Algorithm - Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Distributed Deadlock Detection, Issues, Centralized Deadlock-Detection Algorithms - Distributed Deadlock-Detection Algorithms. Agreement Protocols, Classification - Solutions, Applications.

**UNIT III**

Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm, Protocols - Design Issues. Distributed Scheduling, Issues, Components, Algorithms.

**UNIT IV**

Failure Recovery and Fault Tolerance: Basic Concepts-Classification of Failures, Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Checkpointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and Nonblocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols

**UNIT V**

Multiprocessor and Database Operating Systems: Structures, Design Issues, Threads, Process Synchronization, Processor Scheduling, Memory Management, Reliability / Fault Tolerance; Database Operating Systems, Introduction, Concurrency Control, Distributed Database Systems, Concurrency Control Algorithms.

**TEXT BOOKS:**

1. A. Silberschatz - Applied Operating System Concepts, Wiley, 2000.
2. Lubemir F Bic and Alan C. Shaw - Operating System Principles, Pearson Education, 2003.

**REFERENCE BOOKS:**

1. MukeshSinghal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", 2.McGraw- Hill, 2000
2. Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating 3.System Concepts", Sixth Addison n Wesley Publishing Co., 2003.
3. Andrew S. 4.Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.

<b>MTCS-104</b>	<b>Software Testing and Quality Assurance</b>	<b>L T P</b> <b>3 0 0</b>
<b>Objectives</b> After successful completion of this course, student will be able to learn and develop project documentations and soft skills for effective project presentation develop practical skills related to software quality assurance apply software testing techniques for information systems development.		

**Unit-1**

Software Quality, Role of testing, verification and validation, White-Box and Black-Box Testing , Test Planning and Design, Monitoring and Measuring Test Execution, Test Tools and Automation, Test Team Organization and Management .

**Unit-2****Unit Testing and Control Flow Testing:**

Concept of Unit Testing, Static Unit Testing, Defect Prevention, Mutation Testing, Debugging, Unit Testing in extreme Programming Control Flow Graph, Paths in a Control Flow Graph, All-Path Coverage Criterion, Statement Coverage Criterion, Branch Coverage Criterion, Examples of Test Data Selection.

**Unit-3****Data Flow Testing and System Integration Testing:**

Data Flow Anomaly, Data Flow Graph, Data Flow Testing Criteria, Feasible Paths and Test Selection Criteria, Comparison of Testing Techniques. Types of Interfaces and Interface Errors, System Integration Techniques, Software and Hardware Integration, Off-the-Shelf Component Testing, Built-in Testing,

**System Test Categories:**

Basic Tests, Functionality Tests, Robustness Tests, Interoperability Tests, Performance Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Documentation Tests.

**Unit-4****Functional Testing:**

Equivalence Class Partitioning, Boundary Value Analysis, Decision Tables, Random Testing, Error Guessing, Category Partition. System Test Design: Test Design Factors, Requirement Identification, Characteristics of Testable Requirements, Test Design Preparedness Metrics, Test Case Design Effectiveness System Test Planning and Automation: Structure of a System Test Plan, System Test Automation System Test Execution: Metrics for Tracking System Test, Beta Testing, System Test Report, Product Sustaining, Measuring Test Effectiveness.

**Unit-5****Acceptance Testing Software Quality:**

Types of Acceptance Testing, Selection of Acceptance Criteria, Acceptance Test Execution, Acceptance Testing in eXtreme Programming. Five Views of Software Quality, McCall's Quality Factors and Criteria, Quality Factors Quality Criteria, Relationship between Quality Factors and Criteria, Quality Metrics, ISO 9126 Quality Characteristics, ISO 9000:2000 Software Quality Standard ISO 9000:2000 Fundamentals, ISO 9001:2000 Requirements

