DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

LIST OF COURSES OFFERED FOR MINOR PROGRAM (R20)

Course code	Course Title	Contact hours/week				Credits
		L	T	P	**Total**	
20CSM1	Fundamentals of Data Structures	3	1	0	4	4
20CSM2	Principles of Object Oriented Programming	3	1	0	4	4
20CSM3	Operating Systems processes & Concepts	3	1	0	4	4
20CSM4	Introduction to Database Systems	3	1	0	4	4
20CSM5	Fundamentals of Computer Networks	3	1	0	4	4
20CSM6	Introduction to Software Engineering	3	1	0	4	4
20CSM7	Introduction to Design and Analysis of Algorithms	3	1	0	4	4
20CSM8	Data Mining and Knowledge discovery	3	1	0	4	4

B.Tech-CSE	20CSM1 – FUNDAMENTALS OF DATA STRUCTURES	L	T	P	Cr.
		3	1	0	4

Pre-requisite : Programming Language

Course Educational Objectives:

The objective of the course is to make students familiar with writing algorithms to implement different data structures like stacks, queues, trees and graphs, and various sorting techniques.

Course Outcomes (COs): *At the end of this course, the student will be able to*

CO 1: Write the algorithms for various operations on list using arrays and linked list and analyze the time complexity of its operations.**(Understand - L2)**

CO 2: Apply linear data structures like stack and queue in problem solving.(**Apply - L3**)

CO 3: Demonstrate various searching and sorting techniques and compare their computational complexities in terms of space and time.**(Understand - L2)**

CO 4: Write the algorithms for various operations on binary trees,binary search trees and AVL trees.(**Understand - L2**)

CO 5: Demonstrate graph traversal techniques and hashing techniques.(**Understand - L2**)

UNIT - I

Introduction Abstract Data Type (ADT)

List : List ADT, List using arrays and linked list- Singly Linked List, Doubly Linked List, Circular LinkedList.

UNIT – II

Stacks: Stack ADT, Implementation using arrays and linked list.

Applications of stacks: Infix to postfix expression conversion, Evaluation of Postfix expressions and balancing the symbols.

Queues:

Queue: Queue ADT, Implementation of Queue using arrays and linked list, circular queue

UNIT - III

Sorting: Bubble sort**,** Insertion Sort, Selection sort, Merge Sort, Quick Sort & Heap Sort

Searching: linear & Binary Search

UNIT - IV

Trees: Introduction, Binary Tree Representation using array and Linked list, Tree traversals- In order, pre order and Post order , Binary Search Trees and it's operations – Insert, delete, and search.

UNIT - V

Graphs: Fundamentals, Representation of graphs, Graph Traversals: BFS, DFS.

Hashing: Hash Table, Hash Function, Collision resolution Techniques- separate Chaining,

Open addressing, rehashing.

TEXTBOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd edition,2011
2. Reema Thareja, Data Structures using c, Oxford Publications, 1st Edition,2014.

REFERENCE BOOKS:

1. Langson, Augenstein &Tenenbaum, 'Data Structures using C and C++', PHI, 2nd Edition , 2015.
2. RobertL.Kruse, Leung and Tando, 'Data Structures and Program Design in C', PHI, 2nd edition, 2011.

B.Tech-CSE	20CSM2 -PRINCIPLES OF OBJECT ORIENTED PROGRAMMING	L	T	P	Cr.
		3	1	0	4

Pre-requisite : Programming for Problem Solving using C.

Course Educational Objective: The objective of the course is to learn the constructs of the Java programming language along with built-in facilities to create different applications such as console & graphical user interfaces. In the process of learning the language, they will be applying knowledge of object-oriented programming; they will get the fundamental knowledge reason collection framework.

