



GeeksforGeeks

# GATE CS & IT 2024



**GATE**  
CS 2024

Detailed  
Course Syllabus

# CONTENTS

## COMPUTER NETWORKS

### INTRODUCTION TO CN

- Motivation to study CN

### IP ADDRESSING / SUBNETTING / SUPERNETTING

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- Classful IP addressing - Part 1
- Classful IP addressing - Part 2
- Casting
- Types of IP addresses
- Network Mask / Subnet Mask
- Subnetting
- Applications of Subnetting
- Problem solving with Subnetting - Part1
- Problem solving with Subnetting - Part2
- Variable length subnet mask (VLSM)
- Types of Subnet mask
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- Problem solving with Supernetting
- Classless IP addressing
- Problem solving with Classless addressing
- "Subnet" problems with Classless addressing
- Subnetting in CIDR
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- Dynamic Host Configuration Protocol-DHCP
- Dynamic IP + Static IP + Ping command + Loopback address

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- Introduction to OSI Model
- Flow Control method- Stop & Wait ARQ
- Performance factors
- Performance factors- Examples
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- Drawback of Stop & Wait ARQ
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- Selective Repeat ARQ
- Problem solving with Selective Repeat ARQ
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- Controlled Access Protocol
- Random Access Protocol
- CSMA/CD
- Back-off algorithm
- CSMA/CA
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- Hamming Code
- Cyclic Redundancy Check(CRC)
- Polynomial CRC Generator
- Rules to set CRC Generator
- Check Sum
- Framing in DLL
- Character stuffing & Bit stuffing
- Encoding
- Ethernet & Ethernet Frame Format
- Token Ring Frame format
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- Packet Switching
- Performance of Packet Switching
- Circuit v/s Packet v/s Message Switching
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- IPv4 Header – Part 3
- IPv4 Header Field- Options
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- Network Layer Protocol-RARP
- Network Layer Protocol-ICMP
- Error Reporting with ICMP
- Query messages with ICMP
- Traceroute with ICMP
- Introduction to Routing algorithms
- Distance vector routing(DVR)
- DVR-Example2
- Count to infinity – DVR problem
- Split Horizon
- Link-state routing (LSR)
- Link-state routing (LSR) – Part2
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- Introduction to Transport Layer
- TCP Header
- Congestion control with TCP
- User Datagram Protocol (UDP)

## APPLICATION LAYER

- Application layer protocols
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- Hyper Text Transfer Protocol(HTTP)
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- HUB & Repeater
- Bridge
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- Gate PYQ on endianness
- Memory mapping
- Locality of reference
- Direct Memory mapping
- Set associative mapping
- Fully associative mapping
- Hardware implementation of Direct mapping
- Hardware implementation of set associative & associative mapping
- Block Replacement methods
- Types of cache misses
- Simultaneous & Hierarchical memory access

#### Machine Instructions & Addressing Modes

- Instruction format
- Types of instructions based on operands
- Questions
- Types of instructions based on operations
- Data transfer instructions
- Arithmetic, Logical & shift instructions
- Program Control instructions
- Types of CPU Organizations
- Addressing Modes: Implied, immediate AM
- Register & Register indirect AM
- Direct & indirect AM
- Auto increment & auto decrement AM
- Indexed, relative & Base Register AM
- RISC vs CISC
- Interrupt vs Subroutine

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- Data-Path & Basics of instruction execution
- Instruction cycle
- Program status word
- Control Unit: Hardwired CU & Microprogrammed CU
- Microprogrammed Approach: Horizontal & Vertical Microprogrammed CU

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- Register window and register file size in RISC
- Instruction Pipelining
- Pipeline overhead & Basic Questions
- Pipelining dependencies or hazards
- Structural Dependency
- Control Dependency
- Questions on Control Dependency
- Data Dependency
- Operand Forwarding

## IO Interface

- I/O interface intro
- I/O Processor ,Isolated & Memory mapped I/O
- Isolated I/O vs Memory mapped I/O
- I/O data transfer modes: Programmed & Interrupt driven mode
- DMA

