

## **B.TECH (MST-1 SYLLABUS)**

### **3<sup>rd</sup> Semester**

#### **Object Oriented Programming PCCS-101**

**Object-Oriented Programming Concepts:** Introduction, Comparison between procedural programming paradigm and object-oriented programming paradigm, Features of object-oriented programming: Encapsulation, Class, Object, Abstraction, Data hiding, polymorphism, and Inheritance. Introduction of object oriented design.

**Data Types, Operators, and Control Structures:** Basic data types, Derived data types, Keywords, Identifiers, Constants and variables, Type casting, Operators, and Operator precedence. Control Structures: if statement, switch-case, for, while and do-while loops, break and continue statement.

**Classes and Objects:** Implementation of a class, Creating class objects, Operations on objects, Relationship among objects, Accessing class members, Access specifiers, Constructor and destructor, Types of constructor, Static members, Empty classes, Nested classes, Local classes, Abstract classes, Container classes.

**Functions, Arrays, and String Handling:** Function components, Default arguments, Passing parameters, Function prototyping, Call by value, Call by reference, Return by reference, Inline functions, Friend functions, Static functions, Recursion, Array declaration, Types of arrays, Array of objects, String handling

#### **Computer Networks PCCS-102**

**Data Communication Components:** Representation of data and data flow, Various Network Topologies, Protocols and Standards, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing- Frequency division, Time division and Wave division, Concepts on spread spectrum, OSI model, TCP/IP reference model and their comparison.

**Physical Layer:** Concept of analog and digital systems, Transmission Media, Transmission impairments and Data rate limits- Nyquist formula, Shannon formula, Switching- Circuit, Message and Packet switching.

**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

### **Digital Electronics ESCS-101**

**Number Systems:** Binary, Octal, Decimal, Hexadecimal, Number base conversions, 1's, 2's, rth's complements, signed Binary numbers. Binary Arithmetic, Binary codes: Weighted BCD, Gray code, Excess 3 code, ASCII – conversion from one code to another.

**Boolean Algebra:** Boolean postulates and laws – De-Morgan's Theorem, Principle of Duality, Boolean expression – Boolean function, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS), Minterm, Maxterm, Canonical forms, Conversion between canonical forms, Karnaugh map Minimization

**Logic GATES:** AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR. Implementations of Logic Functions using gates, NAND-NOR implementations, Study of logic families like RTL, DTL, DCTL, TTL, MOS, CMOS, ECL and their characteristics.

**Combinational Circuits:** Design procedure – Adders, Subtractors, Serial adder/Subtractor, Parallel adder/ Subtractor Carry look ahead adder, BCD adder, Magnitude Comparator, Multiplexer/Demultiplexer, encoder/decoder, parity checker, code converters, Implementation of combinational logic using MUX.

### **Human Values and Professional Ethics HSMCS-101**

**Ethics and values:** Importance of Ethics and values, Difference between moral, ethics and values , Nature of Values, The Structure of Value Relations , Integrity, Work ethics, Service learning, Virtues, Respect for others, Living peacefully, caring , Sharing , Honesty, Courage, Valuing time , Cooperation, Commitment, Empathy, Self confidence, Challenges in the work place, spirituality.

**Value education:** Need for value education, Basic guidelines, Self Exploration, Values in family and Harmony in existence, Values across cultures.

**Personality and behavior development:** God and scientific attitude, positive thinking, Integrity and discipline, punctuality, Aware of self destructive habits, Association and cooperation, Doing best, motivation Theories and Case study, Johari Window, Leadership Styles and Theories, WinWin policy, SWOT Analysis

### **Mathematics-III BSCS-101**

**Differential calculus of complex variables:** Separation of elementary functions of complex variables, Cauchy-Riemann equations, analytic functions, elementary analytic functions (exponential, trigonometric, logarithm) and their properties, harmonic functions, finding harmonic conjugate.

**Integral Calculus of functions of complex variables:** Complex integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof) Taylor's series.

**Linear Systems:** Gauss's elimination method and Gauss's Jordan method.

**Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines and second degree parabolas

## 5<sup>th</sup> Semester

### Artificial Intelligence PCCS-108

**Introduction:** Intelligence, Foundations of artificial Intelligence(AI), History of AI, Agents and Environments, Rationality of Agents, Nature and Structure of Agents, Communication among agents.

**Problem formulation and Solution:** Problem types, states and operators, state space, Uninformed Search Strategies , Informed Search Strategies- Best first search, A\* algorithm, heuristic functions, Iterative deepening A\*(IDA), small memory A\*(SMA).

