

CSE41/5034
 PC 6/5/26

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MSE II SYLLABUS (JAN-JUNE 2026)			
S.NO	Semester	Course Name & Course Code	Syllabus
1	BTECH 2nd	Database Management Systems (CCS104)	<p>Unit 4 Normalization The purpose of Normalization, Data redundancy and update anomalies, Functional Dependencies Characteristics of Functional Dependencies, Identifying Functional Dependencies, Identifying the Primary Key for a Relation. The Process of Normalization- First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF). Advanced Normalization- More on Functional Dependencies - Inference Rules for Functional Dependencies, Minimal Sets of Functional Dependencies. Boyce-Codd Normal Form (BCNF) - Definition of BCNF. Fourth Normal Form(4NF) - Multi-Valued Dependency, Definition of Fourth Normal Form. Fifth Normal Form (5NF)- Lossless-Join Dependency, Definition of Fifth Normal Form</p> <p>Unit 5 Database Storage Structures Database Storage Architecture, File Organization, Organization of Records in Files, Data-Dictionary Storage, Database Buffer, Column-Oriented Storage, Storage Organization in Main Memory Databases. Indexing-Basic Concepts, Ordered Indices, B+ Tree Index Files, Hash Indices. Unit 6 Transaction Management Transactions-Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability. Concurrency Control-Lock-Based Protocols, Deadlock handling, Multiple Granularity, Insert Operations, Read operations and Predicate Reads, Timestamp-Based Protocols, Validation-Based Protocols. Recovery System Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm-Log Based Recovery and Shadow Paging. Unit-7 Advanced Databases NoSQL Databases-Introduction to NoSQL Systems, The CAP Theorem, Document-Based NoSQL Systems and MongoDB, NoSQL Key-Value Stores, Column-Based or Wide Column NoSQL Systems, NoSQL Graph Databases and Neo4j. Other Advanced Databases- Introduction of Cloud Databases, Spatial and Geographic information system (GIS) Databases and their applications</p>
2		Operating System (CCS-105)	<p>Hardware Solution- Test and Set instruction, The Producer/Consumer Problem, Semaphore. Part-B Unit-4 Deadlocks: Introduction to deadlocks, Conditions for deadlock, Resource allocation graphs, Deadlock prevention and avoidance, Deadlock detection and recovery. Unit-5 Memory Management: Basic concept, Logical and Physical address map, Swapping, Memory allocation - Contiguous Memory allocation, Fixed and variable partition, Internal and External fragmentation and Compaction, overlay, Paging - Structure of the Page Table, Allocation of Frames, Segmentation. Virtual Memory Management - Demand Paging, Page Replacement algorithms, Thrashing. Unit-6 File and storage Management: Concept of File, Access methods, File types, File operation, Directory structure, Allocation methods (contiguous, linked, and indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table). Secondary Storage: Disk structure, Disk scheduling algorithms. Case study 2: Implementation of Mobile Operating systems and Robotics Operating systems.</p>