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- Disk storage structure & terms used
- Questions on disk

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## DIGITAL LOGIC FOR GATE

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- Introduction to Number System
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- Octal/Hex to Decimal and Decimal to Octal/Hex
- Generalized Base  $r$  to Decimal and Decimal to Base  $r$
- Octal/Hex to Binary and Binary to Octal/Hex
- Fractional Number Conversion
- Examples of Base  $r$  fractional number conversion
- Arithmetic of unsigned numbers (All Number System)
- Previous year GATE questions of Base  $r$  arithmetic
- Representation of Signed Numbers
- Complement of Number (Radix/ Diminished Radix)
- Arithmetic of Signed Numbers
- Miscellaneous codes
- Weighted and Non weighted codes
- Hamming codes
- Practice Set: Previous Year Gate papers
- Practice Set: Previous Year Gate papers 2

### BOOLEAN ALGEBRA

- Introduction to Boolean Algebra
- Minimization of Boolean Expressions
- Relationship between SOP and POS
- K-MAP Introduction
- Examples on Kmap
- Covering Functions
- Implicants and Prime Implicants
- Essential Prime Implicants
- Example on Minimal SOP
- Example on Minimal POS
- Introduction to Don't cares
- Examples on Don't cares P1
- Examples on Don't cares P2
- Finding Minimal Functions
- Branching Technique for Minimizing Cyclic Functions
- Self Dual Functions: Definition

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- Converting Function into self Dual
- Self Dual Functions: No of self Dual functions for n variable
- Combining Functions having Don't cares
- Number of Minimal Expressions
- VEM: Variable Entrant Map
- Examples on VEM
- Previous year GATE questions-1
- Previous year GATE questions-2

## COMBINATIONAL CIRCUITS

- Introduction to Logic Design
- AOR and OAR
- NAND-NAND realization
- Minimum No. of NAND Gates required
- NOR-NOR realization
- Minimum No. of NOR Gates required
- EXOR-EXNOR implementation with NAND and NOR
- Half Adder
- Half Subtractor
- Full Adder
- Binary Adder (Ripple Carry Adder)
- Binary Adder/ Subtractor (Ripple Carry Adder)
- Look Ahead Carry Adder
- Serial Adder
- BCD Adder
- Time Complexity of RCA
- Time Complexity of LACA
- Comparator
- 3,4 bit comparator
- Introduction to MUX
- MUX: Functionally complete?
- Implementing functions using MUX
- Multiplexer with Enable line
- Cascading Multiplexers
- Expansion of Multiplexer
- Introduction to Demultiplexer
- Introduction to Decoders
- Implementing functions using Decoder



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- Implementation Example#1
- Implementation Example#2
- ROM implementation
- 4X32 Decoder using 2X4 Decoder
- Example of Constructing Decoder using decoder
- Address Expansion of ROM
- Word Expansion of ROM
- Determining the address range
- Enabling a Device
- Introduction to Encoders
- Priority Encoders
- Code Conversion
- Introduction to Hazards
- Test Vectors

## SEQUENTIAL CIRCUITS

- Introduction to Sequential Circuits
- Latch and Flipflop
- Level Triggered and Edge Triggered
- SR Latch
- SR Flipflop
- D Flipflop
- JK Flipflop
- T Flipflop
- Flipflop Interconversion method
- Example#1 of Flipflop conversion
- Example#2 of Flipflop conversion
- Example#3 of Flipflop Conversion
- Introduction to Registers
- Introduction to Counters
- Asynchronous and Synchronous Counters
- Ring Counters
- Ring Counters:Mod 4
- Johnson Counter
- Mod 4 Gray Counter
- Determining the Clock Frequency
- Introduction to Asynchronous Counters
- Questions on FFs
- Questions on sequential circuits
- Questions on Mod N counter

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## THEORY OF COMPUTATION

### Introduction to Theory of Computation

- Introduction to Theory of Computation
- Understanding Basic Terminologies
- Chomsky Hierarchy and Classification of FA