**Game Playing:** Perfect information game, imperfect information game, evaluation function, MiniMax algorithm, alpha-beta pruning.

**Applications:** Areas of AI, Natural Language Processing, Case Study of Existing Expert Systems.

### Database Management Systems PCCS-109

**Introduction to Database Concepts:** Introduction, Database systems versus file systems, Difference between Database and non-database system, Characteristics of Database Approach, Advantages and Disadvantages of Using DBMS. Database users and administrators, Schemas and Instances, DBMS Architecture, components of a database system, Data Independence, Database Language And Interfaces, Classification of Database Management Systems.

**Entity Relationship Model:** Data models, Entity types, Entity sets, Attributes and keys, Relationship types, Relationship sets, Roles and structural constraints, Weak entity types, Design choices for ER conceptual design, Comparison of Models.

**Relational Model:** Relational model concepts, Constraints, Update operations, Transaction and dealing with constraint violations. Relational Algebra –Unary relational operations, Operations from Set theory, Binary relational operations, DIVISION operation and additional relational operations. Relational Calculus – Tuple relational calculus and Domain relational calculus, Queries related to Relational Algebra and Relational Calculus.

**SQL:** SQL Data Definition and data types, Specifying constraints in SQL, Schema change statements, Basic queries in SQL, Set operations, Aggregate functions and views, Complex queries in SQL, Additional features of SQL.

## **Formal Language & Automata Theory PCCS-110**

**Finite Automata:** Deterministic Finite Automata, Acceptance by Finite Automata, Transition systems, Non-Deterministic Finite Automata, Equivalence of DFA and NFA, Moore and Mealy machines, Equivalence of Moore and Mealy machine, Minimization of Finite Automata, Applications and limitations of Finite Automata.

**Formal Languages:** Basics of strings, Alphabets, grammar, Formal language, Chomsky classification of languages, Languages and their relation, Operations on languages, Closure properties of language classes.

**Regular Grammar:** Regular grammars, Regular expressions, Algebraic method using Arden's theorem, Equivalence of Finite Automata and Regular expressions, Properties of regular languages, Pumping lemma.

## **Design and Analysis of Algorithms PCCS-111**

**Introduction:** Algorithms, Algorithm Specification, Performance Analysis: Space complexity, Time complexity, Asymptotic Notations- Big-Oh notation ( $O$ ), Omega notation ( $\Omega$ ), Theta notation ( $\Theta$ ), and Little-oh notation ( $o$ ), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples.

**Divide and Conquer:** General method, solving recurrences using recurrence trees, repeated substitution, statement of Master Theorem, applications – Binary search, Merge sort, Quick sort, Strassen's Matrix Multiplication, Finding the maximum and minimum.

**Greedy Algorithms:** Greedy choice, optimal substructure property, minimum spanning trees- Prim's and Kruskal's, Dijkstra shortest path using arrays and heaps, fractional knapsack, Travelling salesperson problem and Huffman coding.

**Dynamic Programming:** Introduction to dynamic programming and application of the algorithm to solve multistage graphs, edit distance, matrix chain multiplication, All pairs shortest path problem and Knapsack problem

## **Advanced Computer Networks PECS-106**

**Introduction:** Basics, History of Internet, Requirements: perspectives, scalable connectivity, cost effective resource sharing, support for common services, manageability, network architecture: layering and protocols, Internet architecture, network performance: bandwidth, latency, high-speed networks, application performance needs.

**Internetworking:** Half and full duplex, Ethernet at physical layer: standard Ethernet, fast Ethernet, gigabit Ethernet, Ethernet cabling-straight-through, crossover and rolled cable, Data encapsulation. Ethernet at data link layer: CSMA, CSMA/CD and CSMA/CA.

**Wireless LANs:** Introduction: architecture comparison, characteristics, access control. IEEE 802.11: architecture, MAC Sublayer, Physical layer. Bluetooth: architecture and its layers.

**Transport Service and Protocols:** User Datagram Protocol (UDP): header format, services, and applications, Transmission Control Protocol (TCP): transport service characteristics; transport protocol: features, segment, and TCP connection.

## **Statistics for Data Science PECS-111**

**Random Variables and Probability Distributions:** Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables , Continuous Random Variables, Joint Distributions, Independent Random Variables, Change of Variables, Probability Distributions of Functions of Random Variables, Convolutions, Conditional Distributions, Applications to Geometric Probability.