3		<p>Computer Networks (CCS-106)</p>	<p>Network Layer: Logical addressing- Classful and classless, IPv4 and IPv6 Address Format. Network Layer Protocols ARP, RARP - Concept and Format of ARP Packet. DHCP- Message Format and working operation. IPv4 and IPv6- Header Format and Comparison. Routing algorithms- Concept of Routing Table, Static and Dynamic routing. Unicast Routing- Inter-domain and Intra-domain. Intra-domain- Distance vector routing, Link State Routing- Dijkstra Algorithm. Inter-domain- Path Vector Routing. Congestion Control Algorithms- Leaky Bucket and Token Bucket Algorithms. Congestion Control Polices- Openloop Congestion Control, Closed-loop Congestion Control. Transport Layer: Services- Process to Process Communication, Addressing, Connectionless and Connection Oriented Services, Multiplexing and De-Multiplexing, Flow Control, Error Control. User Datagram Protocol (UDP)- Header Format and its Applications. Transmission Control Protocol (TCP)- Header Format and its Applications. Elements of Transport Protocols- Three way handshaking Connection Establishment and Release. Session, Presentation and Application Layer: Data Compression Techniques- Lossless and Lossy Compression Techniques. Domain Name Space (DNS)- Purpose, Namespace, DNS in the Internet, Resolution. TELNET- Local versus Remote Logging, EMAIL- Architecture, FTP (File Transfer Protocol)- Control Connection, Data Connection, FTPS, WWW (World Wide Web)- Architecture HTTP (Hyper Text Transfer Protocol), HTTPS.</p>
4		<p>Discrete Mathematics (CCS-107)</p>	<p>Unit-4 Number Theory The division algorithm, modular arithmetic, Primes and greatest common divisors: The fundamental theorem of arithmetic, Euclidean algorithm. Congruences: Congruence relation, Linear congruence equation, The Chinese remainder theorem, Applications of Congruences. Unit-5 Algebraic Structures and Morphism Algebraic structures with one binary operation, Properties of an operation, Congruence relation, Semigroups, Monoids, Groups, Substructures, Cyclic groups, Cosets, Normal subgroups, Dihedral groups, Permutation Groups. Homomorphism and isomorphism of groups, Applications of groups. Algebraic structures with two binary operations, Rings – Introduction, Abelian ring, Ring with unity, Multiplicative inverse, Subrings, Homomorphism of rings. Integral Domain, Ideals. Unit-6 Graph Theory Graphs – Definition, degree, Connectivity, path, cycle, Directed and undirected, Sub Graph, Biconnected component and Articulation points. Eulerian chains and cycles, Hamiltonian chains and cycles, shortest paths algorithms – Dijkstra’s algorithm, Warshall’s algorithm. Rooted trees, Spanning tree algorithms – Kruskal’s algorithm, Prim’s algorithm. Graph coloring, Map Coloring, Chromatic number, Planar graphs, Euler’s formula, Isomorphism and homomorphism of graphs, Applications of graph theory</p>
5		<p>Artificial Intelligence (CCS108)</p>	<p>Part-B Unit-5 Planning : Basic representation of plans, Partial order planning, Planning in the blocks world, Hierarchical planning, Conditional planning, Representation of time, schedule and resource constraints, Measures, temporal constraints. Unit-6 Uncertainty : Basic probability, Bayes rule and its use, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making– Utility theory, Utility functions, Decision theoretic expert systems. Unit-7 Introduction to Machine Learning and Deep Learning: Introduction to machine learning, Types of learning - Supervised, Unsupervised, Reinforcement Learning, Introduction to neural networks and deep learning. Unit-8 Advancements in AI: Explainable AI (XAI), Edge AI, Generative AI, AI for Social Good - Applications of AI in healthcare, education, climate change, and sustainability, AI Security - Protecting AI systems from attacks and ensuring secure AI development), Case studies of AI-driven innovations - Smart Speakers, Self-Driven cars, Smart Agriculture, etc.</p>

7		<p>Compiler Design (PCCS-112)</p>	<p>Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. Intermediate Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Switch-Statements, Intermediate Code for Procedures. Code Generation: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment. Machine-Independent Optimizations: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs</p>
8	BTECH 6th	<p>Computer Graphics (PCCS-113)</p>	<p>2D Viewing and Clipping: The viewing pipeline, Window-to-viewport transformation, Point clipping, Line clipping algorithms – Cohen-Sutherland, Liang-Barsky, Nicholl-Lee-Nicholl. Polygon clipping algorithms –Sutherland-Hodgeman, Weiler-Atherton. Curve and text clipping. 3D Transformations and Viewing: 3D geometric transformations – Scaling, Rotation, Translation, Reflection, Shear. Composite transformations, 3D viewing, Viewing pipeline, Parallel projections, perspective projections, classifications of projections. Visible-Surface Detection: Classification of visible-surface detection algorithms. Techniques for efficient visible-surface algorithms–Back face detection, Depth-buffer method, A-buffer method, Scan line method, Depth sorting method, BSP tree Method, Area-subdivision method, Octree Methods, Ray casting method. Surface Rendering: Light sources, Surface lighting effects, Illumination models, Polygon rendering methods – Constant-intensity shading, Gouraud shading, Phong shading, Fast Phong shading.</p>
9	BTECH 6th	<p>Machine Learning (PCCS-114)</p>	<p>Artificial Neural Networks: Introduction, Neural network representation, appropriate problems for neural network learning, perceptron, gradient descent and the delta rule, Adaline, Multilayer networks, Derivation of Back propagation rule, back propagation algorithm, Initialization, Training & Validation. Bayesian Learning: Introduction, Bayes theorem and concept learning, Maximum likelihood and least squared error hypothesis for predicting probabilities, minimum description length principle, Bayes optimal classifier, Naive Bayes classifier, Bayesian belief networks. Genetic Algorithms: Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning. Design and Analysis of Algorithms: Study of factors and responses related with experimentation, Hypothesis testing, performance analysis, Evaluation measures-bootstraping & cross-validation, ROC curve.</p>
10	BTECH 6th	<p>Cyber Security (PCCS-115)</p>	<p>Micro ATM, e-wallet and POS Security: Security of Micro ATMs, e-wallet Security Guidelines, Security Guidelines for Point of Sales (POS), Cyber Security Exercise, Cyber Security Incident Handling, Cyber Security Assurance. [5 Hours] Social Engineering, Threat Landscape and Techniques: Social Engineering, Types of Social Engineering, How Cyber Criminal Works, How to prevent for being a victim of Cyber Crime, Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques, Firewall. [6 Hours] Information Recovery Tools: Recovering from Information Loss, Destroying Sensitive Information, CCleaner for Windows, Various Case Studies. [6 Hours]</p>