**References:**

- 1.SagarNaik University of Waterloo, PiyuTripathy, Software Testing and Quality Assurance: Theory and Practice, Wiley.
- 2.William Perry, Effective Methods for Software Testing, Wiley.
- 3.Paul C. Jorgensen, Software Testing - A Craftsman's Approach, CRC Press.
- 4.Srinivasan Desikan and GopaldaswamyRamesh, Software Testing, Pearson Education.
- 5.Louis Tamres, Introducing to Software Testing, Addison Wesley Publications.
- 6.Ron Patton, SAMS Techmedia Indian Edition, Software Testing, Pearson Education.
- 7.Glenford J. Myers, The Art of Software Testing, John Wiley & Sons.
- 8.Robert V. Binder, Testing Object-Oriented Systems: Models Patterns and Tools, Addison Wesley.
- 9.Daniel Galin, Software Quality Assurance, Pearson Education.

MTCS-105/MTCS-014	<b>Web Technology</b>	<b>L T P</b> <b>3 0 0</b>
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**Unit 1:**

Introduction: Network concepts - Web concepts - Internet addresses - Retrieving data with URL- HTML- DHTML: Cascading style sheets- Scripting Languages: Javascript, Vbscript.

**Unit 2:**

Common Gateway Interface: Common Gateway Interface: Programming CGI Scripts – HTML forms – Custom database query scripts – Server side includes – Server security issues – XML.

**Unit 3:**

Java Programming: Java Fundamentals: Classes – Inheritance – Packages – Interfaces – Exceptions Handling – Multithreading – Applets.

**Unit 4:**

Server Side Programming: Server side programming – Active server pages – Java server pages – Java servlets: Servlet container – Exceptions – Sessions and session tracking – Using servlet context – Dynamic content generation – Servlet chaining and communications.

**Unit 5:**

Applications: Simple applications – Internet Commerce – Database connectivity- Online databases – FDI applications in business – Plugins – Firewalls.

**REFERENCES:**

1. Balagurusamy E, "Programming in JAVA", TMH
2. Herbert Schildt, "The Complete Reference:Java", TMH.
3. Xavier, C, " Web Technology and Design", New Age International
4. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication
5. Bhave, "Programming with Java", Pearson Education

<b>MTCS-201</b>	<b>BIG DATA ANALYTICS AND BUSINESS INTELLIGENCE</b>	<b>L T P</b> <b>3 0 0</b>
<b>Objectives</b> To have an advanced level of understanding of most recent advancements in Big Data and using insights, statistical models, visualization techniques for its effective application in Business intelligence.		

**Unit-1**

**Introduction to Data Analytics:** Data and Relations, Data Visualization, Correlation, Regression, Forecasting, Classification, Clustering.

**Unit-2**

**Big Data Technology Landscape:** Fundamentals of Big Data Types, Big data Technology Components, Big Data Architecture, Big Data Warehouses, Functional vs. Procedural Programming Models for Big Data.

**Unit-3**

**Introduction to Business Intelligence:** Business View of IT Applications, Digital Data, OLTP vs. OLAP, BI Concepts, BI Roles and Responsibilities, BI Framework and components, BI Project Life Cycle, Business Intelligence vs. Business Analytics.

**Unit-4**

**Big Data Analytics:** Big Data Analytics, Framework for Big Data Analysis, Approaches for Analysis of Big Data, ETL in Big Data, Introduction to Hadoop Ecosystem, HDFS, Map-Reduce Programming, Understanding Text Analytics and Big Data, Predictive analysis on Big Data, Role of Data analyst.

**Unit-5**

**Business implementation of Big Data:** Big Data Implementation, Big Data workflow, Operational Databases, Graph Databases in a Big Data Environment, Real-Time Data Streams and Complex Event Processing, Applying Big Data in a business scenario, Security and Governance for Big Data, Big Data on Cloud, Best practices in Big Data implementation, Latest trends in Big Data, Latest trends in Big Data, Big Data Computation, More on Big Data Storage, Big Data Computational Limitations.

**Reference:**

1. [Minelli M., Chambers M., Dhiraj A.](#), Big Data, Big Analytics: Emerging Business
2. Intelligence and Analytic Trends for Today's Businesses, Wiley CIO Series(2013),1<sup>st</sup> ed.
3. [White T.](#), Hadoop: The Definitive Guide, O' Reilly Media (2012), 3<sup>rd</sup> ed.