### Regular Language and Finite Automata

- Introduction to DFA with examples
- More Examples on DFA Part-1
- More Examples on DFA Part-2
- Complementation of DFA and Examples of DFA
- Different Operations on DFA Part-1
- Different Operations on DFA Part-2
- Introduction to NFA
- Minimization of DFA
- Introduction to Moore and Mealy Machine
- Conversion between Moore and Mealy Machine
- Epsilon NFA
- Regular Language and Regular Expression
- Examples on Regular Expressions
- Regular Expression to Finite Automata
- Examples on Regular Language Part-1
- Examples on Regular Language Part-2
- Pumping Lemma for Regular Language

### Context Free Grammars

- Introduction to Context Free Grammars
- Examples on Context Free Grammars
- Chomsky Classification of Grammars
- Eliminating NULL Production from CFG
- Eliminating Unit Production from CFG
- Eliminating Useless Symbols from CFG
- Introduction to CNF and GNF
- Introduction to CYK Algorithm

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- Introduction to Push Down Automata
- Conversion to PDA from CFG
- Examples on Context Free Language Part-1
- Examples on Context Free Language Part-2
- Pumping Lemma for Context Free Language

## Turing Machine and Unrestricted Grammars

- Introduction to Turing Machines with Examples
- Representation of Turing Machine
- Turing Thesis(Optional)
- Different Types of Turing Machines
- Universal Turing Machine
- Introduction to REL and RL
- Understanding CSL

## Theory of Computation-Miscellaneous

- Introduction to Countability
- Examples of Countability
- Different Properties on Countability
- Difference Between Computability and Decidability
- Turing Machine Halting Problem
- Post Correspondence Problem and Complexity Classes
- Properties of CFL and PDA
- Properties of RL and FA
- Decidability Chart
- Closure Property Chart

## DATABASE MANAGEMENT SYSTEM for GATE

### Introductory

- DBMS Syllabus
- Intro to DBMS
- File System vs DBMS
- DBMS architectures
- OLAP vs OLTP
- Schema and three schema Architecture
- What is Data Independence?

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## Concept of Keys

- Concept of Keys
- Candidate Keys and Super Keys
- Primary Key and Alternate Keys
- Model Questions on Number of Super Keys
- Foreign Keys
- Referential Key Integrity Constraints
- Functional Dependency
- Attribute Closure
- How to find number of Candidate Keys
- Model Questions on Number of Candidate Keys

## ER Model

- Intro to ER Model
- Types of Attributes
- Relationships in ER diagram
- Cardinality Ratio and Participating Constraints
- One to Many Mapping
- One to One Mapping
- Many to Many Mapping
- Model questions on min number of tables - I
- Self-Referential
- Weak Entity
- Model questions on min number of tables – II

## Normalization

- Canonical Cover
- Equivalence of FDs
- Armstrong Axioms
- Lossless Join Decomposition
- Dependency Preserving Decomposition
- Normalization
- First Normal Form
- Second Normal Form
- Third Normal Form
- Boyce Codd Normal Form
- How to find Normal Form
- Model Question on Highest Normal Form
- Decomposition into Highest Normal Form

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## Relational Algebra

- Intro to Relational Algebra
- Selection and Projection Operation
- Cartesian Product or Cross Product
- Union Operator
- Set-Difference Operator
- Rename Operator
- Intersection Operator
- Intro to Joins
- Natural Join
- Conditional Join
- Outer Join
- "More/Less than Some" type of queries
- "More/Less than Every" type of queries
- "Maximum and Minimum" type of queries
- Queries on Set Operation
- Division Operator
- Max and Min number of tuples on Join
- Tuple Relation Calculus
- Model Questions on TRC

## SQL

- Intro to SQL
- Aliases
- Alter v/s Update
- Delete v/s Drop v/s Truncate
- Constraints in SQL
- Aggregate Function
- "Group By" Clause
- "Having" Clause
- "Order By" Clause
- Nested and Correlated Nested Query
- WITH Clause
- ANY & ALL Operators
- IN & NOT IN Operators
- EXISTS and NOT EXIST Operators
- Set Operations
- Model SQL Queries - I