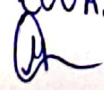
11	Network Security and Cryptography (PECS-108)	<p>Modern Symmetric-key Ciphers: Modern Block cipher, components of block cipher, two classes of product cipher, Feistel structure, Data Encryption Standard (DES). Modern stream ciphers, Advanced Encryption Standard (AES), Stream ciphers – RC4. Public Key Cryptography and RSA: Symmetric – Key vs Asymmetric-key cryptosystems, Principles of public key cryptosystems, RSA algorithm and its attacks, Diffie Hellman Key Exchange. [4 Hours] Data Integrity and Authentication: Message: Hash function (SHA-1), Message Authentication (MD5), Digital Signature: services, attacks on digital signature, RSA Digital signature scheme. Internet Security Protocols: General structure of Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET), Email Security: Pretty Good Privacy (PGP), IP Security – Overview, IP security architecture modes, security protocols: Authentication header(AH) and Encapsulation security payload (ESP).</p>
12	Advanced Database Management Systems (PECS-114)	<p>Distributed Databases and Client-Server Architectures: Distributed Database Concepts, Data Fragmentation, Replication, and Allocation techniques for Distributed Database Design. Types of Distributed Database Systems, Query Processing in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases. Overview of Data Warehousing and OLAP: Introduction, Characteristics of Data Warehouses, Data Modeling for Data Warehouses, Building a Data Warehouse, Typical Functionality of a Data Warehouse, Data Warehouse versus Views, Problems and Open Issues in Data Warehouses. Data Mining Concepts: Overview of Data Mining Technology, Association rules, Classification, Clustering, Approaches to Other Data Mining Problems, Application of Data Mining, Commercial Data Mining Tools. Emerging Database Technologies and Applications: Mobile Databases, Multimedia Databases, Geographical Information Systems (GIS), Genome Data Management.</p>
13	Natural Language Processing (PECS-120)	<p>Syntactic Analysis: Introduction to parsing, Basic parsing strategies, Top-down parsing, Bottom-up parsing, Dynamic programming – CYK parser, Issues in basic parsing methods, Earley algorithm, Parsing using Probabilistic Context Free Grammars. Semantic Analysis: Lexical semantics, Lexemes, Relations among lexemes and their senses, WordNet, Word Sense Disambiguation – Supervised and Un-supervised approaches. Information Extraction – Introduction to Named Entity Recognition and Relation Extraction. Pragmatics: Discourse, Discourse structure. Dialogue – Acts, structure, conversational agents. Language generation, Architecture for generation.</p>

