DISCIPLINE SPECIFIC ELECTIVE COURSE – 5(iii): FUNDAMENTALS OF TOPOLOGY

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		
Fundamentals of Topology	4	3	1	0	Class XII pass with Mathematics	Metric Spaces

Learning Objectives: The main objective of this course is to:

- Having in depth understanding of metric spaces and realizing strength of notions like path connectedness, countability axioms and theorems due to Tietze and Baire.
- Create Topological spaces fundamentals, naturally abstracting out from metric spaces.
- Study powerful notions like connectedness, compactness, product topology leading to major results like Tychonoff Theorem.

Learning Outcomes: This course will enable the students to:

- Realize beautiful transitions of some of the major notions and results from metric spaces to topological spaces wherein we do not have facility of distance.
- Appreciate possibility of continuous deformation of several spaces into known spaces through notions developed during the course work.
- Enhance ability to create examples and counter examples classifying various notions.
- Have better understanding of Euclidean spaces and its subspaces, infinite dimensional spaces, and several non-Euclidean spaces.
- Acquire a detailed elucidation of connectedness and compactness of topological spaces.

SYLLABUS OF DSE-5(iii)

UNIT-I: Countability Axioms, Separability and Lindelöf Spaces (12 hours)

Review of the properties of metric spaces; Spaces of sequences of numbers, their convergence and completeness, Completion of a metric space; Local base and base, First and second axiom of countability, Separable and Lindelöf spaces.

UNIT-II: Baire Category Theorem and Localized Versions of Connectedness (12 hours)

Nowhere dense subsets, Category I and category II sets, Baire category theorem; Extension theorems; Tietze's Extension Theorem; Local connectedness, Arcwise connectedness; Totally bounded sets and its connection with completeness and compactness.

UNIT-III: Introduction to Topological Spaces (21 hours)

Topology; Basis and subbasis for a topology; Product and subspace topology; Closed sets, Closure, Interior and limit points of a set, Hausdorff spaces; Continuous functions, Homeomorphism; Product topology for an indexed family of spaces; Connectedness and Compactness.

Essential Readings

1. Munkres James R. (2002). Topology (2nd ed.). Prentice Hall of India Pvt. Ltd.
2. Shirali Satish and Vasudeva, H. L. (2009). Metric Spaces. Springer. Indian Reprint 2019.

Suggestive Readings

- Kumaresan, S. (2014). Topology of Metric Spaces (2nd ed.). Narosa Publishing House. Delhi.
- Searcóid, Mícheál Ó (2007). Metric Spaces. Springer-Verlag.
- Simmons, G. F. (2017). Introduction to Topology and Modern Analysis. McGraw Hill Education. Delhi.

DISCIPLINE SPECIFIC ELECTIVE COURSE – 5(iv): INFORMATION THEORY AND CODING

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		
Information Theory and Coding	4	3	1	0	Class XII pass with Mathematics	Probability and Statistics, Linear Algebra

Learning Objectives: The main objective of this course is to:

- Define and comprehend the concepts of information and its relationship with uncertainty and entropy.
- Apply basic principles of probability theory to measure information content.
- Learn basic information inequalities and their applications.
- Introduce error-detecting and error-correcting codes.
- Learn various decoding techniques.
- Get exposure to linear codes and bounds on linear codes.

Learning Outcomes: This course will enable the students to:

- Understand information and entropy, and calculate various entropies.
- Apply mutual information, conditional entropy, and information-theoretic measures.
- Know about the detection and correction of errors while transmission.
- Understand and demonstrate encoding and decoding of linear codes, and gain knowledge about some bounds on linear codes.

SYLLABUS OF DSE-5(iv)

UNIT – I: Concepts of Information Theory (15 hours)

A measure of uncertainty, H function as a measure of uncertainty, Sources and binary sources, Measure of information for two-dimensional discrete finite probability schemes. Entropy,