

Module:1	Mathematical Logic	7 hours
Statements and Notation-Connectives–Tautologies-Equivalence - Implications–Normal forms - The Theory of Inference for the Statement Calculus - Predicate Calculus - Inference Theory of the Predicate Calculus		
Module:2	Algebraic Structures	6 hours
Semigroups and Monoids - Groups – Subgroups – Lagrange’s Theorem Homomorphism – Properties-Group Codes.		
Module:3	Counting Techniques	6 hours
Basics of counting - Pigeonhole principle - Permutations and combinations - Inclusion-exclusion principle - Recurrence relations - Solving recurrence relations - Generating functions-Solution to recurrence relations.		
Module:4	Lattices and Boolean algebra	6 hours
Partially Ordered Relations -Lattices as Posets – Hasse Digram – Properties of Lattices – Boolean algebra-Properties of Boolean Algebra-Boolean functions.		
Module:5	Fundamentals of Graphs	6hours
Basic Concepts of Graph Theory – Planar and Complete graph - Matrix representation of Graphs – Graph Isomorphism – Connectivity–Cut sets-Euler and Hamilton Paths–Shortest Path algorithms		
Module:6	Trees, Fundamental circuits, Cut sets	6 hours
Trees – properties of trees – distance and centres in tree – Spanning trees – Spanning tree algorithms- Tree traversals- Fundamental circuits and cut-sets		
Module:7	Graph colouring, covering, Partitioning	6 hours
Bipartite graphs - Chromatic number – Chromatic partitioning – Chromatic polynomial - matching – Covering– Four Colour problem.		

Module:1	Algorithm Analysis	8 hours
Importance of algorithms and data structures - Fundamentals of algorithm analysis: Space and time complexity of an algorithm, Types of asymptotic notations and orders of growth - Algorithm efficiency – best case, worst case, average case - Analysis of non-recursive and recursive algorithms - Asymptotic analysis for recurrence relation: Iteration Method, Substitution Method, Master Method and Recursive Tree Method.		
Module:2	Linear Data Structures	7 hours
Arrays: 1D and 2D array- Stack - Applications of stack: Expression Evaluation, Conversion of Infix to postfix and prefix expression, Tower of Hanoi – Queue - Types of Queue: Circular Queue, Double Ended Queue (deQueue) - Applications – List: Singly linked lists, Doubly linked lists, Circular linked lists- Applications: Polynomial Manipulation.		
Module:3	Searching and Sorting	7 hours
Searching: Linear Search and binary search – Applications. Sorting: Insertion sort, Selection sort, Bubble sort, Counting sort, Quick sort, Merge sort - Analysis of sorting algorithms.		
Module:4	Trees	6 hours
Introduction - Binary Tree: Definition and Properties - Tree Traversals- Expression Trees:- Binary Search Trees - Operations in BST: insertion, deletion, finding min and max, finding the k th minimum element.		
Module:5	Graphs	6 hours
Terminology – Representation of Graph – Graph Traversal: Breadth First Search (BFS), Depth First Search (DFS) - Minimum Spanning Tree: Prim's, Kruskal's - Single Source Shortest Path: Dijkstra’s Algorithm.		
Module:6	Hashing	4 hours
Hash functions - Separate chaining - Open hashing: Linear probing, Quadratic probing, Double hashing - Closed hashing - Random probing – Rehashing - Extendible hashing.		
Module:7	Heaps and AVL Trees	5 hours
Heaps - Heap sort- Applications -Priority Queue using Heaps. AVL trees: Terminology, basic operations (rotation. insertion and deletion).		

Module:1	Java Basics	2 hours
OOP Paradigm - Features of Java Language - JVM - Bytecode - Java program structure – Basic programming constructs - data types - variables – Java naming conventions – operators.		
Module:2	Looping Constructs and Arrays	2 hours
Control and looping constructs - Arrays – one dimensional and multi-dimensional – enhanced for loop – Strings - Wrapper classes.		
Module:3	Classes and Objects	2 hours
Class Fundamentals – Access and non-access specifiers - Declaring objects and assigning object reference variables – array of objects – constructors and destructors – usage of “this” and “static” keywords.		
Module:4	Inheritance and Polymorphism	3 hours
Inheritance – types – use of “super” – final keyword - Polymorphism – Overloading and Overriding - abstract class – Interfaces.		
Module:5	Packages and Exception Handling	2 hours
Packages: Creating and Accessing - Sub packages. Exception Handling - Types of Exception - Control Flow in Exceptions - Use of try, catch, finally, throw, throws in Exception Handling - User defined exceptions.		
Module:6	IO Streams and Files	2 hours
Java I/O streams – FileInputStream & FileOutputStream – FileReader & FileWriter- DataInputStream & DataOutputStream – BufferedInputStream & BufferedOutputStream – PrintOutputStream - Serialization and Deserialization.		
Module:7	Collection Framework	2 hours
Generic classes and methods - Collection framework: List and Map.		

