

University of Information Technology

Department of Languages (English)

Question Scope for Master's and Ph.D Entrance Examination (2025)

Question I : Reading Comprehension (20 marks)

Question II : Multiple Choice Cloze Type (10 marks)

: Tenses (10 marks)

Question III : Vocabulary (20 marks)

(Affixes/Word formation, Confusing words)

Question IV : Advanced Grammar (25 marks)

(Mixed conditional, Clauses (Noun, Adjective, Adverb), Passive,
Comparison)

Question V : Argumentative Essay Writing (15 marks)

University of Information Technology
2025-2026 Academic Year
Faculty of Computer Science (FCS)
Scope for M.C.Sc. / M.C.Tech. + Ph.D. (IT) Entrance Exam

Operating System

Textbook – Operating Systems Internals and Design Principles (Seventh Edition)
by William Stallings

Chapter 4 – Threads
Chapter 7 – Memory Management
Chapter 9 – Uniprocessor Scheduling
Chapter 11 – I/O Management and Disk Scheduling

Data Structure

Text Book – Introduction to The Design and Analysis of Algorithm by Anany
Levitin

Chapter 3: Brute Force and Exhaustive Search
Chapter 4: Decrease- and- Conquer
Chapter 5: Divide- and- Conquer
Chapter 9: Greedy Technique

Artificial Intelligence

Text Book – Introduction to Artificial Intelligence, second edition", by Wolfgang
Ertel

Chapter 2: Propositional Logic
Chapter 9: Neural Networks
Chapter 10: Reinforcement Learning

University of Information Technology
2025-2026 Academic Year
Faculty of Computer Systems and Technologies (FCST)
Scope for M.C.Sc. / M.C.Tech. + Ph.D. (IT) Entrance Exam

Computer Architecture

Text Book – Computer Architecture and Organization (3rd Edition) by John. P. Hayes, McGraw-Hill International Edition

Chapter 1: Computing and Computers

Chapter 2: Design Methodology

Chapter 3: Processor Basics

Communication and Networking

Text Books – 1) Data and Computer Communications by William Stallings (10th Edition)

PART II – Data Communications

PART VI – Data Communications and Wireless Networks

PART VII – Internetworking

2) Computer Networking – A Top-Down Approach by James F. Kurose (8th Edition)

Chapter 4 – The Network Layer: Data Plane

Chapter 5 – The Network Layer: Control Plane

Chapter 8 – Security in Compute Networks

University of Information Technology
Faculty of Information Science (FIS)
(2025-2026) Academic Year
Scope for M.C.Sc. / M.C.Tech. + Ph.D. (IT) Entrance Exam

1. Text Book: Software Engineering

Author: Ian Sommerville

Edition: Tenth Edition

Chapter 8 - Software Testing

Chapter 10 - Dependable Systems

Chapter 11 - Reliability Engineering

2. Text Book: Data Mining: Concepts and Techniques

Authors: Jiawei Han, Micheline Kamber, and Jian Pei

Edition: Third Edition

Chapter 2 - Getting to Know Your Data

Chapter 3 - Data Preprocessing

Chapter 6 - Mining Frequent Patterns, Associations, and Correlations

Chapter 10 - Cluster Analysis

University of Information Technology

2025-2026 Academic Year

Faculty of Computing (FC)

Scope for M.C.Sc./ M.C.Tech. + Ph.D. (IT) Entrance Exam

Calculus

Textbook – Thomas Calculus (Fifteenth Edition)

1. Limits and Continuity:

- Detailed understanding of limits, continuity, and differentiability.
- Epsilon-delta definitions and proofs.

2. Differentiation:

- Mastery of derivative techniques.
- Applications of derivatives, including optimization, curve sketching, and related rates.
- Higher-order derivatives and their applications.

3. Integration:

- Both definite and indefinite integrals.
- Techniques of integration (e.g., substitution, partial fractions, integration by parts).
- Improper integrals and their convergence.

4. Series and Sequences:

- Convergence tests for series.
- Power series and Taylor series.
- Fourier series and their applications.