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- Model SQL Queries - II
- "Kth MAX and MIN"
- SQL Query implementing Division Operator of RA
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## File Organization

- File Organization
- Indexing //Dense Index and Sparse Indexing
- Primary Indexing
- Clustering Indexing
- Secondary Indexing over Key
- Secondary Indexing over Non Key
- Intro to B Tree
- Construction of B Tree
- Order of B Tree
- Intro to B+ Tree
- Construction of B+ Tree
- Order of B+ Tree
- Min and Max Keys and Nodes in B/B+ Tree
- Bulk Loading in B+ Tree
- Join Algorithms

## Transaction and Concurrency Control

- Transactions
- ACID Properties
- Schedule
- Conflict
- Conflict Equivalent Schedules
- Conflict Serializable Schedule
- View Serializable Schedule
- Concurrency Problems
- Recoverable and Irrecoverable Schedule
- Cascading and Cascadeless Schedule
- Simple Lock based Protocol
- Basic 2PL Locking Protocol
- Model Questions on 2 PL
- 2 PL categories
- Basic Time Stamp Ordering Protocol
- Model Questions on Basic TO Protocol

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## COMPILER DESIGN

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- Introduction to Compiler Design
- Ambiguous Grammar
- Recursive Grammar
- Left factoring
- Introduction to Compiler Phase
- Language Processing

### LEXICAL ANALYZER PHASE

- Lexical Analyzer or Scanner
- Gate Questions on Lexical Analyzer

### SYNTAX ANALYZER PHASE -> TOP-DOWN PARSER

- Parsers
- Recursive Descent Parser
- Recursive Descent Parser with Left Recursive and Left
- Factored grammar
- LL(1) Parser
- First() function
- Follow() function
- LL(1) parsing table construction
- Checking a Grammar LL(1) or not
- How much powerful is LL() parser

### SYNTAX ANALYZER PHASE -> TOP-DOWN PARSER

- Bottom-up Parsers
- LR(0) parser
- Goto() and Closure() functions
- LR(0) parsing table construction
- Problem Solving with LR(0) parser
- Types of conflicts in LR(0) and SLR(1)
- Handling Left Recursive grammar with LR(0) parser
- SLR(1) parsing table construction

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- Problem solving with SLR(1) parser - Part 1
- Problem solving with SLR(1) parser - Part 2
- Closure/ Goto functions with LR(1) item
- CLR(1) parsing table construction
- LALR(1) parsing table construction
- Types of conflicts in CLR(1) and LALR(1)
- Problem solving with CLR(1) and LALR(1) parser - Part 1
- Problem solving with CLR(1) and LALR(1) parser - Part 2
- Power comparison of parsers
- Operator Precedence Parser
- Operator Precedence Parser Table Construction

## SEMANTIC ANALYZER PHASE

- Syntax Directed Translation
- Applications of SDT-Part 1
- Applications of SDT-Part 2
- Applications of SDT-Part 3
- Construct SDT based on S-attributed definition and attributed definition
- Gate Question 1 based on SDT
- Gate Question 2 based on SDT
- Gate Question 3 based on SDT

## INTERMEDIATE CODE GENERATION PHASE

- Intermediator Code Generator
- Examples-Intermediate Code Generation
- Types of 3-address code
- Conditional statement in 3-address code
- Loop statement in 3-address code
- Switch statement in 3-address code
- Representation of 3-address code in memory

## SYMBOL TABLE AND STORAGE ALLOCATION

- Run time environment
- Symbol table
- Representing scope information
- Error Detection and Recovery
- Storage Allocation



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## CODE OPTIMIZATION PHASE

- Code Optimization
- Finding loop in code with Basic blocks and Leaders
- Data flow analysis
- Data flow analysis example

## OPERATING SYSTEM

### BASIC CONCEPTS

- Operating System for GATE
- Functions and GOAL of Operating System
- Process | Process States | Process Control Block
- Process state transition diagram
- Multi Programming
- Multi Tasking
- Context Switch

