641. INFORMATION TECHNOLOGY

Information Technology

Engineering Mathematics

Discrete Mathematics: Propositional and First Order Logic, Sets, Relations, Functions, Partial Orders and Lattices, Groups, Graphs: Connectivity, Matching, Coloring. Combinatorics: Counting, Recurrence Relations, Generating Functions.

Linear Algebra: Matrices, Determinants, System of Linear Equations, Eigen values and Eigen vectors, LU Decomposition.

Calculus: Limits, Continuity and Differentiability, Maxima and Minima, Mean Value Theorem, Integration.

Probability: Random Variables: Uniform, Normal, Exponential, Poisson and Binomial Distributions. Mean, Median, Mode and Standard Deviation. Conditional Probability and Bayes Theorem.

Computer Science and Information Technology

Digital Logic: Boolean algebra: Logic Gates, Number Representations, Combinational and Sequential Circuits, Flip- Flops & Counters: Minimization, and Computer Arithmetic (Fixed and Floating Point Representations).

Computer Organization and Architecture: Machine Instructions and Addressing Modes, ALU, Data and Control Unit, Instruction Pipelining, Pipeline Hazards, Memory Hierarchy: Cache, Main Memory and Secondary Storage, I/O Interface (Interrupt and DMA).

Programming and Data Structures: Programming in C, functions, Parameter Passing, Recursion, Structured Data Types: arrays, structure, union, strings, pointers, file handling. Arrays, Stacks, Queues, Linked Lists, Trees: Binary Trees, Tree Traversal techniques, Binary Search Trees, Tree Operations, Heaps, Graph terminology and representation

JAVA : Object Oriented System Development: Understanding Object Oriented Development, Understanding Object Concepts, Benefits of Object Oriented Development. **Java Programming Fundamentals**: Introduction, Overview of Java, Data Type, Variables and Arrays, Operators, Control statements, Classes, Methods, Inheritance, Packages and Interfaces, Inner Classes. I/O basics, Stream and Byte classes, Character Streams, Reading Console input and output, Print Writer Class, String Handling, Exceptions Handling, Multithreaded Programming. Exploring Java Language, Collections Overview, Collections Interfaces, Collections Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy classes and interfaces, Sting Tokenizer, BitSet, Date, Calendar, Timer. **Introducing AWT working With Graphics:** AWT Classes, Working with Graphics. **Event Handling:** Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. **AWT Controls:** Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, CheckboxGroup,

Choice Controls, Using Lists, Managing Scroll Bars, Using TextField, Using TextArea, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, FileDialog, Handling events by Extending AWT Components, Exploring the controls, Menus and Layout Managers. Introduction to Swing Package, Java I/O classes and interfaces, Reading and Writing Files, Serialization, Introduction to Java Network Programming, Object Class, Exploring Image package.

Algorithms: Searching, Sorting, Hashing, Asymptotic Notations, Time and Space Complexity. Algorithm Design Techniques: Greedy, Dynamic Programming and Divide-and-Conquer. Graph traversal techniques, Spanning Trees, Shortest Path Algorithms.

Operating System: Processes, Threads, CPU Scheduling, Disk Scheduling, Inter-Process Communication, Concurrency and Synchronization, Deadlock, Memory Management and Virtual Memory, File Systems and System calls.

Databases: ER-Diagrams, Relational Model: Relational Algebra, Tuple Calculus, SQL, Integrity Constraints, Normal Forms, File Organization: Indexing, B Trees and B+ Trees, Transactions and Concurrency Control.

Computer Networks: Concept of Layering, Flow and Error Control Techniques, Switching, IPv4/IPv6, Routers and Routing Algorithms (Shortest path, flooding, Distance Vector, Link State). TCP/UDP and Sockets, Congestion Control. Application Layer Protocols: DNS, SMTP, POP, FTP, HTTP, Email. Basics of Wi-Fi, Network Security: Authentication, Basics of Public Key and Private Key Cryptography, Digital Signatures and Certificates, Firewalls.

Software Engineering: Software Process Models, Data Flow Diagram, UML Diagrams, Requirements engineering, Design, Software Testing and Maintenance.

Web Technologies: XML-Documents and Vocabularies-Versions and Declaration -Namespaces JavaScript and XML: Ajax-DOM based XML processing, Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations, XSLT-Displaying XML Documents in Browsers. Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications. Web Services: JAX-RPC-Concepts-Writing a Java Web Service Client, Describing Web Services: WSDL- Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies

Machine Learning : Basic Maths **:** Probability, Linear Algebra, Convex Optimization

Background: Statistical Decision Theory, Bayesian Learning (ML, MAP, Bayes estimates, Conjugate priors) **Regression**: Linear Regression, Ridge Regression, Lasso **Dimensionality Reduction**: Principal Component Analysis, Partial Least Squares **Classification**: Linear Classification, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminate Analysis, Perceptron, Support Vector Machines + Kernels, Artificial Neural Networks + Back Propagation, Decision Trees, Bayes Optimal Classifier, Naive Bayes. **Evaluation measures**: Hypothesis testing, Ensemble Methods, Bagging, Adaboost Gradient Boosting, Clustering, K-means, K-medoids, Density-based Hierarchical, Spectral **Miscellaneous topics**: Expectation Maximization, GMMs, Learning theory.

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