Course Outcomes: At the end of this course, the student will be able to

CO 1 Demonstrate the fundamentals of object-oriented programming and basic building blocks of Java. **(Understand- L2)**

CO 2 Apply object-oriented programming principles for the development of reusable applications. **(Apply - L3)**

CO 3 Understand the importance of abstraction, user defined package creation and handling different exceptions. **(Understand- L2)**

CO 4 Develop multitasking applications using JAVA multithreaded programming and perform different operations upon various data structures by using collection framework. **(Apply – L3)**

CO 5 Develop GUI applications using AWT (Abstract Window Toolkit). **(Apply- L3)**

UNIT-I

Introduction to OOP: Programming paradigms, procedural programming language versus object-oriented language, principles of OOP.

Introduction to JAVA: Data types, variables, keywords, operators, and control statements.

UNIT-2

Introduction to Classes and Object: Class definition, variables, and methods. Declaring Objects, Constructors, and this keyword.

Classes and objects: overloading methods and constructors, parameter passing, returning objects, recursion. Access control, nested and inner classes, final and static keyword, variable and command-line arguments.

UNIT-3

String handling classes: String, StringBuffer, StringTokenizer.

Inheritance and polymorphism: Inheritance, types of inheritance, super keyword, polymorphism (overloading & overriding), dynamic method dispatch, abstract class, using final with inheritance.

UNIT-4

Interfaces and packages: Interface methods, inheritance in interfaces. API : The built-in JAVA packages and creating and managing user defined packages, importance of CLASSPATH.

Exception Handling: Exception hierarchy, importance of try, catch, throw, throws and finally. Block creation of user-defined exceptions, Assertions.

UNIT-5

Multithreading: Introduction, thread life cycle, creation of threads, naming a thread, joining a thread, thread priorities, daemon thread, thread pool, thread group, thread synchronization, Inter-thread communication.

TEXTBOOKS:

1. Herbert Schildt, "Java: The complete reference", TMH Publications, 7th edition, 2006.
2. Cay S. Horstmann, "Core Java Volume I – Fundamentals", Pearson, Eleventh edition, 2018.

REFERENCE BOOKS:

1. Dr.R.NageswaraRao, "Core JAVA: An Integrated Approach", Dreamtech Press, 1st Edition,2008.
2. E. Balaguruswamy, "Programming with JAVA", TMH Publications, 2ndEdition, 2000.
3. Patrick Niemeyer & Jonathan Knudsen, "Learning Java", O'REILLY Publications, 3rd Edition, 2005.
4. Benjamin J Evans & David Flanagan, "Java–in a Nutshell – A desktop quick reference", O'REILLY Publications, 6th Edition, 2014.

B.Tech. -CSE	20CSM3 - OPERATING SYSTEMS PROCESS & CONCEPTS	L	T	P	Cr.
		3	1	0	4

Pre-requisite **:** Knowledge of Computer fundamentals & Data structures& Algorithms

Course Educational Objective: The objective of the course is to provide basic knowledge of computer operating system structure and functioning, understand how Operating Systems evolved with advent of computer architecture, and comprehend the different CPU scheduling algorithms, page replacement algorithms, disk scheduling and identify best one.

Course Outcomes: At the end of this course, the student will be able to

CO1: Demonstrate the underlying principles and techniques of operating system**(Understand-L2)**

CO2: Interpret scheduling and communication methods of processes handled by operating systems**(Understand-L2)**.

CO3: Distinguish the process synchronization methods and deadlock handling approaches employed in operating systems**(Understand-L2)**.

CO4: Classify memory management techniques and virtual memory mechanisms**(Understand-L2)**.

CO5: Interpret the strategies of disk scheduling algorithms and file system architecture **(Understand-L2)**.

Unit-1:

Operating System Structures: Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, Virtual Machines, Operating-System Generation, System Boot.

Unit-2:

Processes: Process concept, Inter-process Communication,
Threads: Overview, Multithreading Models
Process Scheduling: Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, PRIORITY, ROUNDROBIN)

Unit-3:

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

Unit-4:

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention. Deadlock Avoidance, Deadlock Detection, Recovery from deadlock.

Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.