Module:1	Macroeconomic Principles	5 hours
Introduction to Macroeconomics – Macroeconomic issues – Importance of Macroeconomics – Macroeconomic Aggregates.		
Module:2	National Income	5 hours
Circular flow of income, National income: Meaning, - Concepts – Nominal and real income -Methods of measurement – Importance – Problems in measurement.		
Module:3	Theory of Income and Employment Determination	5 hours
Classical dichotomy – Keynesian income determination model – Money illusion, wage price rigidity – stability of equilibrium– stabilization of fiscal policy, Labour market and unemployment – Aggregate demand, aggregate supply and price level.		
Module:4	Consumption and Investment Function	7 hours
Consumption: Meaning - Components – Determinants - Consumption function: Meaning – Kinds - Investment: Meaning - Components – Determinants - Investment function: Meaning – Kinds –Application.		
Module:5	Multiplier and Accelerator	7 hours
Multiplier: Meaning – Working of multiplier – Accelerator: meaning – Working of accelerator – Super multiplier.		
Module:6	Inflation and Deflation	7 hours
Inflation: Meaning - Types - Causes – Philips curve - The long-run Phillips curve. Inflation Expectations. The rational expectations - Deflation: Meaning – Causes – Consequences.		
Module:7	Money, Banking and Financial Market and Institution	7 hours
Demand and Supply of money – The IS curve. Money Market and the LM curve. Liquidity trap. The IS-LM model – Central Bank - Monetary policy: meaning – Objectives – Variables – The instruments of Monetary control. Financial Markets - Savings, Investment and Financial System – Financial Markets and Financial Intermediaries. Financial Institution. Global Economic Indicators.		

Module:1	Analytic Functions	7hours
Complex variable - Analytic functions and Cauchy – Riemann equations; Laplace equation and Harmonic functions; Construction of Harmonic conjugate and analytic functions; Applications of analytic functions to fluid-flow and electric field problems.		
Module:2	Conformal and Bilinear transformations	7 hours
Conformal mapping - Elementary transformations; Translation, Magnification, Rotation, Inversion; Exponential and Square transformations (w = e ^z , z ²); Bilinear transformation; Cross-ratio-Images of the regions bounded by straight lines under the above transformations;		
Module:3	Complex Integration	7 hours
Functions given by Power Series - Taylor and Laurent series-Singularities - Poles – Residues; Integration of a complex function along a contour; Statements of Cauchy-Goursat theorem- Cauchy’s integral formula-Cauchy’s residue theorem-Evaluation of real integrals- Indented contour integral.		
Module:4	Vector Spaces	6 hours
Vector space – subspace; linear combination - span - linearly dependent – Independent – bases; Dimensions; Finite dimensional vector space. Row and column spaces; Rank and nullity.		
Module:5	Linear Transformations	6 hours
Linear transformations – Basic properties; Invertible linear transformation; Matrices of linear transformations; Vector space of linear transformations; Change of bases; Similarity.		
Module:6	Inner Product Spaces	5 hours
Dot products and inner products; Lengths and angles of vectors; Matrix representations of inner products; Gram - Schmidt – Orthogonalization.		
Module:7	Matrices and System of Equations	5 hours
Eigenvalues and Eigen vectors; Properties of Eigenvalues and Eigen vectors; Cayley-Hamilton theorem; System of linear equations; Gaussian elimination and Gauss Jordan methods.		

Module:1	Digital Logic	8 hours
Boolean Algebra: Basic definitions, Axiomatic definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms Simplification of Boolean functions. Gate-Level Minimization: The Map Method (K-map up to 4 variable), Product of Sums and Sum of Products Simplification, NAND and NOR implementation. Logic Families: Digital Logic Gates, TTL and CMOS logic families.		

Module:2	Verilog HDL	5 hours
Lexical Conventions, Ports and Modules, Operators, Dataflow Modelling, Gate Level Modelling, Behavioural Modeling, Test Bench.		

Module:3	Design of Combinational Logic Circuits	8 hours
Design Procedure, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Decoders Encoders, Multiplexers, De-multiplexers, Parity generator and checker, Applications of Decoder, Multiplexer and De-multiplexer. Modeling of Combinational logic circuits using Verilog HDL.		

Module:4	Design of data path circuits	6 hours
N-bit Parallel Adder/Subtractor, Carry Look Ahead Adder, Unsigned Array Multiplier, Booth Multiplier, 4-Bit Magnitude comparator. Modeling of data path circuits using Verilog HDL.		

Module:5	Design of Sequential Logic Circuits	8 hours
Latches, Flip-Flops - SR, D, JK & T, Buffer Registers, Shift Registers - SISO, SIPO, PISO PIPO, Design of synchronous sequential circuits: state table and state diagrams, Design of counters: Modulo-n, Johnson, Ring, Up/Down, Asynchronous counter. Modeling of sequential logic circuits using Verilog HDL.		

Module:6	Design of FSM	4 hours
Finite state Machine(FSM):Mealy FSM and Moore FSM , Design Example : Sequence detection, Modeling of FSM using Verilog HDL.		

Module:7	Programmable Logic Devices	4 hours
Types of Programmable Logic Devices: PLA, PAL, CPLD, FPGA Generic Architecture.		