<b>MTCS-202</b>	<b>ADVANCED COMPUTER ARCHITECTURE</b>	<b>L T P</b> <b>3 0 0</b>
<b>Objectives</b> The student should be made to: Understand the micro-architectural design of processors Learn about the various techniques used to obtain performance improvement and power savings in current processor.		

**Unit-1****Parallel computer models:**

The state of computing, Classification of parallel computers, Multiprocessors and Multicomputers , Multivector and SIMD computers.

**Unit-2****Program and network properties and Principles of Scalable Performance:**

Conditions of parallelism, Program partitioning and scheduling, Program flow mechanisms, System Interconnect Architectures. Performance Metrics and Measures, Parallelprocessing applications, speedup performance laws, scalability analysis and approaches.

**Unit-3****Processors and Memory Hierarchy:**

Advanced processor technology, Superscalar and Vector Processors, Vector processing principles, Memory hierarchy technology, virtual memory technology.

**Unit-4****Pipelining & Superscalar Techniques:**

Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Arithmetic Pipeline Design, Superscalar and Superpipeline design.

**Unit-5****Parallel & Scalable architectures:**

Multiprocessor system Interconnects, Cache coherence and synchronization mechanisms, message passing mechanisms, latency hiding techniques, principles of multithreading, scalable and multithreaded architecture

**Reference:**

1. Kai Hwang, "Advanced computer architecture"; TMH. 2000

Reference Books:

1. J.P.Hayes, "Computer Architecture and organization"; MGH. 1998

2. V.Rajaraman & C.S.R.Murthy, "Parallel computer"; PHI. 2002

3. Stalling W, "Computer Organisation & Architecture", PHI. 2000

4. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design";

Narosa Publishing. 1998

5. Hwang and Briggs, "Computer Architecture and Parallel Processing"; MGH.

<b>MTCS-203</b>	<b>ADVANCED DBMS</b>	<b>L T P</b> <b>3 0 0</b>
<b>Objectives</b> By the end of the course, you will know: History and Structure of databases How to design a database, How to convert the design into the appropriate tables Handling keys appropriately Enforcing Integrity Constraints to keep the database consistent Normalizing the tables to eliminate redundancies Querying relational data Optimizing and processing the queries Storage Strategies for easy retrieval of data through index Triggers, Procedures and Cursors ,Transaction Management Distributed databases management system concepts and Implementation		

**UNIT I**

Database System Applications, Purpose of Database Systems, View of Data – Data Abstraction, Instances and Schemas, Data Models – the ER Model, Relational Model, Other Models – Database Languages – DDL,DML, Database Access from Applications Programs, Transaction Management, Data Storage and Querying, Database Architecture, Database Users and Administrators, ER diagrams,. Relational Model: Introduction to the Relational Model – Integrity Constraints Over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views –Altering Tables and Views, Relational Algebra, Basic SQL Queries, Nested Queries, Complex Integrity Constraints in SQL, Triggers

**UNIT II**

Introduction to Schema Refinement – Problems Caused by redundancy, Decompositions – Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms – FIRST, SECOND, THIRD Normal forms – BCNF –Properties of Decompositions- Loss less- join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design – Multi valued Dependencies – FOURTH Normal Form, Join Dependencies, FIFTH Normal form.

**UNIT III**

Transaction Management: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions – Lock Based Concurrency Control, Deadlocks – Performance of Locking – Transaction Support in SQL.

Concurrency Control: Serializability, and recoverability – Introduction to Lock Management – Lock Conversions, Dealing with Dead Locks, Specialized Locking Techniques – Concurrency Control without Locking.

Crash recovery: Introduction to Crash recovery, Introduction to ARIES, the Log, and Other Recovery related Structures, the Write-Ahead Log Protocol, Check pointing, recovering from a System Crash, Media recovery

**UNIT IV**

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing – Clustered Indexes, Primary and Secondary Indexes, Index data Structures – Hash Based Indexing, Tree based Indexing Storing data: Disks and Files: -The Memory Hierarchy – Redundant Arrays of Independent Disks. Tree Structured Indexing: Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM) B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendable vs. Linear Hashing.