### CPU SCHEDULING

- Introduction to CPU Scheduling
- CPU and I/O Burst Cycle
- Preemptive and Nonpreemptive Scheduling
- CPU Scheduling Performance criteria
- First Come First Serve CPU scheduling
- Convoy Effect
- Priority CPU Scheduling | Non Preemptive
- Preemptive Priority Scheduling
- Shortest Job First (SJF) CPU Scheduling
- Shortest Remaining Time First Scheduling
- Longest Job First (LJF) CPU Scheduling
- Longest remaining time first scheduling
- Round-Robin CPU Scheduling
- CPU Scheduling with CPU & I/O Burst Time
- SJF with CPU & I/O Burst Time
- SRTF with CPU & I/O Burst Time
- Shortest Job First CPU Scheduling with predicted burst time
- Highest Response Ratio Next(HRRN)
- Multilevel Queue Scheduling
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- Critical Section & Race Condition
- Critical Section Problem | Condition to process synchronization
- Busy Wait and Spin Lock
- Lock Variable Synchronization Mechanism
- Test and Set Instruction
- Turn Variable | Strict Alteration Method
- Interested variable
- Peterson's Solution
- Semaphores | Wait, Signal Operation
- Binary Semaphore
- Counting Semaphore
- Producer Consumer Problem
- Printer-Spooler Problem
- Readers-writers Problem
- Dining philosophers Problem
- Examples of Counting Semaphore Basic Wait and Signal
- Examples of Binary Semaphore
- Examples of producer consumer problem with semaphore

## DEADLOCK

- Introduction to Deadlock
- Deadlock Characteristics
- Deadlock Example \_Basic PYQ
- Resource Allocation Graph
- Deadlocks Handling Methods
- Deadlock Prevention
- Deadlock Avoidance
- Resource Allocation Graph Algorithm
- Bankers Algorithm
- Deadlock Detection And Recovery

## MEMORY MANAGEMENT

- Memory Management
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- Contiguous and non Contiguous Memory management
- Fixed size Partitioning | Internal Fragmentation

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- First Fit, Next Fit, Best Fit, Worst Fit Memory Allocation
- Examples on First Fit, Best Fit and Worst fit
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- Paging Part-1
- Paging Part-2
- Paging Part-3
- Physical Address and Logical Address Space
- Address Translation
- Translation Lookaside Buffer
- Paging : Numerical Session-1
- Paging : Numerical Session-2
- Page Table Entries
- Multi Level Paging
- 2-Level Paging
- Inverted Paging
- Thrashing
- Segmentation
- Segmented Paging
- Virtual Memory
- Page Replacement
- Page Fault
- FIFO Page Replacement
- Belady's Anomaly in FIFO page Replacement
- Optimal Page Replacement algorithm
- Least Recently Used Page Replacement Algorithm
- Most recently used page replacement Algorithm

## DISK MANAGEMENT

- Disk Access Time
- Disk Scheduling
- FCFS Disk scheduling
- SSTF Disk scheduling
- SCAN Disk Scheduling
- C-Scan Disk Scheduling
- LOOK Disk Scheduling
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## DATA STRUCTURE & PROGRAMMING

### INTRODUCTION TO C PROGRAMMING

- Introduction to C Programming
- Data Type and Operators

### CONDITIONAL STATEMENTS, STORAGE CLASSES & SCOPES

- Condition Statements and Built-in Functions
- Storage Class and Scope
- Questions on Operators, Conditions, Storage Classes and Scope

### LOOPS, FUNCTIONS AND RECURSION

- Loops
- Functions, Recursion
- Questions on Loops, Functions and Recursion

### POINTER

- Pointer Concept
- Pointer and Array
- Pointer and Functions
- Pointer Arithmetic
- Questions on Pointers

### STRING, STRUCTURE, UNION & DMA

- Strings
- Structure
- Dynamic Memory Allocation
- Questions on String, Structure, Union and DMA