**Special Probability Distributions-** Binomial Distribution, Normal Distribution , Poisson Distribution, The Central Limit Theorem, Multinomial Distribution, Hyper geometric Distribution, Uniform Distribution, Cauchy Distribution, Gamma Distribution, Beta Distribution, The Chi-Square Distribution, Student's t Distribution, F Distribution, Relationships Among Chi-Square, t, and F Distributions ,Bivariate Normal Distribution.

**Introduction to Statistics:** Population and sample, parameters and statistics, Simple descriptive statistics - Mean, Median, Quantiles, percentiles, and quartiles, Variance and standard deviation, Standard errors of estimates, Interquartile range.

**Correlation:** Definition of Correlation, Types of Correlation, Scatter Diagram Method, Karl Person's Correlation Coefficients, Correlation Coefficients for Bivariate frequency distribution, Probable error for Correlation Coefficients, Rank Correlation Co-efficient.

**Regression:** Definition of Regression, Regression lines, Regression Coefficients, Properties of regression Coefficients

### **Information Retrieval PECS-116**

**Introduction:** Introduction , History of IR, Components of IR, The IR Problem, The IR System, The Software Architecture of the IR System, The impact of the web on IR, The role of artificial intelligence (AI) in IR, IR Versus Web Search, Components of a Search engine.

**Basic IR Models:** Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity.

**Experimental Evaluation of IR:** Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections.

**Retrieval Utilities, Indexing and Searching:** Relevance feedback; Thesauri.

### **Constitution of India MCI-102**

Constitution of INDIA 1950

Parliamentary form of government in INDIA

Emergency provisions

Amendments of the Constitution

## 7<sup>th</sup> Semester

### Advanced Computer Networks CS-14701

**Internetworking:** Half and full duplex Ethernet, Ethernet at the data link layer, Ethernet at the physical link layer, Ethernet cabling–Straight-through, Crossover and rolled Cable, Data encapsulation, Three-layer hierarchical network model.

**TCP Protocols:** Internet layer protocols–IP, ICMP, ARP, RARP; Host to host layer protocols: TCP, UDP; Application layer protocols– Telnet, FTP, TFTP, NFS, SMTP, LPD, X Window, SNMP, DNS, and DHCP.

### Compiler Design CS-14702

**Introduction to Compiler:** Compilers, Analysis of the source program, Cousins of the compiler, Analysis – Synthesis model of compilation, Phases of compilation, Grouping of phases, Phases of translation.

**Lexical Analysis:** Role of lexical analyser – Issues in lexical analysis, Tokens, Patterns, Lexemes. Input buffering – Buffer pairs, Sentinels. Specification of tokens, Token recognition, Transition diagrams, Introduction to lexical analysis tool – LEX.

**Syntax Analysis:** Role of the parser, Top down parsing –Backtracking, LL(1), Recursive descent parsing, Predictive parsing. Bottom-up parsing – Shift reduce parsing, Operator precedent parsing, LR parsers, SLR parser, Canonical LR parser, LALR parser.

### Cyber Laws and IPR CS-14703

**Cyber World and Security:** Introduction to Cyberspace and Cyber law, Different components of cyber laws, Cyber law and Netizens. Attacks and Malware – The Zero-Day Attack and Mutation in delivery, Crimeware Toolkits and Trojans, Sophisticated Malware. Defensive measures for Cybersecurity – The Firewall, The Intrusion Detection System (IDS) and The Intrusion Prevention System (IPS), Virtual Private Networks (VPN) and Access control, Integrated defence for an enterprise network



**E-commerce:** Introduction to e-commerce, Different e-commerce models, E-commerce trends and prospects, E-commerce and taxation, Legal aspects of e-commerce.

**Patents:** Objectives, Rights, Assignments, Defences in case of infringement, Copyright – Objectives, Rights, Transfer of copyright. Work of employment infringement, Defences for infringement. Trademarks – Objectives, Rights, Protection of Goodwill, Infringement, Passing off, Patents in the cyber world.

**IT ACT 2000:** Aim and objectives, Overview of the Act, Information Technology Act-2000-1 Information Technology Act-2000-2, Information Technology Act-2000-3, Information Technology Act-2000-4, Information Technology Act-2000-5, Information Technology Act-2000-6, Amendments in IT Act. Jurisdiction, Role of certifying authority, Regulators under IT Act, Cyber crimes – offences and contraventions. Grey areas of IT Act.

## **Cloud Computing DECS-14706**

**Cloud Computing Fundamentals:** Evolution of cloud computing, Overview of computing paradigms – Distributed computing, Cluster computing, Grid computing, Utility computing, Autonomic computing, and Cloud computing. NIST model of cloud computing, Benefits and challenges of cloud computing, Big Data, Internet of things (IOT).