**UNIT V**

**Distributed databases:** Introduction to distributed databases, Distributed DBMS architectures, Storing data in a distributed DBMS, Distributed catalog management, Distributed query processing Updating distributed data, Distributed transactions, Distributed concurrency control, Distributed recovery

**Text Books**

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TMH, 3<sup>rd</sup> Edition, 2003.
2. Data base System Concepts, A.Silberschatz, H.F. Korth, S.Sudarshan, McGraw hill, VI edition, 2006.
3. Fundamentals of Database Systems 5th edition. Ramez Elmasri, Shamkant B.Navathe, Pearson Education, 2008.

**REFERENCE BOOKS:**

1. Introduction to Database Systems, C.J.Date, Pearson Education.
2. Database Management System Oracle SQL and PL/SQL, P.K.Das Gupta, PHI.
3. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning, 2008.
4. Database Systems, A Practical approach to Design Implementation and Management Fourth edition, Thomas Connolly, Carolyn Begg, Pearson education.
5. Database-Principles, Programming, and Performance, P.O'Neil&E.O'Neil, 2<sup>nd</sup> ed., ELSEVIER
6. Fundamentals of Relational Database Management Systems, S.Sumathi, S.Esakkirajan, Springer.
7. Introduction to Database Management, M.L.Gillenson and others, Wiley Student Edition.
8. Database Development and Management, Lee Chao, Auerbach publications, Taylor & Francis Group.
9. Distributed Databases Principles & Systems, Stefano Ceri, Giuseppe Pelagatti, TMH.
10. Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez , Pearson Education, 2nd Edition.
11. Distributed Database Systems, Chhanda Ray, Pearson.
12. Distributed Database Management Systems, S.K.Rahimi and F.S.Haug, Wiley.

<b>MTCS-204</b>	<b>MOBILE ADHOC NETWORKS</b>	<b>L T P</b> <b>3 0 0</b>
<b>Objectives</b> To teach the design issues and different routing protocols for unicast and multicast routing protocols. To give an idea about different transport layer and security solutions. To make them understand the different energy management schemes and wireless sensor network architecture. To analyze the different parameters using the network simulator		

**Unit-1****Introduction**

Introduction - Fundamentals of wireless communication technology - The Electromagnetic spectrum - Radio propagation mechanisms - Characteristics of the wireless channel - IEEE 802.11a,b standard - Origin of Ad hoc: Packet radio networks - Technical challenges - Architecture of PRNETs - Components of packet radios - Adhoc wireless networks - Heterogeneity in mobile devices - Wireless sensor networks - Traffic profiles - Types of Ad hoc mobile communications - Types of mobile host movements - Challenges facing Ad hoc mobile networks - Ad hoc wireless internet.

**Unit-2****AD HOC ROUTING PROTOCOLS:**

Introduction - Issues in designing a routing protocol for Ad hoc wireless networks - Classifications of routing protocols - Table-Driven routing protocols -Destination Sequenced Distance Vector (DSDV) - Wireless Routing Protocol (WRP) - Cluster Switch Gateway Routing (CSGR) - Source-Initiated On-Demand approaches - Ad hoc On-Demand Distance Vector Routing (AODV) Dynamic Source Routing (DSR) -Temporally Ordered Routing Algorithm (TORA) - Signal Stability Routing (SSR) -Location-Aided Routing (LAR) - Power-Aware Routing (PAR) - Zone Routing Protocol (ZRP).

**Unit-3****MULTICAST ROUTING IN AD HOC NETWORKS**

Introduction - Issues in designing a multicast routing protocol - Operation of multicast routing protocols - An architecture reference model for multicast routing protocols -Classifications of multicast routing protocols - Tree-Based multicast routing protocols - Mesh-based multicast routing protocols - Summary of tree and mesh based protocols - Energy-efficient multicasting - Multicasting with quality of service guarantees - Application-dependent multicast routing - Comparisons of multicast routing protocols.

