MSE I SYLLABUS (JAN-JUNE 2026)			
S.NO	Semester	Course Name & Course Code	Syllabus
1	BTECH 2nd	Database Management Systems (CCS104)	**Unit-1 Database Environment and Development Process** Basic Concepts and Definitions, Traditional File Processing Systems, The Database Approach-Data Models, Relational Databases, Database Management Systems, Advantages of the Database Approach, Components of the Database Environment The Database Development Process-Systems Development Life Cycle, Three-Schema Architecture for Database Development, Managing the People involved in Database Development **Unit-2 Relational Model and Database Design using the E-R Model** Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages- The Relational Algebra. Overview of the Design Process, The Entity-Relationship Model, Complex Attributes, Mapping Cardinalities, Primary Key, Removing Redundant Attributes in Entity Sets, Reducing E-R diagrams to Relational Schemas, Extended E-R features, EntityRelationship Design Issues, Alternative Notations for Modeling Data, Other Aspects of Database Design **Unit-3 Structured Query Languages (SQL)**Overview of the SQL Language, SQL Data Definition, Basic Structure of SQL Queries, AdditionalBasic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries,Modification of the Database, Intermediate SQL-Join Expressions, Views, Transactions, IntegrityConstraints, SQL Data types and
2		Operating System (CCS-105)	**Unit-1 Introduction** Concept of Operating Systems, Generations of Operating systems, Types and structures of OperatingSystems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel OperatingSystems, System Programs, System boot, Basics of OS security, user authentication **Unit-2 Process management and scheduling algorithms**Concept of processes and threads, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread - Definition, Various states and types, Benefits ofthreads, Multithreading Models. Process Scheduling - Foundation and Scheduling objectives, Types ofSchedulers, Scheduling criteria, Scheduling algorithms, Multiprocessor scheduling.
3		Computer Networks (CCS-106)	Introduction- Data Communication Components, Representation of data and data flow, Networks-Network criteria, Physical Structure- Type of connections. Network Type - LAN and WAN. Internet brief History, Protocols- Syntax, Semantics, Timing, Standards and Administration. Networks Models- Protocol Layering, Principle of Protocol Layering, Addressing- Physical Address, Logical Address, Port Address, Specific Address. TCP/IP Protocol suite OSI Model. Physical Layer-Analog and digital signals, Analog and digital transmission, Data Rate limits- Nyquist formula, Shannon formula. Transmission impairments- Attenuation, Noise, Distortion. Network Performance - Bandwidth, Bit Rate, Throughput, Latency, Propagation Time, Propagation speed. Techniques for Bandwidth utilization- Frequency division, Time division and Wave division Multiplexing. Concepts of Spread Spectrum. Transmission Media- Guided media- Twisted Pair, Co-axial, Fiber optics with propagation modes, Connectors and its applications. Unguided Media- Radio Wave, Micro Wave, Infra-Red, Ranges, Propagation Methods and its Applications. Switching- Circuit, Message and Packet switching and their comparison Data Link Layer- Types of Errors, Detection- Redundancy, Parity, Cyclic
4		Discrete Mathematics (CCS-107)	**Unit-1 Fundamentals of Sets, Relations and Functions:** Sets – Operations on sets, Subsets, Types of sets, ordered pairs, Proofs of general identities of sets, Classes of sets and partitions, Countable and uncountable sets. Relations –Representations of relations, Types of relations, Composition of relations, Closure properties of relations, Equivalence relations, Compatibility relations, Partial order relations. Functions – Introduction and types of functions, Sum and product of functions, Hashing functions, recursively defined functions. **Unit-2 Prepositional and Predicate Logic :**Prepositions and compound prepositions, Logical connectives, Truth tables, Logical implication and logical equivalence,Normal forms– Conjunctive and Disjunctive, Validity of well-formed formula, Propositional inference rules–Modus ponens and modus tollens. Predicate logic, Universal and existential quantification, Limitations of propositional and predicate logic **Unit-3 Combinatorial Mathematics:** Basic counting principles, Permutations and combinations, Pigeonhole principle, Inclusion and exclusion principle, Recurrence relations – Solving homogeneous and non- homogeneous recurrence relations, Sequences, Generating function
5		Artificial Intelligence (CCS108)	Physical Layer-Analog and digital signals, Analog and digital transmission, Data Rate limits- Nyquist formula, Shannon formula. Transmission impairments- Attenuation, Noise, Distortion. Network Performance - Bandwidth, Bit Rate, Throughput, Latency, Propagation Time, Propagation speed. Techniques for Bandwidth utilization- Frequency division, Time division and Wave division Multiplexing. Concepts of Spread Spectrum. Transmission Media- Guided media- Twisted Pair, Co-axial, Fiber optics with propagation modes, Connectors and its applications. Unguided Media- Radio Wave, Micro Wave, Infra-Red, Ranges, Propagation Methods and its Applications. Switching- Circuit, Message and Packet switching and their comparison.