### INTRODUCTION TO DATA STRUCTURE

- Introduction to Data Structure

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## ARRAY AND LINKED LIST

- Array
- Array Arithmetic
- Linked List Construction
- Linked List Operations
- Types of Linked Lists
- Questions on Array and Linked List

## STACK

- Stack Definition
- Applications of Stack
- Questions on Stack, Tower of Hanoi

## QUEUE AND TREES

- Queue Implementation
- Queue Applications
- Trees part-1
- Trees part-2
- Questions on Queue and Trees

## HASHING

- Hashing
- Questions on Hashing and All DS

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- Additional Problems on Programming and Data Structure

## DATA STRUCTURES & PROGRAMMING IN C

- Short notes for C
- Short Notes for DS

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- Short Notes for DS

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## ALGORITHMS

### INTRODUCTION AND COMPLEXITY ANALYSIS

- Introduction to Algorithms
- Introduction to Asymptotic Notations
- Asymptotic Notation (insight)
- Practice Session on Asymptotic Notation
- Complexity Analysis
- Practice Session on Complexity Analysis

### RECURSION

- Understanding recursion through Tower of Hanoi
- Space complexity of Recursive Procedures
- Substitution and Recurrence
- The Master Theorem

### DIVIDE & CONQUER

- Introduction to Divide and Conquer
- Merge Sort
- Practice Session on Merge Sort
- Quick Sort
- Quick Sort Analysis

### SEARCHING & SORTING

- Linear and Binary Search
- Matrix Multiplication Methods
- Comparison-Based Sorting Techniques
- Non-comparison Based Sorting Techniques

### HEAPS

- Introduction to Heaps
- The Heapify procedure
- Heap Sort
- Extract Min/Max element from Heap

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## GRAPHS

- Representation of Graphs
- Depth First tree traversal
- Breadth First tree traversal
- Diving deep into DFT
- Diving deep into BFT
- Topological Sorting

## DYNAMIC PROGRAMMING

- Introduction to Dynamic Programming
- Matrix Chain Multiplication using Dynamic Methods
- Matrix Chain Multiplication Analysis
- Longest Common Subsequence problem
- Longest Common Subsequence using Dynamic Programming
- 0/1 KnapSack
- Subset-Sum problem
- Floyd-Warshall algorithm
- Floyd-Warshall algorithm Analysis

## GREEDY ALGORITHM

- Introduction to Greedy Algorithms
- Dijkstra's single-source Shortest Path Algorithm
- Bellman Ford Algorithm
- Introduction to Spanning Trees
- Minimum Spanning Tree - Prim's Algorithm
- Minimum Spanning Tree - Kruskal's Algorithm
- Huffman Coding

## ALGORITHMS

- Algorithms Short Notes

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- Algorithms Short Notes

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## ENGINEERING MATHEMATICS

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- Introduction of Matrices
- Types of Matrices
- PYQ on symmetric matrix
- Inverse of Matrices
- Determinants
- PYQ's on determinants
- Properties of determinants
- PYQ's on properties of determinants
- Row reduced echelon form of matrices
- Rank of matrices
- Properties of rank of matrices
- System of Linear Equation
- Homogeneous System of Linear Equation
- Non-Homogeneous System of Linear Equation
- Eigen Values and Eigen Vectors
- Properties of Eigen Values and Eigen Vectors
- Cayley Hamilton Theorem
- LU Decomposition
- System of linear equations using LU Decomposition method

### DISCRETE MATHEMATICS

#### ● PROPOSITIONS AND THEIR FIRST ORDER LOGIC

- Introduction to discrete mathematics
- Introduction to Propositional Logic
- Connectives
- Translating English Sentences
- PYQ on Connectives
- Special Conditional Statements
- Types of Proposition based on Truth Values
- Propositional Equivalence
- GATE PYQ's on Propositional Equivalence
- Rules of Inference (Basic Terminology)
- Rules of Inference
- PYQ's on Rules of Inference



