SEM IV EComE

Syllabus

Course Name: Discrete Mathematics **[2:0:0=2]**

Course Content:

Equivalence relations and Equivalence Classes and Partition, Digraph, Partial order Relation, Lexicographic Order Relation, Hasse diagram, Poset. Mathematical Induction and strong induction, Recursive definition, Recurrence Relations. The Division algorithm, The Greatest Common Divisor, Prime Numbers, The Fundamental Theorem of Arithmetic, Pseudoprimes, Modulo arithmetic, Linear congruences, Chinese remainder theorem. Basic Connectives and Truth Tables, Logical Equivalence, The Laws of Logic, Logical Implication, Rules of Inference, Validity of Arguments, The use of Quantifiers, Predicate Logic, Arguments in Predicate Logic. Pigeonhole Principle, Generalized Pigeonhole Principle, Generalized Permutations and Combinations. Graph Terminologies and Types of graphs, Representing Graph, Adjacency, and Incidence Matrix, Connectivity, Euler and Hamiltonian Paths, Prim's algorithm and Dijkstra's algorithm for shortest path.

Course Outcomes:

CO1: Understand mathematical relations and their representations, principle of mathematical induction, basic and advanced counting techniques, number theoretic techniques, predicate and propositional logic, rules of inference and graphs.

CO2: Apply the concept of equivalences classes, partitions of a set, mathematical induction and counting techniques, rules of inference, linear congruence, graph theory in solving various problems. Apply the concepts of logic to translate a given sentence in terms of predicates, quantifiers, and logical connectives. Apply modulo arithmetic in cryptography and network security.

CO3: Analyze the validity of an argument using predicate logics and the complexity of encryption-decryption techniques in cryptography and efficiency of shortest path algorithms.

CO4: Model real world computer science problems and find their solutions using computer algorithms, programs and write a project to summarize the findings.

Textbook:

1) Kenneth Rosen, Discrete Mathematics and Its Applications, 7th Ed, McGraw Hill Publishing Co., 2012.

Course Name: Circuit Analysis and Synthesis **[2:1:0=3]**

Course Content

Network Theorems: Review of Thevenin's theorem, Norton's theorem, Superposition theorem and Maximum power transfer theorem; Compensation theorem, Reciprocity theorem and Tellegen's theorem.

Network Topology: Network graph, Tree, Co tree, Link, Cut set, Node incidence matrix, Loop incidence matrix, Cut set incidence matrix, Primitive network, Bus impedance/admittance matrix, Branch impedance/admittance matrix, Loop impedance/admittance matrix.

Transient Circuit Analysis: Natural response of series and parallel RL, RC and RLC circuits, Forced functions (unit step, impulse and ramp inputs) of series and parallel RL, RC and RLC circuits through Laplace method and Matlab Analysis.

Two Port Networks: Open circuit impedance, Short circuit admittance, Hybrid parameters, Transmission parameters, Series and parallel connection of networks, T network & Π network representation.

Network Functions: Transfer function of a network, poles and zeros, Driving point function, Routh Hurwitz Criteria.

Network Synthesis: Positive real function and its properties, Hurwitz polynomials, Foster forms and Cauer forms.

Course Outcomes:

CO1: To understand the basic concepts of electric networks, theorems and synthesis, circuit matrices using graph theory, steady state and transient response, two-port networks.

CO2: To apply network theorems, graph theory and two port networks for determining parameters in electric circuits with independent/dependent sources.

CO3: To analyze natural and forced steady state and transient response of complex DC and AC networks.

Recommended Books:

1) M. S. Sukhija and T. K. Nagasarkar, "Circuits and Networks: Analysis, Design and Synthesis", Oxford Press, 4th Edition.
2) M. E. Van Valkenburg, "Network Analysis", Pearson, 3rd Edition.

Course Name: Linear Integrated Circuits **[2:0:2=3]**

Course Content

Introduction to integrated circuits: Advantages and characteristic parameters of IC's, basic building components, data sheets. Differential amplifier and analysis, Configurations- Dual input balanced output differential amplifier, Dual input Unbalanced output differential amplifier, Single input balanced output differential amplifier, Single input Unbalanced output differential amplifier. Introduction of Operational Amplifier, Block diagram, characteristics and equivalent circuits of an ideal op-amp, Power supply configurations for op-amp. Ideal and Practical characteristics of an op-amp, Input offset voltage, offset current, Input bias current, Output offset voltage, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio (CMRR), Slew rate and its effect, PSRR and gain bandwidth product, frequency limitations and compensations, transient response, analysis of TL082 datasheet. Applications of operational amplifier: Inverting and non-inverting amplifier configurations, Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO, Comparator, Zero Crossing Detector. Operational amplifiers as filters: Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, Notch filter; all pass filters, self-tuned filters, AGC,AVC using op-AMP. Timer ICs: Timer concept, Block pin configuration of timer. Monostable, Bistable and Astable Multivibrator using timer 555-IC, Schmitt Trigger, Voltage limiters, Clipper and clampers circuits, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision rectifiers, Voltage-to-current converter, Current-to-voltage converter. Voltage Regulator: simple OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs such as linear regulator, Switching regulator and low-drop out regulator. Study of LM317, TPS40200 and TPS7250.

Course Outcomes:

CO1: Understanding the basic concepts of linear integrated circuits, differential amplifier and features of operational amplifiers.

CO2: Applying the operational amplifier concepts in problem solving and forming elementary level circuits in order to produce basic mathematical operations.

CO3: Problem solving and analysis of important characteristics of operational amplifier by having knowledge of slew rate, CMRR, gain bandwidth product and use of frequency responses as well as timing circuits.

CO4: Designing of complex practical filters, timers, regulator and multivibrator circuits.

Recommended Books:

1) Ramakant. A. Gaikward,"OP- Amp and linear Integrated circuits" Third edition 2006, Pearson.
2) B. Visvesvara Rao Linear Integrated Circuits Pearson.
3) David A. Bell: Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition,2010.
4) Millman and Halkias: Integrated electronics, TMH.
5) Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education.
6) Sedra and Smith: Microelectronics, Oxford Press
7) D. Roy Choudhury:Linear Integrated Circuits New Age Publication.
8) S.Salivahanan,V S KanchanaBhaaskaran: Linear Integrated Circuits",second edition, McGraw Hill.

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

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: 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.

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

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.