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Unit-5:

Virtual Memory Management: Demand Paging, Page Replacement, Allocation of Frames, Thrashing

Implementing File System: File-System Structure, Allocation Methods, Free-Space Management

TEXTBOOKS:

1. Silberschatz& Galvin, "Operating System Concepts", Wiley, 7th edition, 2007.

REFERENCE BOOKS:

1. William Stallings, "Operating Systems", PHI, 5th Edition, 2004.
2. B.A. Forouzan& R.F. Giberg, "Unix and shell Programming", Thomson, New Delhi, 1st Edition, 2003.
3. http://codex.cs.yale.edu/avi/os-book/OS9/slide-dir/index.html
4. https://swayam.gov.in/nd1_noc19_cs50/preview

B.Tech.-CSE	20CSM4 - INTRODUCTION TO DATABASE SYSTEMS	L	T	P	Cr.
		3	1	0	4

Pre-requisite : Data Structures

Course Educational Objective: The Objective of this course is to know about basic concepts of DBMS, Database Languages, Database Design, Normalization Process, Transaction Processing, Indexing.

Course Outcomes: At the end of this course, the student will be able to

CO1: State the Basic Components of Database Management System and data modelling using Entity-Relationship Diagrams. **(Understand -L2)**
CO2: Examine the relational model using Structured Query Language (SQL). **(Apply- L3)**
CO3: Employ principles of normalization for effective database design. **(Apply- L3)**
CO4: Demonstrate the necessity of transaction processing, Concurrency control mechanisms and recovery strategies in DBMS. **(Understand- L2)**
CO5: Describe file organization, indexing techniques and the competency in selecting NoSQL Database. **(Understand- L2)**

UNIT – I

Introduction: An overview of Database Management System, Database System Vs File System, Database System Concepts and Three Schema Architecture, Data Models, Database Schema and Instances, Data Independence, Database Languages, Database Structure.

Data Modelling using the Entity Relationship Model: ER model concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables.

UNIT – II

Relational Data Model and Language: Relational Data Model Concepts, Integrity Constraints: Entity Integrity, Referential Integrity, Key Constraints, Domain Constraints.

Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data types and Literals, Insert, Update and Delete Operations, Tables, Views and Indexes, Nested Queries, Aggregate Functions, Joins, Unions, Intersection, Minus, Cursors in SQL, Triggers in SQL.

UNIT – III

Normalization: Functional Dependencies, Normal Forms - First, Second, Third Normal Forms, BCNF, Inclusion Dependences, Loss Less Join Decompositions, Multi Valued Dependencies, Fourth Normal Form, Join Dependencies and Fifth Normal Form.

UNIT – IV

Transaction Processing Concepts: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializability, Recoverability, Deadlock Handling.

Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Recovery with Concurrent Transactions.

UNIT – V

Crash Recovery: Log Based Recovery, Checkpoints.

Physical Database Design: Storage and file structure, indexed files, hashed files, B+ trees, files with dense index; files with variable length records.

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TEXTBOOKS:

1. Henry F. Korth, Abraham Silberschatz, S.Sudarshan, "Database System Concepts", McGrawHill, 6th edition, 2009.
2. Shashank Tiwari, " ProfessionalNoSql", John Wiely& Sons, 2011.

REFERENCE BOOKS:

1. Raghu Ramakrishnan, JohanneseGehrke, ―Database Management System‖, McGrawHill, 3rd edition, 2000.
2. Date C J, ―An Introduction to Database System, Pearson Education, 8th edition, 2003.
3. RamezElmasri, ShamkanthB.Navathe, "Fundamentals of Database Systems", Addison Wesley, 6th edition, 2010.

B.Tech.-CSE	20CSM5-FUNDAMENTALS OF COMPUTER NETWORKS	L	T	P	Cr.
		3	1	0	4

Pre-requisite : Data Structures and Operating Systems

Course Educational Objective: The Objective of the course is to provide a foundation to understand computer networks using layered architectures. It also helps students to understand the various network models, addressing concept, routing protocols and design aspects of computer networks.

Course Outcomes: At the end of this course, the student will be able to

CO1: Understand the modern network architectures from a design perspective **(Understand- L2)**

CO2: Apply various Data Link layer design issues and error detection & correction techniques to solve collisions problems. **(Apply- L3)**

CO3: Demonstrate the network Layer functionalities **(Understand- L2)**

CO4: Outline the functions of transport layer protocols **(Understand- L2)**

CO5: Examine different application layer protocols. **(Understand- L2)**

UNIT-I

Data Communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media- guided and unguided.