**Cloud Concepts and Technologies:** Virtualization – Definition, Characteristics and benefits of virtualization, Virtualization and cloud computing, Types of virtualization, Load balancing. Hypervisors, Multitenancy, Scalability and elasticity, Billing and metering of services, Application programming interfaces (APIs), and Service level agreement (SLA).

**Cloud Architecture and Services:** Cloud computing reference model architecture, Commoncloud management platform, Cloud service models – Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Cloud-based services and applications –Healthcare, Energy systems, Transportation systems, Manufacturing industry, Government, Education. Cloud deployment models – Public, Private, Community, and Hybrid cloud.

## **Big Data and Business Analytics DECS-14707**

**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, Map Reduce 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.

## **Data Warehouse and Data Mining DECS-14708**

**Introduction:** Features of a data warehouse, Data granularity, The information flow mechanism, Metadata, Two classes of data, Life cycle of data, Data mining concepts, Data mining process, Data mining techniques, Data warehouse v/s data mining, OLAP v/s data mining, Data mining functionalities, Data pre-processing – Descriptive data summarization, Data cleaning, Integration and Transformation, Reduction, Discretization and Concept hierarchy generation.

**Physical Architecture of a Data Warehouse and Data Mart Issues:** Data warehouse architectural goals, Data warehouse architecture, Distinguishing characteristics of data warehouse architecture, Data warehouse and Data marts, Building data marts, Data mart issues.

**Data Warehouse Schema:** Introduction, Building the fact tables and Dimension tables, Characteristics of a dimension table, Characteristics of a fact table, The factless fact table, Updates to dimension tables, Cyclicity of data – Wrinkle of time, Dimensional modeling, The star schema, The snowflake schema, Aggregate tables, Fact constellation schema or Families of star, Strengths of dimensional modeling, Data warehouse and the data model, Keys in the data warehouse schema, Enhancing the data warehouse performance, Data warehousing and the technology. OLAP vs OLTP.

## **Natural Language Processing DECS-14709**

**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.

**Syntactic Analysis:** Introduction to parsing, Basic parsing strategies, Top-down parsing, Bottom-up parsing.

**Applications:** Different application areas of natural language processing – Machine translation, Machine learning, Text categorisation and summarisation, Speech synthesis, Speech recognition, Optical character recognition, Database access, etc.

## **Machine Learning DECS-14710**

**Introduction:** Designing a learning system, Perspectives, and issues in machine learning, Types of machine learning – Supervised learning, Unsupervised learning.

**Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, ID3 learning algorithm, Issues in decision tree learning – Overfitting, Pruning, Noisy data.

**Bayesian Learning:** Probability theory and Bayes rule, Bayes theorem and Concept learning, Maximum likelihood estimation, Maximum A Posteriori (MAP) estimation, Bayesian estimation, Naive Bayes classifier, Parameter smoothing, Logistic regression.

**Instance-Based Learning:** Introduction, k-nearest Neighbor learning, Distance weighted nearest neighbor algorithm, Case-based learning.

## **Soft Computing DECS-14713**

**Introduction:** Introduction to soft computing– Definition and importance, Evolution of soft computing, Usefulness and applications.

**Neural Networks:** Model of an artificial neuron, Comparison of artificial neural network and Biological neural network, Neural network architectures, Learning methods–Hebbian, competitive, Boltzmann. Neural network models– Perceptron, Adaline and medaline networks, Single layer, Back propagation, Radial basis function network and multi-layer networks.

**Genetic Algorithms:** Working principle– Crossover, Mutation, Encoding, Fitness function and Reproduction, Classification of genetic algorithm, Multi-objective genetic algorithm, Genetic Programming, Application of GA in search and optimization.

# M.TECH (MST-1 SYLLABUS)

## 3<sup>rd</sup> Semester

### Data Preparation & Analysis MCS-155

**Introduction to Data Analysis :** Problem definition , Data preparation, Implementation of the analysis , Deployment of the results, Data sources , Data understanding, Data preparation, Tables and graphs.

**Exploratory Analysis:** Descriptive statistics-Central tendency, Variation, Shape.Inferential statistics- Confidence intervals, Hypothesis tests, Chi-square, One way analysis of variance. Comparative statistics: Visualizing relationships Correlation coefficient( $r$ ), Correlation analysis for more than two variables.

**Grouping:** Introduction, Clustering: Hierarchical agglomerative clustering, K means clustering. Associative rules: Grouping by value combinations, Extracting Rules from groups. Decision trees: Tree generation, Splitting criteria.