14		Java Programming (PECS-126)	<p>Packages and Interfaces: Defining a package, Accessing a package, Understanding CLASSPATH, Importing packages, Differences between classes and interfaces, defining an interface, implementing interface, Variables in interface, Extending interfaces. Exception Handling: Concepts of exception handling, Exception types, Using try, catch, throw, throw and finally, Java's built in exceptions, Creating own exception subclasses. Multithreading: Java thread life cycle, Creating threads, Using isAlive() and join(), Synchronization, Interthread communication, Suspending, resuming, stopping threads. Event Handling: Delegation event model, Event classes, Sources of events, Event listeners, Handling mouse and keyboard events, Adapter classes, Inner classes. The AWT class hierarchy, User interface components – Labels, Button, Canvas, Scrollbars, Text components, Check box, Check box groups, Choices. Lists panels – Scrollpane, Dialogs, Menubar, Graphics. Understanding layout managers – FlowLayout, BorderLayout, GridLayout and CardLayout. Applets: Basics of applets, Differences between applets and applications, Life cycle of an applet, Types of applets, The HTML applet tag, Creating applets, Passing parameters to applets.</p>
15		Software Metrics (PECS-105)	<p>Component-based system: Metrics for object-oriented systems, Object-oriented analysis and design and its characteristics. MOOD metrics: Component-based metrics and its characteristics and various component-based suites. Dynamic Metrics: Runtime Software Metrics, Extent of Class Usage, Dynamic Coupling, Dynamic Cohesion, and Data Structure Metrics. Software Quality: Concepts of software quality, software quality control and software quality assurance, evolution of SQA, major SQA activities and issues, zero defect software. Software Quality Assurance: SQA techniques; Management review process, technical review process, walkthrough, software inspection process, configuration audits, and document verification.</p>
16	BTECH 8th	Blockchain Technology (PECS-113)	<p>Distributed Consensus II: Consensus Algorithms: Proof of Work, Proof of Stake, Delegated Proof of Stake, Proof of Activity, Comparison among them. Ethereum: Public consortium blockchain: Introduction of Ethereum, Ethereum account, Ethereum network, Ethereum client, Ethereum gas, Ethereum virtual machine, Ethereum block, header, Ether, smart contracts. Blockchain use cases: Applications in finance: settlements, KYC, capital markets, insurance; supply chain: provenance of goods, visibility, trade supply chain finance, invoice management Discounting ;government: digital identity, land registration; medical information systems.</p>
17		Human Computer Interaction (PECS-123)	<p>Web Interface Design: Hypertext, Multimedia, World Wide Web, Overlays, Inlays and Virtual Pages, Contextual Tools, Designing Process, Case Studies. User Interface Evaluation: Heuristic Evaluation, Evaluation with Users, Model-based Evaluation, Mobile Application Frameworks, Types of Mobile Applications, Mobile Design Architecture and its Elements, Computing Theories & Recent Trends: Groupware and Computer Supported Collaborative Work, Ubiquitous Computing, Virtual Reality and Augmented Reality, Speech Recognition and Translation</p>

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18	Parallel and Distributed Algorithms (PECS-129)	<p>Synchronous Parallel Processing: Introduction, Example-SIMD Architecture and Programming Principles, SIMD Parallel Algorithms, Data Mapping and scheduling in array processors. Distributed Algorithms: Definition, Issues, Goals, Types of distributed systems, Distributed System Models and complexity measures, Distributed Graph algorithms, Safety, liveness, termination, logical time and event ordering, Global state and snapshot algorithms, Mutual exclusion.</p> <p>Synchronization: Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure, Non Token based Algorithms: Lamport Algorithm, Ricart-Agrawala's Algorithm, Maekawa's Algorithm, Token Based Algorithms: Suzuki-Kasami's Broadcast Algorithms, Singhal's Heuristic Algorithm, Raymond's Tree based Algorithm, Comparative Performance Analysis</p>
19	Big Data (PECS-118)	<p>Big Data Management: In-database Analytics – Introduction to NoSQL– Aggregate data models, Graph databases, Graph-less databases, Distribution models, Introduction to HBase, MongoDB, and Cassandra. Business Analytics: Decision making in business analytics, Business analytics in practice – Financial analytics, Healthcare analytics, Sport and web analytics. Categorization of analytics methods and models – Descriptive analytics, Predictive analytics, Perspective analytics. Analytical Methods and Case studies: Linear regression, Logistic regression, K-Means clustering, Decision tree classification. Case studies: Social data analytics, Recommendation engines, Customer analytics.</p>
20	Component Based Developments (PECS-107)	<p>The Management of Component-Based Software Systems: Measurement and Metrics for Software Components, The Practical Reuse of Software Components, Selecting the Right COTS Software: Why Requirements are Important, Software Component Project Management Processes, The Trouble with Testing Software Components, configuration Management and Component Libraries, The Evolution, Maintenance and Management of Component-Based Systems, Component Technologies: Overview of the CORBA Component Model, Transactional COM+: Designing Scalable Applications, The Enterprise JavaBeans Component Model, Choosing Between COM+, EJB, and CCM, Software Agents as Next Generation Software Components.</p>
21	Internet of Things (PECS-112)	<p>IoT Reference Architecture: Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment, Constraints affecting design of IoT, Technical design Constraints. applications, Environmental and Agriculture applications, Other IoT applications.</p> <p>Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.</p>