UNIT-II

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

UNIT-III

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT-IV

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT-V

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls,

TEXTBOOKS:

1. Behrouz A. Forouzan, , "Data Communication and Networking", McGraw-Hill, 4th Edition, 2011.
2. Andrew S. Tanenbaum, "Computer Networks", Pearson New International Edition, 8th Edition, 2013.

REFERENCE BOOKS:

1. William Stallings, "Data and Computer Communication", Pearson Prentice Hall India, 8th Edition,2011
2. Douglas Comer, Internetworking with TCP/IP, Prentice Hall of India, Volume 1, 6th Edition, 2009.
3. W. Richard Stevens, "TCP/IP Illustrated" , Addison-Wesley, Volume 1, 2001.
4. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
5. http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm

B.Tech.-CSE	20CSM6 – INTRODUCTION TO SOFTWARE ENGINEERING	L	T	P	Cr.
		3	1	0	4

Pre-requisite : Object Oriented Programming

Course Educational Objective: The objective of the course is to provide understanding of different s/w process models and how to choose one among them by gathering the requirements from a client and specifying them. Using those requirements in the design of the software architecture based on the choices with the help of modules and interfaces. To enable s/w development, by using different testing techniques like unit, integration and functional testing, the quality assurance can be achieved.

Course Outcomes: At the end of this course, the student will be able to

CO 1 Understand the fundamentals of software engineering concepts and software process models. **(Understand-L2)**

CO 2 Apply the requirement elicitation techniques for preparing SRS and design engineering. **(Apply-L3)**

CO 3 Understanding the basic building blocks of UML, Class and object diagrams. **(Understand-L2)**

CO 4 Apply the behavioral models for real world applications. **(Apply-L3)**

CO 5 Demonstrate different software testing approaches for testing the real time applications. **(Understand-L2)**

UNIT – I:

Software and software Engineering: The evolving role of Software, Characteristics of Software, Importance of software Engineering, Changing nature of software, Legacy Software, Software Myths.

UNIT – II:

Software Process and Process Models: Layered technology, Process frame work, The process and Product, software process models, the water fall model, incremental model, the spiral and V Model, Component based s/w development, Unified process model,

UNIT – III:

Requirements Analysis and Software design: Requirements gathering and analysis, software requirements specifications (SRS).
Design Engineering: overview of design process, Design Concepts, Architectural Concepts

UNIT – IV:

Design Using UML: Building Blocks of UML, Defining things, relationships and diagrams, Common Mechanism in UML, Class and Object Diagrams

Behavioral Modeling: Interactions, Interaction diagrams, use cases, Use case Diagrams, Activity Diagrams, Events and signals, state machines, processes and Threads, time and space, state chart diagrams

UNIT – V:

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

Testing Techniques: Software testing fundamentals, Unit testing, Integration testing, Black box testing, white box testing, Debugging, System testing.

TEXTBOOKS:

1. Roger S. Pressman, "Software engineering- A practitioner 's Approach", TMH International Edition, 6th edition, 2005.

2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modelling Language User Guide", PEARSON ,4th Impression, 2012.

REFERENCE BOOKS:

1. Ugrasen Suman, "Software Engineering - Concepts and practices", Cengage learning,2nd Edition,2011
2. Mahesh P. Matha, "Object-oriented analysis and design using UML", PHI,3nd Edition,2015
3. Rajib Mall , "Fundamentals of Software Engineering", PHI,3rd Edition, 2010
4. https://onlinecourses.nptel.ac.in/noc20_cs68

B.Tech.- CSE	20CSM7 – INTRODUCTION TO DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	Cr.
		3	1	0	4

Pre-requisite : Programming language and Data structures.

