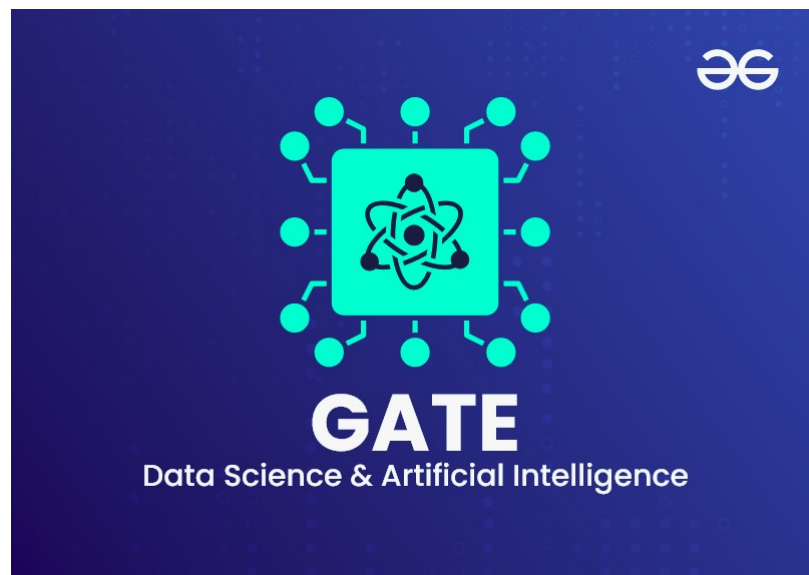


# GATE

## DATA SCIENCE and AI 2024



# DETAILED COURSE SYLLABUS

## CONTENTS



## PROBABILITY AND STATISTICS

- Permutations and Combinations
- Probability Axioms
- Sample Space and Events
- Independent Events
- Mutually Exclusive Events
- Marginal, Conditional, and Joint Probability
- Bayes Theorem
- Conditional Expectation and Variance
- Mean, Median, Mode, and Standard Deviation
- Correlation and Covariance
- Random Variables
- Discrete Random Variables and Probability Mass Functions
- Uniform Distribution
- Bernoulli Distribution
- Binomial Distribution
- Continuous Random Variables and Probability Distribution Functions
- Uniform Distribution

## CONTENTS



- Bernoulli Distribution
- Binomial Distribution
- Continuous Random Variables and Probability Distribution Functions
- Uniform Distribution
- Exponential Distribution
- Poisson Distribution
- Normal Distribution
- Standard Normal Distribution
- t-Distribution
- Chi-Squared Distributions
- Cumulative Distribution Function
- Conditional Probability Density Function
- Central Limit Theorem
- Confidence Interval
- z-Test
- t-Test
- Chi-Squared Test

## LINEAR ALGEBRA

- Vector Space
- Subspaces
- Linear Dependence and Independence of Vectors
- Matrices
- Projection Matrix
- Orthogonal Matrix
- Idempotent Matrix
- Partition Matrix and Their Properties
- Quadratic Forms

## CONTENTS



- Systems of Linear Equations and Solutions
- Gaussian Elimination
- Eigenvalues and Eigenvectors
- Determinant
- Rank and Nullity
- Projections
- LU Decomposition
- Singular Value Decomposition

## CALCULUS AND OPTIMIZATION

- Functions of a Single Variable
- Limit, Continuity, and Differentiability
- Taylor Series
- Maxima and Minima
- Optimization Involving a Single Variable

## PROGRAMMING AND DATA STRUCTURES

- Programming in Python
- Basic Data Structures
- Stacks
- Queues
- Linked Lists
- Trees
- Hash Tables

# DETAILED COURSE SYLLABUS

## CONTENTS



- Search Algorithms
- Linear Search
- Binary Search
- Basic Sorting Algorithms
- Selection Sort
- Bubble Sort
- Insertion Sort
- Divide and Conquer
- Merge Sort
- Quick Sort
- Introduction to Graph Theory
- Basic Graph Algorithms
- Traversals
- Shortest Path

## DATABASE MANAGEMENT AND WAREHOUSES

- ER-Model
- Relational Model
- Relational Algebra
- Tuple Calculus
- SQL
- Integrity Constraints
- Normal Form

# DETAILED COURSE SYLLABUS

## CONTENTS



- File Organization
- Indexing
- Data Types
- Data Transformations
- Normalization
- Discretization
- Sampling
- Compression
- Data Warehouse Modeling
- Schema for Multidimensional Data Models
- Concept Hierarchies
- Measures: Categorization & Computations

## MACHINE LEARNING

- Supervised Learning
- Regression: Simple Linear Regression, Multiple Linear Regression Ridge Regression
- Classification
- Logistic Regression
- k-Nearest Neighbor
- Naive Bayes Classifier
- Linear Discriminant Analysis
- Support Vector Machine
- Decision Trees

## CONTENTS



- Bias-Variance Trade-Off
- Cross-Validation Methods
- Leave-One-Out (LOO) Cross-Validation
- k-Folds Cross-Validation
- Multilayer Perceptron
- Feed-Forward Neural Network
- Unsupervised Learning
- Clustering Algorithms: K-Means/K-Medoid  
Hierarchical Clustering (Simple & Multiple Linkage)
- Dimensionality Reduction
- Principal Component Analysis

## ARTIFICIAL INTELLIGENCE

- Search Algorithms: Informed, Uninformed & Adversarial
- Logic
- Propositional
- Predicate
- Reasoning Under Uncertainty
- Conditional Independence Representation
- Exact Inference Through Variable Elimination
- Approximate Inference Through Sampling