7	BTECH 6th	Compiler Design (PCCS-112)	**Introduction to Compiler:** Language Processors, The Structure of a Compiler, The Grouping of Phases into Passes, Applications of Compiler Technology, Programming Language Basics. **Lexical Analysis:** Role of lexical analyzer, Tokens, Patterns, and Lexemes, Attributes for Tokens, Lexical Errors, Input Buffering, Sentinels, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata. **Syntax Analysis:** Introduction, Role of the parser, Context-Free Grammars (CFG), Writing a Grammar, Writing a Grammar, Top down parsing –Backtracking, LL(1), Recursive descent parsing, Non-recursive Predictive Parsing. Bottom-up parsing – Shift reduce parsing, LR parsers, SLR parser. Canonical LR parser, LALR parser, Introduction to The Parser Generator Yacc
8		Computer Graphics (PCCS-113)	**Introduction:** Overview of computer graphics, Computer graphics applications, Different I/O deviceswith specialized graphics features, Elements of graphics. Graphic systems – Video display devices, Rasterscan systems, Random scan systems. Video basics – Video controller, Raster-scan display processor. **2D Primitives:** Scan conversion basics, Algorithm for scan converting a point, Scan converting a line –Digital differential analyser algorithm, Bresenham's line algorithm. Scan converting circle – Bresenham'scircle drawing algorithm, Midpoint circle drawing algorithm. Scan converting ellipse– Midpoint ellipse algorithm. Filling Techniques – Scan line polygon fill algorithm, Boundary-fill, Flood-fill. Anti-aliasing **2-D**
9		Machine Learning (PCCS-114)	**Introduction:** Well defined learning problems, defining a learning system, perspectives and issues in machine learning, the concept learning task, concept learning as search, Find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, Inductive bias, probability theory. **Supervised Learning:** Basic methods: Distance based methods, Nearest- Neighbors, Decision Trees, Naive Bayes, and Linear models: Linear regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and kernel Methods. **Unsupervised Learning:** Clustering: k-means/ kernel k-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative models (mixture models and latent factor models). **Decision Tree Learning:** Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Ensemble methods- Bagging, Gradient Boosting, Random Forest.