Course Educational Objective: The Objective of the course is to learn various algorithm design techniques and analyze the computing resources of the algorithms ,and motivate the students to design new algorithms for various problems

Course Outcomes: At the end of this course, the student will be able to

CO1: Identify the characteristics of an algorithm and analyze its time and space complexity. **(Understand- L2)**
CO2: Apply the divide-and-conquer method for solving problems like searching and sorting. **(Apply- L3)**
CO3: Design Greedy algorithms for the optimization problems like knapsack problem, minimum cost spanning tree, single source shortest path problem. **(Apply - L3)**
CO4: Apply dynamic programming paradigm to solve optimization problems like travelling salesperson problem,0/1 knapsack problem, Optimal binary search tree. **(Apply - L3)**
CO5: Apply the backtracking method on optimization problems like N-queens, sum of subsets, Hamiltonian circuit and graph coloring. **(Apply - L3)**

UNIT – I

Introduction: Algorithm definition, Specifications, Performance Analysis- Time Complexity, Space Complexity. Asymptotic Notations-Big-Oh, Omega, Theta.

UNIT – II

Divide and Conquer: General Method, Binary Search, Finding Maximum and Minimum, Merge Sort, Quick sort, Strassen's matrix multiplication, Closest Pair of Points using Divide and Conquer algorithm

UNIT – III

The Greedy Method – General Method, Knapsack Problem, Job sequencing with deadlines, Minimum-cost spanning trees, Optimal storage on tapes, Single source shortest paths, Huffman coding.

UNIT - IV

Dynamic Programming - General method, Multistage graph, All pairs shortest path, Single Source Shortest path, Optimal Binary search trees, 0/1 Knapsack, Reliability design, the travelling salesman problem.

UNIT-V

Back tracking - The General Method, The 8-Queens Problem, Sum of subsets, Graph Coloring, Hamiltonian cycles.

TEXTBOOK(S):

1. Ellis Horowitz, SartajSahni,S Rajasekaran , "Fundamentals of Computer Algorithms", University press, 2nd edition, 2012.

REFERENCE BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson, 3rd edition , 2007.
2. Aho, Hopcroft & Ullman, "The Design and Analysis of Computer Algorithms", Addison Wesley publications, 2008.
3. Thomas H.Corman et al, "Introduction to Algorithms", PHI, 3rd edition, 2008
4. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", PEA,
5. P. H. Dave, H. B. Dave, "Design and Analysis of Algorithms‖, Pearson Education", 2008.

B.Tech.- CSE	20CSM8 - DATA WAREHOUSING AND KNOWLEDGE DISCOVER	L	T	P	Cr.
		3	1	0	4

Pre-requisite : Database Management Systems

Course Educational Objective: The Objective of the course is to introduce the concepts of data warehouse and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.

Course Outcomes: At the end of this course, the student will be able to

CO1: Summarize the architecture of data warehouse. **(Understand- L2)**
CO2: Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data. **(Apply – L3)**
CO3: Construct a decision tree and resolve the problem of model overfitting. **(Analyze – L4)**
CO4: Compare Apriori and FP-growth association rule mining algorithms for frequent itemset generation. **(Apply - L3)**
CO5: Apply suitable clustering algorithm for the given data set. **(Apply - L3)**

UNIT-I

Overview: The process of knowledge discovery in databases, predictive and descriptive data mining techniques, supervised and unsupervised learning techniques.

UNIT-2

Data Preprocessing – Need for Preprocessing the Data, Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT-3

Classification:-Introduction, Decision Tree, The Tree Induction Algorithm, Split Algorithms Based on Information Theory, Split Algorithm Based on the Gini Index, Overfitting and Pruning,

Decision Trees Rules, Naïve Bayes Method.

UNIT-4

Clustering: Unsupervised learning for descriptive data mining, Basic issues in clustering, Partitioning methods, Hierarchical methods for clustering, Density-based methods, Cluster Validation methods and metrics.

UNIT-5

Association Rule Mining: Frequent item set, Maximal and Closed item sets, Apriori property, Apriori algorithm.

TEXTBOOKS:

1. Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression, Pearson, 2015.
2. Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011

REFERENCE BOOKS:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010.
2. Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
3. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008.
4. Data Mining Techniques, Arun K Pujari, Universities Press, 2001