

## TOPOLOGY: NOTES AND PROBLEMS

ABSTRACT. These are the notes prepared for the course MTH 304 to be offered to undergraduate students at IIT Kanpur.

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### 1. TOPOLOGY OF METRIC SPACES

A function  $d : X \times X \rightarrow \mathbb{R}_+$  is a *metric* if for any  $x, y, z \in X$ ,

- (1)  $d(x, y) = 0$  iff  $x = y$ .
- (2)  $d(x, y) = d(y, x)$ .
- (3)  $d(x, y) \leq d(x, z) + d(z, y)$ .

We refer to  $(X, d)$  as a *metric space*.

**Exercise 1.1** : Give five of your favourite metrics on  $\mathbb{R}^2$ .

**Exercise 1.2** : Show that  $C[0, 1]$  is a metric space with metric  $d_\infty(f, g) := \|f - g\|_\infty$ .

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