Syllabus

Course Name: Database Management System **[2:0:2=3]**

Course Content:

Introduction to DBMS: Basic Concepts, Conceptual Database Design, Schemas and Instances, DBMS Architecture /3-tier Architecture, Data Independence, Database Languages, Overview of Hierarchical, Network and Relational DBMS. Data Modeling Using ER-Model: Basic Terminology Related to ER-Models, Notations Used in ER- diagrams, Strong and weak Entity Sets, Generalization, specialization and Aggregation, Translating ER-Model into Relational Model. Relational Model: Introduction, Terminologies Related to Relational Models, Types of Keys, Relational Integrity Rule, Entity Integrity Rule, Referential Integrity Rule, Codd's Rules, Relational Algebra. SQL: Introduction MS SQL, Features of SQL, Data Definition Language (DDL), Constraints, Data Manipulation Language (DML), Data Query Language (DQL), Datatypes, Operators, Functions in SQL, Where, Group BY and Having Clauses, Joins, Subqueries, Views, Procedures, Roll Back, Commit and Save Point. Normalization: Introduction, Terminologies Related to Normalization, First Normal Form (1NF), Functional dependency, Second Normal Form (2NF), Transitivity dependency, Third Normal Form (3NF) and BCNF, Fourth Normal Form (4NF), Fifth Normal Form (5NF). Transaction Management: Introduction, Transaction Concept and Properties, State of a Transaction, Concurrent Executions, Scheduling of transactions, Operations Conflicts, Testing for Serializability, Conflict schedule, View Serializability, Recoverability of Schedule. Concurrency Control Techniques: Introduction, Three Problems of Concurrency Control -Case Studies, Lock -Based Protocol, Deadlock Handling, Recovery System, Failure Classification, Time stamping Protocol, Validation based Protocol, Thomas Write Rule, Multiple Granularity Recovery And Atomicity: Introduction, Categorization of Recovery Algorithm, Terminologies Used, Log-based Recovery, Shadow Paging, Recovery with concurrent Transaction, Check Points / Syncpoints /Save Points. Indexing: Introduction, Type of index, Clustered vs non-clustered index.

Course Outcomes:

CO1: Understand and apply principles of database design, including entity-relationship modeling and normalization techniques and translating the design into an actual database structure.

CO2: Apply the learned concepts to break complex problems into subproblems and use the concepts of ER-Model, normalization, transaction management, etc. to minimize data redundancy and ensure data integrity.

CO3: Analyze the database and execute SQL queries to retrieve specific information from the database and to optimize queries for better performance.

Text Book:

1) Database System Concepts - 6th edition - Avi Silberschatz
2) Database Management Systems By Raghu Ramkrishnan, Gehrke

Reference Book:

1) Fundamentals of Database Systems - Elmasari , Navathe.
2) SQL, PL/SQL the Programming Language of Oracle by Ivan Bayross

Course Name: Design and Analysis of Algorithms [2:0:2=3]

Course Content:

Preliminaries: Algorithms, Analyzing algorithms - problems and instances; efficiency- average and worst-case analysis; elementary operations. Complexity of algorithms, Growth of functions and Asymptotic notations, Performance measurements, pseudo code, RAM model. Quick Review of Data Structures: Stack, Queue, Linked List, BST, Disjoint-set data structures. Concept of Heap and Heap sort, Comparison of sorting algorithms, Sorting in linear time. Divide and Conquer: Recurrence relations, Masters method, Merge sort, Quick sort, Matrix multiplication. Divide and conquer – Binary search. Greedy Methods: Introduction to greedy algorithms – examples such as Fractional Knapsack problem, Minimum Spanning Trees – Prim's and Kruskal's algorithms, Single source shortest paths - Dijkstra's algorithm, Huffman coding. Dynamic Programming: Matrix-chain multiplication problem; Longest common subsequence problem; 0/1-Kanpsack problem, Single source shortest paths - Bellman Ford algorithm. All pair shortest paths – Floyd-Warshall algorithm. String/Pattern Matching: Brute force method for string matching, Boyer-Moore algorithm, KMP algorithm. Correctness of Algorithms: Loop invariant technique and induction. Intractable problems - Backtracking with examples such as N-Queens problem, Branch and Bound. Introduction to Non-deterministic algorithms, NP-Completeness and NP-Hard problems with discussions on Travelling Salesman problem, 3-SAT, Graph Coloring, Hamiltonian Cycles and Sum of Subsets, Cook's Theorem. Undecidable problem: Halting problem.