5. Multivariable Calculus:

- Partial derivatives, gradient, divergence, and curl.
- Double and triple integrals in various coordinate systems.
- Line integrals, surface integrals, and Green's, Stokes', and Divergence theorems.

6. Differential Equations:

- First and second-order differential equations.
- Application of differential equations in physical and engineering problems.

7. Vector Calculus:

- Vectors, dot and cross products.
- Vector fields and vector-valued functions.
- Applications of vector calculus in geometry and physics.

Discrete Mathematics

Text Book – Discrete Mathematics and its Application (7th Edition)

Set Theory

- **Basics of Sets:** Set operations (union, intersection, complement, difference, Cartesian product), Venn diagrams.
- **Relations on Sets:** Equivalence relations, partial orders, total orders.
- **Functions:** One-to-one, onto functions, inverse functions, bijections, composition of functions.

2. Logic and Propositional Calculus

- **Propositional Logic:** Logical operators, truth tables, tautologies, contradictions, logical equivalence, implications, and logical inference.
- **Predicate Logic:** Quantifiers (universal and existential), negation, and translating statements into predicate logic.
- **Proof Techniques:** Direct proofs, proof by contradiction, proof by induction, and counterexamples.

3. Combinatorics

- **Basic Counting Principles:** Permutations, combinations, Pigeonhole Principle, and inclusion-exclusion principle.
- **Recurrence Relations:** Solving linear recurrence relations with constant coefficients.
- **Generating Functions:** Application of generating functions to solve combinatorial problems.
- **Graphical Counting:** Counting paths, circuits, and trees in graphs.

4. Graph Theory

- **Graph Terminology:** Types of graphs (directed, undirected, weighted, simple, multigraphs), degree, adjacency, paths, circuits.
- **Graph Traversal Algorithms:** Depth-First Search (DFS), Breadth-First Search (BFS).
- **Graph Coloring:** Chromatic number, chromatic polynomials.
- **Planar Graphs:** Euler's formula, Kuratowski's Theorem.
- **Trees:** Properties of trees, spanning trees, minimal spanning trees (Kruskal's and Prim's algorithms).
- **Connectivity:** Cut vertices, bridges, and network flow.

5. Algebraic Structures

- **Groups and Monoids:** Definitions, examples (cyclic groups, permutation groups), group properties, homomorphisms, isomorphisms.
- **Rings and Fields:** Basic definitions, properties, examples of rings, integral domains, fields, and applications.
- **Boolean Algebra:** Boolean functions, logic gates, simplification of Boolean expressions (Karnaugh maps, Quine-McCluskey method).

6. Number Theory

- **Divisibility and GCD:** Division algorithm, Euclidean algorithm, greatest common divisor (GCD), least common multiple (LCM).
- **Modular Arithmetic:** Congruences, Chinese remainder theorem, Fermat's little theorem, Euler's theorem.
- **Primes:** Prime numbers, primality testing, prime factorization, sieve of Eratosthenes.

7. Recursion and Recurrence Relations

- **Mathematical Induction:** Strong and weak induction principles.
- **Recurrence Relations:** Solving linear recurrence relations using characteristic equations, homogeneous and non-homogeneous recurrences.
- **Divide and Conquer Recurrences:** Master Theorem for analyzing the complexity of recursive algorithms.

8. Algorithms and Complexity

- **Algorithm Complexity:** Big-O, Big-Theta, and Big-Omega notation for asymptotic complexity analysis.
- **Basic Algorithms:** Sorting (quicksort, mergesort, heapsort), searching algorithms, and their complexities.
- **Graph Algorithms:** Dijkstra's shortest path, Floyd-Warshall, Bellman-Ford algorithms, and complexity analysis

Linear Algebra

Text Book – Introduction to linear algebra 5th edition chegg,

Vector Spaces

- **Definition and Properties:** Understanding vector spaces, subspaces, and properties such as closure under addition and scalar multiplication.

- **Basis and Dimension:** Concept of a basis, spanning sets, and the dimension of a vector space.
- **Linear Dependence and Independence:** Criteria for linear independence and dependence of vectors in a vector space.
- **Finite and Infinite Dimensional Spaces:** Focus on finite-dimensional spaces but have an understanding of infinite-dimensional spaces.