**Unit-4****TRANSPORT LAYER, SECURITY PROTOCOLS**

Introduction - Issues in designing a transport layer protocol for Ad hoc wireless networks - Design goals of a transport layer protocol for Ad hoc wireless networks -Classification of transport layer solutions - TCP over Ad hoc wireless networks - Other transport layer protocols for Ad Hoc wireless networks - Security in Ad hoc wireless networks - Network security requirements - Issues and challenges in security provisioning - Network security attacks - Key management - Secure routing in Ad hoc wireless networks.

**Unit-5****QoS AND ENERGY MANAGEMENT**

Introduction - Issues and challenges in providing QoS in Ad hoc wireless networks -Classifications of QoS solutions - MAC layer solutions - Network layer solutions - QoS frameworks for Ad hoc wireless networks energy management in Ad hoc wireless networks -Introduction - Need for energy management in Ad hoc wireless networks - Classification of energy management schemes - Battery management schemes - Transmission power management schemes - System power management schemes.

**References:**

1. C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Pearson Prentice-Hall, 2004.



2. C.K. Toh, "Ad Hoc Mobile Wireless Networks: Protocols and Systems", Prentice-Hall of India, 2001.

<b>MTCS-301</b>	<b>RESEARCH METHODOLOGY</b>	<b>L T P</b> <b>3 0 0</b>
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#### **Unit-1**

**An Introduction:** Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India

#### **Unit 2:**

**Research Design :** Research design, Methods of research design, research process and steps involved, Literature Survey

#### **Unit-3**

**Sampling Design:** Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, Measurement and Scaling Techniques.

#### **Unit-4**

**Methods of Data Collection:** Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection.

#### **Unit 5:**

**Technical writing and research report documentation:** Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing and citation of Journals, Intellectual property, Plagiarism.

#### **Text Books:**

1. C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques , New Age International publishers, Third Edition.
2. Ranjit Kumar, Research Methodology: A Step- by- Step Guide for Beginners, 2nd Edition, SAGE, 2005
3. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
4. Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013.

<b>MTCS302/</b> MTCS-032	<b>Advanced Computer Networks</b>	<b>L T P</b> <b>3 0 0</b>
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**Unit 1:**

**Introduction:** Computer Networks and Devices, Introduction to Layered Architecture, LAN technologies, Routers and Routing Algorithms, Modern networks (e.g. Sensor networks, Mobile networks, Vehicular networks and their performance), Distributed systems: Basic concepts, main issues, Basics of Internet of Things (IoT) and Cloud Computing.

**Unit 2:**

**Data Link Protocols and Internetworking:** Ethernet, Token Ring and Wireless (802.11), Wireless LAN technologies, Cellular Networks and Mobile IP. Intra-Domain and Inter-Domain Routing Protocols, Congestion Control, Logical Addressing, IPv4, and IPv6.

**Unit 3:**

**Transport and Application Layer Protocols:** Client-Server and Peer-to-Peer Application Communication, Mobile Transport Protocols, P2P File Sharing, Pipelined Protocols: go-Back-N, Selective Repeat, Application Layer Protocols for IoT.

**Unit 4:**

**Network Performance and Data Communication:** Network Simulation and Performance Issues, Routing Protocols in Wired and Wireless Networks, Communication Satellites, Multiplexing, Switching.

**Unit 5:**

**Network Security:** Cryptography- Public key, Private key, Digital Signatures: Symmetric – key Signatures, Public-key Signatures, Firewalls, Public key Algorithms: RSA and other Public-key Algorithms, Domain Name System (DNS)- Electronic mail and World Wide Web (www).

## REFERENCES:

1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tanenbaum, Computer Networks, Pearson Education
3. W. Stallings, Data and Computer Communication, Macmillan Press
4. Anuranjan Misra, "Computer Networks", Acme Learning
5. G. Shanmugarathinam, "Essential of TCP/ IP", Firewall Media