22		Applied Cloud Computing (PECS-135)	<p>Cloud Security and Cloud Monitoring: Cloud Security: AWS Identity and Access Management(IAM), Role, User, Security group, Policy, Amazon Inspector, Root User, Credential, Multi-FactorAuthentication (MFA), AWS shield, AWS Web Application Firewall (WAF), Distributed Denial ofService (DDoS), AWS Artifact. Cloud Monitoring: Amazon CloudWatch, AWS CloudTrail, AWSConfig, Amazon Simple Notification Service (Amazon SNS) Databases and Load Balancing: Databases: Relational database, Amazon Relational Database Service (Amazon RDS), Nonrelational database, Amazon DynamoDB, Amazon Redshift, Online Transaction Processing (OLTP), Online Analytic Processing (OLAP), Amazon Aurora, MySQL. Load balancing: Load balancer, Amazon ElastiCache, Data Caching, Elastic Load Balancing,Random Access Memory (RAM) Elastic Beanstalk, CloudFormation, Billing and Support: AWS Elastic Beanstalk, AWS CloudFormation, Stack. Billing and Support: AWS simple monthly calculator, AWS support plan.Consolidated billing, Technical Account Manager (TAM) Emerging Technologies in Cloud and Cloud Optimization: Artificial Intelligence(AI), Machine Learning (ML), Amazon SageMaker, Deep Learning, AWS DeepRacer, AWS DeepLens, Neuralnetwork, Blockchain technology. Cloud optimization using AWS Cloud Development Kit (CDK).</p>
23		Deep Learning (PECS-124)	Part B
24		Advanced Algorithms (MCS-103)	<p>Flow Networks and Matching: Definitions of Flow networks and flows, Ford-Fulkerson method to compute maximum flow, Max-flow min-cut theorem, Edmonds-Karp algorithm, Maximum bipartite matching problem, Push-relabel algorithm.String Matching: Naive string matching algorithm, Rabin-Karp algorithm, Longest Common Subsequence (LCS), Knuth-Morris-Pratt pattern searching algorithm, String matching with finite automata.NP-Completeness and Approximation Algorithms: Introduction to NP, NP-hard and NP-complete problems, polynomial-time verification, proof of NP-completeness. Vertex-cover problem and Traveling-Salesman problem.</p>
25	Mtech 2nd	Soft Computing (MCS-104)	<p>Fuzzy Logic: Concept of fuzziness, Fuzzy vs crisp, Crisp sets, Operations on crisp sets, Properties of crisp sets, Fuzzy sets, Features of fuzzy sets, Basic fuzzy set operations, Properties of fuzzy sets, Fuzzy relations, Fuzzy membership functions, linguistic hedges, Fuzzy rule-based system, De-fuzzification methods, Fuzzy extension principle.Genetic Algorithms and Multi-objective Optimization: Concept of natural evolution, Generation of population, Encoding, Fitness Function, Reproduction, Crossover, Mutation, probability of crossover and probability of mutation, convergence. Concept of multi-objective optimization problems (MOOPs), Multi-Objective Evolutionary Algorithm (MOEA), NonPareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs, Some applications with MOEAs.</p>
26		Data Science (MCS-134)	Last 2 Units
27		Natural Language Processing (MCS-143)	<p>Phonology: Phoneme and phonological rules, machine learning of phonology, phonological aspects of prosody and speech synthesis.Part-of-Speech Tagging and Parsing: Word Classes, Part of speech tagging, Tagsets, Rule based, Stochastic and Transformation based POS tagging. Basic parsing strategies, top down parsing, bottom up parsing, parsing with context free grammars, a basic top down parser, Earley parser, CYK parser, Finite state parsing methods, Unification of feature structures.Semantic Analysis and Pragmatics: Lexical Semantics, Lexemes, Relations among lexemes and their senses, WordNet, Internal structure of words, metaphor and metonymy & their computational approaches, Word Sense Disambiguation. Discourse, Reference resolution, syntactic and semantic constraints on coreference, pronoun resolution reference, text coherence, discourse structure, Dialogue- Acts, structure, conversational agents, Introduction to language generation, architecture, discourse planning.</p>

MSE COORDINATOR


HOD CSE