2. Linear Transformations

- **Definition and Examples:** Functions that preserve vector addition and scalar multiplication.
- **Kernel and Image:** Understanding the null space (kernel) and range (image) of a linear transformation.
- **Rank-Nullity Theorem:** The relationship between the dimensions of the domain, image, and kernel of a linear transformation.
- **Matrix Representation:** How linear transformations can be represented as matrices, and changing bases for matrix representations.

3. Matrices

- **Matrix Operations:** Matrix addition, multiplication, and scalar multiplication.
- **Matrix Inverses:** Conditions for a matrix to be invertible, computation of the inverse, and the application of inverses.
- **Determinants:** Properties of determinants, Laplace expansion, and applications such as determining matrix invertibility.
- **Special Matrices:** Types of matrices like diagonal, symmetric, skew-symmetric, orthogonal, Hermitian, and unitary matrices.

4. Systems of Linear Equations

- **Solving Linear Systems:** Gaussian elimination, Gauss-Jordan elimination, back substitution, and understanding underdetermined/overdetermined systems.
- **Row-Reduction:** Row echelon form (REF) and reduced row echelon form (RREF), including techniques for determining the rank of a matrix.
- **Existence and Uniqueness Theorems:** Conditions for the existence and uniqueness of solutions in systems of linear equations.

5. Eigenvalues and Eigenvectors

- **Definitions and Computation:** How to compute eigenvalues and eigenvectors of a matrix.

- **Diagonalization:** Conditions under which a matrix can be diagonalized, and the process of diagonalizing a matrix using its eigenvalues and eigenvectors.
- **Applications:** Applications of eigenvalues and eigenvectors in differential equations, dynamical systems, and stability analysis.
- **Spectral Theorem:** For symmetric and Hermitian matrices, the existence of an orthonormal set of eigenvectors and diagonalization of such matrices.

6. Inner Product Spaces

- **Definition:** Understanding inner products, norms, and angles between vectors.
- **Orthogonality:** Orthogonal vectors, orthogonal projections, and orthogonal complements.
- **Gram-Schmidt Process:** Orthogonalization of a set of vectors and converting a basis into an orthonormal basis.
- **Normed Spaces:** Norms of vectors, including the Euclidean norm, and properties of normed spaces.
- **Orthogonal and Unitary Matrices:** Understanding properties and applications of these matrices, including preserving lengths and angles.

7. Singular Value Decomposition (SVD)

- **Definition and Computation:** Singular value decomposition of matrices and its applications.
- **Applications of SVD:** SVD in data analysis, principal component analysis (PCA), and other computational applications.
- **Rank of Matrices:** Using SVD to determine the rank, range, and nullity of a matrix.

Probability and Statistics

Text Book – Advance Engineering Mathematics, 10th edition kreyszing,

Probability Theory

- **Basic Probability Concepts:**
 - Sample spaces, events, and probability measures.
 - Axioms of probability (Kolmogorov's axioms).
 - Conditional probability, the law of total probability, and Bayes' theorem.
- **Random Variables:**
 - Definition of random variables (discrete and continuous).
 - Probability mass function (PMF) for discrete random variables.

- Probability density function (PDF) for continuous random variables.
 - Cumulative distribution function (CDF) and properties.
- **Joint and Marginal Distributions:**
 - Joint distributions for multiple random variables (discrete and continuous).
 - Marginal and conditional distributions.
 - Independence of random variables.
- **Expectation and Moments:**
 - Expected value (mean), variance, and higher-order moments.
 - Moment-generating functions (MGF) and characteristic functions.
 - Covariance and correlation between random variables.
 - Chebyshev's inequality and applications in probability bounds.
- **Key Distributions:**
 - **Discrete Distributions:** Binomial, Poisson, geometric, hypergeometric distributions.
 - **Continuous Distributions:** Uniform, normal (Gaussian), exponential, gamma, beta, and Cauchy distributions.
 - Understanding how to derive moments, PDFs, and CDFs for these distributions.
- **Functions of Random Variables:**
 - How to compute the distribution of functions of random variables.
 - Transformations of random variables (e.g., change of variables technique).
 - Sum of independent random variables and convolution of PD