



# AN INVITATION TO TOPOLOGY

**PROF. INDRAVA ROY**

Department of Mathematics  
IMSc Chennai

**TYPE OF COURSE** : New | Core | UG

**COURSE DURATION** : 12 weeks (24 Jan' 22 - 15 Apr' 22)

**EXAM DATE** : April 24, 2022

**PRE-REQUISITES** : None

## **COURSE OUTLINE :**

Topology is the study of abstract shapes and their properties which do not change under stretching or squeezing an object without tearing. In this course, we shall investigate and formalize the abstract notion of a “space” under a bare minimum set-theoretic structure, called a topology. This basic structure gives rise to a beautiful and rich source of ideas which at the same time greatly simplify and extend familiar objects in mathematics, such as limits and continuous functions. Arguably, topology (along with the theory of numbers) lies at the heart of mathematics. I invite you to explore this abstract yet foundational theory which plays a significant role in modern mathematics, and by extension, other mathematical sciences.

## **ABOUT INSTRUCTOR :**

Indrava Roy is an Assistant Professor of Mathematics at the Institute of Mathematical Sciences, Chennai

## **COURSE PLAN :**

- Week 1:** Set theory and Logic: Sets and functions, Finite and Infinite sets, Well-ordered sets, Zorn's lemma and the Axiom of Choice
- Week 2:** Topological spaces: the basic axioms of topology with examples, Bases and Subbases, Various kinds of topologies on the real line
- Week 3:** Limit points and closed sets, continuous functions
- Week 4:** Product topology, Quotient topology and Metric topology
- Week 5:** Connectedness: connected spaces and subspaces, Connectedness of the real line, Intermediate value theorem
- Week 6:** Connected components, Path connected, locally connected, and locally path-connected spaces
- Week 7:** Compact spaces: open cover characterization, Finite intersection property, various notions of compactness
- Week 8:** Compact subspaces of the real line, Heine-Borel theorem, extreme value theorem
- Week 9:** Urysohn's Lemma and Tietze extension theorem on metric spaces
- Week 10:** Complete metric spaces, Totally bounded metric spaces and compactness, Lebesgue number lemma
- Week 11:** Function spaces and the Arzela-Ascoli theorem
- Week 12:** Baire spaces and the Baire category theorem