10		Cyber Security (PCCS-115)	**Introduction to Cyber Space:** History of cyber space, Cyber Crime, Information Security, Computer Ethics and Security for users, Familiarization with secure web browser and guidelines to choose, Role of Antivirus, Guidelines for Secure password, Two-steps authentication, Introduction to Password Manager, Wi-Fi Security. **Secure Social Media usage and security:** Best practices for safer Social Networking, Basic Security for Windows, User Account Password Smartphone Security, Android Security, IOS Security. **E-commerce Security:** Familiarization: Online Banking Security, Mobile Banking Security, Security of Debit and Credit Card, UPI Security
11		Network Security and Cryptography (PECS-108)	**Introduction to Security:** Essentials of network security, Architecture, Security goals, cryptographicattacks: cryptanalytic, non-cryptanalytic attacks, active attack and passive attack, security Servicesand security mechanism, Fundamental Security design principles, Network security model, standards. **Number Theory:** Integer Arithmetic, Euclidean Algorithm, Extended Euclidean Algorithm, Modular Arithmetic, Matrices, Linear Congruence, Prime numbers, Fermat's and Eular's Theorem, Factorization, Chinese Remainder Theorem **Classical Encryption Techniques:** Encryption, Decryption, Plaintext, Cipher text, Key range and Size, Symmetric cipher model, Substitution techniques: Mono-alphabetic ciphers (additive, Caesar,Multiplicative, affine), polyalphabetic cipher (autokey, playfair, Hill Cipher) Transposition techniques (keyless, keyed, combined approaches)

12		**Advanced Database Management Systems (PECS-114)**	**Introduction to SQL Programming Techniques:** Database Programming: Issues and Techniques,Embedded SQL, Dynamic SQL; Database Programming: Data Types, Variables, Constraints,Operators, Conditions, Loops, Strings, Arrays, Procedures, Functions, Cursors, Records, Exceptions,Triggers, Packages, Database Stored Procedures. **Transaction Processing and Optimization:** Transaction Processing Concepts, Concurrency ControlTechniques, Timestamp ordering, Multiversion Concurrency Control Techniques, Validation(Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking. **Query Processing and Optimization:** Query Processing, Syntax Analyzer, Query decomposition,Query Optimization, Heuristic Query Optimization, Algorithms for SELECT and JOIN Operations, Algorithms for PROJECT and Set Operations, Implementing Aggregate Operations and OUTERJOINS. Using Selectivity and Cost Estimation in Query Optimization. Semantic Query Optimization **Object-Oriented DBMS:** Introduction. Advanced Database Applications, Weaknesses of RDBMS,Storing Objects in Relational Database. Next- Generation Database
13		**Natural Language Processing (PECS-120)**	**Introduction:** Introduction to natural language and speech processing, Steps for processing natural languages, Issues and challenges for processing of natural languages, Elements of information theory, Brief history of natural language processing. **Morphological Analysis:** Inflectional and Derivational morphology, Morphological parsing, Lexicon and Morphotactics, Finite state transducers, N-gram language models, N-gram smoothing, Entropy. **Part-of-Speech Tagging:** Word classes, Part-of-speech tagging, Tagsets, POS tagging Techniques – Rule-based, Stochastic, Transformation-based. **Applications:** Different application areas of natural language processing – Machine translation, Machinelearning, Text categorisation and summarisation, Speech synthesis, Speech recognition, Optical characterrecognition, Database access, etc.
14		**Java Programming (PECS-126)**	**Introduction**: History of Java, Importance of Java to the internet, Java's Magic – The Byte code features of Java, Overview of Java. **Java Basics:** Data-types, Variables, Arrays, Operators, Expressions, Control statements, Type conversion, Concepts of classes and objects, Constructors, Methods, Access control, this keyword, Garbage collection, Overloading methods and constructors, Parameter passing, Recursion, Understanding static, Introducing nested and inner classes, Using command line arguments, Introduction to string handling **Inheritance:** Basics of inheritance, Types of inheritance, Member access rules, Using super, Using final with inheritance, Method overriding, Dynamic method dispatch, Using abstract classes.
15		**Software Metrics (PECS-105)**	**Software Metrics:** Measurement in software engineering, software metrics, Metrics data collection and analysis. **Complexity Metrics and Models:** Lines of Code, Halstead's Software Science, Cyclomatic Complexity Syntactic Metrics, and An Example of Module Design Metrics in Practice. Object Oriented Projects. Object Oriented Concepts and Constructs, Productivity Metrics, Quality Management Metrics. **Estimate internal product attributes:** Aspects of software size, length, functionality, and complexity, measuring structure, types of structural measures, control-flow structure, and modularity and information flow attributes, data structures. **Estimate external product attributes:** Modeling software quality, software reliability, software reliability problem, parametric reliability growth models, predictive accuracy, importance of operational environment, and wider aspects of software reliability.
