

DSE Courses of B.Sc. (Physical Sciences/Mathematical Sciences) Sem-III

DISCIPLINE SPECIFIC ELECTIVE -1(i): COMBINATORICS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Combinatorics	4	3	1	0	Class XII pass with Mathematics	Nil

Learning Objectives

The primary objective of this course is to:

- Introduce various techniques of permutations, combinations and inclusion-exclusion.
- Learn basic models of generating functions and recurrence relations in their application to the theory of integer partitions.

Learning Outcomes

After completing the course, student will:

- Enhance the mathematical logical skills by learning different enumeration techniques.
- Be able to apply these techniques in solving problems in other areas of mathematics.
- Be trained to provide reasoning and arguments to justify conclusions.

SYLLABUS OF DSE-1(i)

Unit - 1

(15 hours)

Basics of Combinatorics

Basic counting principles, Permutations and Combinations (with and without repetitions), Binomial coefficients, Multinomial coefficients, Counting subsets of size k ; Set-partitions, The inclusion-exclusion principle and applications.

Unit - 2

(18 hours)

Generating Functions and Recurrence Relations

Generating functions: Generating function models, Calculating coefficients of generating functions, Polynomial expansions, Binomial identity, Exponential generating functions.

Recurrence relations: Recurrence relation models, Divide-and-conquer relations, Solution of linear recurrence relations, Solutions by generating functions.

Unit – 3

(12 hours)

Partition

Partition theory of integers: Ordered partition, Unordered partition, Ferrers diagram, Conjugate of partition, Self-conjugate partition, Durfee square, Euler's pentagonal theorem.

Essential Readings

1. Sane, Sharad S. (2013). Combinatorial Techniques. Hindustan Book Agency (India).
2. Tucker, Alan (2012). Applied Combinatorics (6th ed.). John Wiley & Sons, Inc.

Suggested Readings

- Brualdi, Richard A. (2009). *Introductory Combinatorics* (5th ed.). Pearson Education Inc.
- Cameron, Peter J. (1994). *Combinatorics: Topics, Techniques, Algorithms*. Cambridge University Press.