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- Predicate Logic
- Quantifiers
- Translating English Sentences using Quantifiers
- PYQ's on Quantifiers
- Logical Equivalences involving Predicate and Quantifiers
- Quantifiers with restricted domains
- Negating Quantified statements
- Nested Quantifiers
- Negation of nested quantifiers
- Inference Rules of Predicate Logic
- Inference Rules of Predicate Logic (Continued)

## • SET THEORY

- Introduction to Set Theory
- Introduction to Set Theory(Continued)
- Set Operations
- PYQ's on Set Operations
- Power Sets
- PYQ's on Power Sets
- Relations and their types
- PYQ's on Relations
- Composition of Relations
- Equivalence Relations and Equivalence Classes
- Closure of Relations
- Functions
- PYQ's on Functions
- Composite Functions and Increasing-Decreasing functions
- Counting of functions
- PYQ's on Functions(Continued)
- Partial Orders
- Hasse Diagrams
- Important Terms in Posets
- Lattices

## • GROUP THEORY

- Groups
- Important Groups
- Order of an element and a group
- Subgroups

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- Cyclic Groups
- PYQ's ON Groups
- PYQ's on Groups(Continued)

## ● GRAPH THEORY

- Graph Theory Basics
- Handshaking Lemma
- Some special simple graphs
- Walk in Graph Theory
- Isomorphism in Graph Theory
- PYQ's on Isomorphism
- Connected Graphs and Subgraphs
- Connected Component
- Euler Graph
- Hamiltonian Graph
- Planar Graphs
- PYQ's on Planar Graphs
- Graph Coloring
- PYQ's on Graph Coloring
- Independent Sets
- Graph Covering
- Matching in Graph Theory
- Matching in Graph Theory (Continued)
- GATE PYQ's on Graph Theory
- GATE PYQ's on Graph Theory (Continued)

## ● COMBINATORICS

- Combinatorics Basics
- The Pigeonhole Principle
- The Pigeonhole Principle strong form
- Binomial Theorem
- Generalized PnC-1 (Permutation with repetitions)
- Generalized PnC-2 (Combination with repetitions)
- Generalized PnC-3
- Generalized PnC-4
- Inclusion-Exclusion Principle
- Derangements
- Generating Function
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- Limits
- L'Hospital's rule
- PYQ's on Limits
- PYQ's on Limits (Continued)
- Continuity
- Examples on Continuity
- PYQ's on Continuity
- Differentiability
- Examples on Differentiability
- Difference between Continuity and Differentiability
- PYQ's on Differentiability
- Rolle's theorem
- Lagrange Mean Value theorem
- Cauchy Mean Value theorem
- PYQ's on Mean Value Theorem
- Indefinite Integrals
- Integration by Substitution
- Integration by Parts
- Integration by Partial Fraction
- Examples on Indefinite Integration
- Definite Integral
- Properties of Definite Integral
- PYQ's on Definite Integral
- PYQ's on Definite Integral (Continued)
- Maxima and Minima
- PYQ's on Maxima and Minima
- PYQ's on Calculus

## PROBABILITY

- **Basics of Probability**
  - Sample Space and Events
  - Different Types of Events
  - Mean, Variance and Standard Deviation
  - PYQ'S On Basis Of Probability

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- **Conditional Probability**

- Introduction Of Conditional Probability
- Examples Of Conditional Probability
- Properties Of Conditional Probability
- Law of Total Probability
- Baye's Theorem
- PYQ'S On Conditional Probability

- **Conditional Probability**

- Introduction Of Conditional Probability
- Examples Of Conditional Probability
- Properties Of Conditional Probability
- Law of Total Probability
- Baye's Theorem
- PYQ'S On Conditional Probability

- **Random Variable**

- Random Variable
- Bernoulli Distribution
- Expectation of Bernoulli Distribution
- Binomial Distribution
- Expectation of Binomial Distribution
- Poisson Distribution
- Expectation of Poisson Distribution
- Exponential Distribution
- Expectation of Exponential Distribution
- Uniform Distribution
- Expectation of Uniform Distribution
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- PYQ's On Probability

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