16		**Blockchain Technology (PECS-113)**	Introduction to Cryptography: Need of Cryptography, Traditional and Modern techniques, Hash function, Distributed Hash Table, Digital Signatures, Symmetric and Asymmetric Key Cryptography, Zero Knowledge Proof, Double Spending problem. [6 Hours] Introduction to Blockchain: Distributed Database, shortcomings of current transaction systems, distributed network, difference between blockchain and traditional database, evolution of blockchain. Bitcoin's Architecture, Blockchain Architecture: merkle root tree, gas limit, transactions and fee, nonce value, anonymity, reward, chain policy, miners, validators, types (private and public blockchains), Challenges to Blockchain Implementation, Features of Blockchain Network, Soft & Hard Fork. [8 Hours] Distributed Consensus I: The mining mechanism, Two Generals Problem, Byzantine General problem and Fault Tolerance, Nakamoto consensus, Evaluation aspects Blockchain consensus protocols: Scalability, Throughput (TPS), Latency, Security, Fault Tolerance Rate, Energy Department of Computer Science and Engineering Consumption. [5 Hours]

17	BTECH 8th	**Human Computer Interaction (PECS-123)**	Foundations of Human Computer Interaction. Introduction to HCI, The Human: I/O channels, Memory,Reasoning and Problem Solving; The Computer: Devices, Memory, Processing and Networks, Interaction Models, Frameworks, Ergonomics, Styles, Elements, Interactivity and Paradigms.Design Process and Implementation. Interactive Design Basics. Process, Scenarios, Navigation, ScreenDesign, Iteration and Prototyping. HCI in Software Process. Software Life Cycle, Usability Engineering.Prototyping in Practice, Design Rationale. Design Rules: Principles, Standards, Guidelines, Rules Evaluation Techniques. Universal Design. User and Task Model. Cognitive Models, Socio-Organizational
18		**Parallel and Distributed Algorithms (PECS-129)**	Introduction: The Idea of Parallelism, Parallel Computing, Models of computation, Parallel Algorithms analysis, Parallel Algorithms models, Design Techniques, Matrix Multiplication, Sorting, Parallel Search Algorithm, Graph Algorithms. PRAM Algorithms: PRAM Model of Parallel Computation, Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Coloring, Reducing the Number of Processors and Brent's Theorem, Dichotomoy of Parallel Computing Platforms, Cost of Communication. Pipeline Processing: Introduction, Pipeline Performance, Arithmetic Pipelines, Pipelined Instruction Processing, Pipeline Stage Design, Hazards, Dynamic Instruction Scheduling
19		**Big Data (PECS-118)**	Introduction to Big Data: Big data overview, V's of big data, Data structures, State of the practice in analytics, Current analytical architecture, Drivers of big data, Big data ecosystem and a New Approach to Analytics, Key roles for the new big data ecosystem, Data at rest v/s data at motion, Examples of big data analytics tools. Apache Hadoop: Understanding distributed system and Hadoop, Comparing SQL databases and Hadoop, MapReduce building blocks of Hadoop –Name node, Data node, Secondary name node, Job-Tracker, Task-Tracker, Introducing and configuring Hadoop cluster – Local, Pseudo distributed mode, Fully distributed mode, Handling web-based Cluster, and Configuring XML files.Working with Hadoop: Interacting with HDFS, Steps to read and write into HDFS. Anatomy of MapReduce Program – Hadoop data type, Mapper and Reducer, Partitioner, Combiner, Reading and writing format, Word count with predefined Mapper and reducer. Introduction to with
20		**Component Based Developments (PECS-107)**	Component Definition: Definition of Software Component and its Elements. Component Models and Component Services: Concepts and Principles, COTS Myths and Other Lessons Learned in ComponentBased Software Development, Roles for Component-Based Development, Common High-Risk Mistakes in Component-Based Software Engineering, CBSE Success Factors: Integrating Architecture, Process, and Organization. Software Engineering Practices: The Practice of Software Engineering, From Subroutines to Subsystems: Component-Based Software Development. The Design of Software Component Infrastructures: Software Components and the UML, Placing Software Components in Context, Business Components, Components and Connectors: Catalysis Techniques for Defining Component Infrastructures, An Open Process for Component-Based Development, Designing Models of Modularity, and Integration.