Course Outcomes:

CO1: Apply the concepts of math and computer science to understand algorithm theories.

CO2: Analyze given problem and find algorithmic solution for computationally hard problems in a reasonable time.

CO3: Design suitable algorithms for finding solutions to novel real-world problems, considering practical implementation technologies.

Text Book:

1) Thomas H. Cormen, Charles E. Leiserson, Ronald Rivest, Clifford Stein; "Introduction algorithms" 3rd edition, Prentice Hall of India.
2) Anany Levitin: "Introduction to the design and analysis of the algorithms" 2nd Ed. Person.

Reference Book:

1) Sara Baase and Allen Van Gelde; "Computer Algorithms: Introduction to Design and Analysis, 3rd Ed., Pearson.
2) Robert Sedgewick and Kevin Wayne, "Algorithms", 4th Ed., Addison-Wesley Professional.
3) J. Kleinberg, E Tardos; "Algorithm Design", Pearson, A. V. Aho, J. E. Hopcraft, J. D. Ullman, "The Design and Analysis of Computer Algorithms" Pearson.
4) M. T. Goodrich and R. Tamassia, "Algorithm Design – Foundations, Analysis and Internet Examples", Student Ed., Wiley India Pvt. Ltd.
5) Steven S Skiena, The Algorithm Design Manual, 2nd Ed. Springer Verlag.

Course Name: Data Communication & Computer Networks **[2:0:2=3]**

Course Content:

Introduction to Networking. Application Layer (Web and HTTP, Email, P2P Applications). Transport Layer (UDP/TCP, TCP Connection Set-up and Tear-Down); Reliable Data Transfer (Stop-&-Wait; Efficiency of Protocol Design); Go-Back-N, Selective Repeat; RTT Estimation; TCP Flow & Congestion Control. Network Layer - Data Plane vs. Control Plane; Network Service Model & SDN Overview; IPv4 Addressing and DHCP; IP Datagram Forwarding and Longest Prefix Matching. Data Link Layer Overview; MAC Addresses and ARP; IP & Data Link Layer Interaction; IPv4 Datagram Fragmentation and Reassembly; NAT; IPv6; Virtual Circuits and MPLS; VLAN. Bridges & Switches: Ethernet Self-Learning & Spanning Tree; outer/Switch Architecture and Packet Scheduling; Openflow and SDN. Network Control Plane: Distributed vs. Centralized Control; Basic Routing Algorithms; Internet Routing Protocols: RIP, OSPF; Inter- domain Routing and BGP; ICMP & SNMP; Media Access Control Protocols; DOCSIS. Wireless Links, Wireless LANs & WiFi (802.11); Mobile Cellular Networks; Mobility Management.

Course Outcomes:

CO1: To understand the fundamental underlying principles of computer networking.

CO2: To analyze the details and functionality of layered network architecture.

CO3: To apply the acquired knowledge to interpret how protocols work and the what are the requirements for designing new protocols.

Text Book:

1) "Computer Networking: A Top-Down Approach," by James F Kurose and Keith W Ross, Pearson, 7th edition.
2) "Computer Networks," by Andrew S. Tanenbaum, Prentice Hall, 4th edition.

Reference Book:

1) Data Communications and Networking by Behrouz A. Forouzan, 4th Edition, McGraw Hill.
2) Computer Networks: Principles, Technologies and Protocols for Network Design by Natalia Olifer and Victor Olifer, 4st Edition, John Wiley and Sons.

Course Name: Operating Systems **[2:0:2=3]**

Course Content:

Processes and operations performed on the process, process state diagram, role of context switching and dispatcher. CPU scheduling, and under which condition this scheduling is done and goals related to it. Different CPU Scheduling Algorithms: First Come First Serve, Shortest Job First, Round Robin Scheduling, Longest Job, First, Highest Response Ratio Next, Priority Based Scheduling, Multilevel Queue Scheduling, and Multilevel Feedback Queue. Process Synchronization, Concurrent programming. Deadlocks: Detection, Prevention and Recovery. Threads: advantages and categorization. Contiguous and non-contiguous memory management techniques. Main memory management and Virtual Memory management. Page replacement algorithms: First in First Out, Optimal Page Replacement, Least Recently Used and Most Recently Used. File management, directory structure, operation, and disk space allocation method, Shell Scripting.

Course Outcomes:

CO1: Understand how application software interacts with hardware with the help of operating system.

CO2: Implement various CPU scheduling algorithms.

CO3: Analyse operating system with respect to process management, memory management etc.