21		**Internet of Things (PECS-112)**	**Introduction to Security:** Essentials of network security, Architecture, Security goals, cryptographic attacks: cryptanalytic, non-cryptanalytic attacks, active attack and passive attack, security Services and security mechanism, Fundamental Security design principles, Network security model, standards. **Number Theory:** Integer Arithmetic, Euclidean Algorithm, Extended Euclidean Algorithm, Modular Arithmetic, Matrices, Linear Congruence, Prime numbers, Fermat's and Eular's Theorem, Factorization, Chinese Remainder Theorem. **Classical Encryption Techniques:** Encryption, Decryption, Plaintext, Cipher text, Key range and Size, Symmetric cipher model, Substitution techniques: Mono-alphabetic ciphers (additive, Caesar, Multiplicative, affine), polyalphabetic cipher (autokey, playfair, Hill Cipher) Transposition techniques (keyless, keyed, combined approaches)
22		**Applied Cloud Computing (PECS-135)**	Introduction to Amazon Web Services (AWS) Cloud: AWS Cloud global infrastructure, Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), Cloud storage. Structure of Cloud: Availability Zone, Edge Location, Origin, Latency, Region. Introduction to AWS Console. Virtual Servers, Content Delivery and Virtual Storage: Virtual Servers: Amazon Elastic Compute Cloud (Amazon EC2), Domain Name,Domain Name System (DNS), Amazon Simple Storage Service(S3) bucket, Amazon Route 53, Javascript Object Notation (JSON), Dynamic website, Static website. Content Delivery: Amazon CloudFront, AWS Direct Connect, Caching, Content Delivery Network (CDN), Distribution. Virtual Storage: Amazon Simple Storage Service (Amazon S3), Amazon Elastic Block Store (Amazon EBS), Hard Disk Drive (HDD), Solid StateDrive (SDD), Input/Output Operations Per second (IOPS) Cloud Security and Cloud Monitoring: Cloud Security: AWS Identity and Access Management (IAM), Role, User, Security group, Policy, Amazon Inspector, Root User, Credential, Multi-Factor Authentication (MFA), AWS shield, AWS Web Application Firewall (WAF), Distributed Denial of Service (DDoS), AWS Artifact. Cloud
23		**Deep Learning (PECS-124)**	Introduction: Deep Learning definition, why Deep Learning, history of Deep Learning, Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Convergence theorem for Perceptron Learning Algorithm. Feedforward Networks: Multilayer Perceptron, Representation power of Feedforward Neural Networks, Backpropagation Gradient Descent, Empirical Risk Minimization, autoencoders. Deep Neural Networks: Difficulty of training deep neural networks, Greedy layerwise training, Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Recurrent Neural Networks: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs
24	Mtech 2nd	**Advanced Algorithms (MCS-103)**	**Introduction to analysis of algorithms:** Review of various sorting algorithms, Asymptotic Notation, Performance analysis, space and time complexity. **Fundamental Techniques:** Divide and Conquer, Greedy Method, Dynamic Programming. Graphs: Definitions and Elementary Algorithms-Shortest path by Breadth First Search, Depth First Search and computation of strongly connected components, shortest path in edge weighted case (Dijkstra's Algorithm), correctness proof of Dijkstra's algorithm, Directed Acyclic Graphs -Topological sorting. **DynamicProgramming:** Elements of dynamic programming, Applications of dynamic programming – Rod cutting problem, Bellman-Ford algorithm and Floyd-Warshall
25		**Soft Computing (MCS-104)**	**UNIT-I Introduction:** Introduction to Soft Computing, Historical Development, Definitions, advantages and disadvantages, Hard computing vs soft computing, Applications of soft computing. **UNIT-II Neural Networks:** Model of an artificial neuron, Comparison of artificial neural network and biological neural network, Neural network architectures, Learning methods, Activation functions, Perceptron, Hopfield network, Back-propagation network, Radial basis function network, Competitive Neural Nets- Kohonen self-organizing feature maps, Learning Vector
26		**Data Science (MCS-134)**	Unit 1 and Unit 2
27		**Natural Language Processing (MCS-143)**	**Introduction:** Need for processing of natural languages, Language processing levels, Issues and challenges in NLP, History, Classical approaches to NLP with knowledge bases and linguistic rules. Introduction to formal languages, finite state automata and regular expressions. Applications of NLP.**Morphology and Phonology:** Morphology fundamentals, Inflectional and Derivational morphology, Morphological parsing, Finite State transducers, N- gram language models.

MSE COORDINATOR

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