Textbook:

1) Operating Systems Concepts – A. Silberschatz, P. Galvin and G. Gagne. Wiley India

Course Name: Mobile Application Development **[1:0:2=2]**

Course Content:

Introduction to Android, History of Android versions, Android versions and its feature set, Android development environment system, Requirements, Android SDK, Installing Java, Creating Android Virtual Devices (AVDs). Android Runtime - Dalvik Virtual Machine, Android runtime – core libraries, Creating an activity, Running/stopping/modifying application in AVD, Layout Managers (Constraint, Linear, Relative) , Resource files, Activity lifecycle and saving State, Activities and Intents, Implicit intent, Explicit intent, working with Implicit and Explicit intent. Designing for Different Android Devices, Views and View Groups, Screen Navigation using App Bar and Tabs, Fragment and Fragment Manager, Creating navigation drawer, Loading different fragments on clicking different menu item, Date and Time picker, List View, Grid View, Spinner, Recycler View, Turning on Wi-Fi and Bluetooth, Accessing camera and multimedia (Audio and Video), Sending SMS, Interacting with WhatsApp, Sending email, Dialling a number. Introduction to location-based service, configuring the Android Emulator for Location- Based Services, Geocoding and Map-Based Activities. Development of application using Firebase database, Testing and deploying these applications on SDK and on the device

Course Outcomes:

CO1: Understand the Android booting process, underlying Android system architecture and different .

CO2: Design and develop an application based on real word scenario to demonstrate the interaction between user-interface and android platform.

Text Books:

1) Griffiths, D., & Griffiths, D. (2017). Head first android development: a brain-friendly guide. " O'Reilly Media, Inc.".

2) Hardy, B., & Phillips, B. (2017). Android programming: the big nerd ranch guide. Addison-Wesley Professional.

Reference Book:

1) Horton, J. (2018). Android Programming for Beginners: Build in-depth, full-featured Android 9 Pie apps starting from zero programming experience. Packt Publishing Ltd.

Course Name: Human Computer Interaction **[1:0:2 =2]**

Course Content:

Understanding Design Issues and HCI Approach to UI design, How to Understand User's Needs, Ethnography and Market Research, Contextual Inquiry, Various Techniques to conduct contextual inquiry, Understanding HCI process in industry, Various theories, and models behind User Experience Design e.g Task Analysis. Prototyping – Sketching Low Fidelity and High-Fidelity Prototypes, Conducting User Tests, Processes for Building Applications, Websites and Mobile apps design evaluation, Understanding Design Patterns, Fundamentals of Visual Designs, Data Gathering Techniques, Discount Usability, Action Analysis and GOMS, Usability and User Experience Evaluation, Reporting User Interviews, Remote Usability Testing

Course Outcomes:

CO1: Sketching Low & Hi Fidelity prototyping.

CO2: Learn the skills of usability and user experience evaluation.

Text Book:

1) The Design of Everyday Things - Donald A Norman

2) Interaction Design – Rogers Preece Sharp

Course Name: Practice School II **[4 Credits]**

Course Content:

Practice School at BMU serves as a holistic bridge between industry exposure and university learning, fostering students' proficiency in corporate work settings and deepening their understanding of the dynamic demands and challenges in a professional workplace. This educational initiative promotes experiential and collaborative learning, contributing to innovation and research within the country.

The Practice School-II (PS-II) course is conducted in the summer term immediately following the completion of the 2nd year of the B.Tech. degree programme. The duration of the PS-II course is 6-8 weeks, and it is offered during the summer after students have completed two years of coursework, which includes a well-balanced mix of Foundation, Skill, Perspective, and Core courses.

PS-II holds significance as an integral part of the curriculum. In this course, students are awarded letter grades, and these grades are factored into the CGPA calculations. The PS-II course provides a comprehensive exposure to the professional workplace, allowing students to understand real-time industry scenarios, learn organizational structures and functions, develop personality traits, and enhance communication and presentation skills. This opportunity for practical experience takes place in a company's professional setting, offering students a chance to intern and develop their abilities as industry professionals.

The students address pre-defined problems within the host organization, working independently under the guidance of an Industry Mentor and supported by a Faculty Mentor. Periodic assessments by the Faculty Mentor at the work site ensure ongoing progress. The culmination of PS-III involves the student defending their project work before a departmental panel.

Course Outcomes:

CO1: Demonstrate critical thinking, keen observation, and effective communication skills.

CO2: Attain advanced self-directed learning experiences characterized by depth, complexity, and active engagement within an industrial setting.

CO3: Analyze, evaluate, and critically assess existing solutions and strategies to address real case problems encountered during the internship.