



# GROUPS: MOTION, SYMMETRY AND PUZZLES

**PROF. AMIT KULSHRESTHA**

Department of Mathematics  
IISER Mohali

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

**COURSE DURATION** : 4 weeks (20 Jul' 20 - 14 Aug' 20)

**EXAM DATE** : 27 Sep 2020

**PRE-REQUISITES** : Basic school level co-ordinate geometry and familiarity with matrices.

**INTENDED AUDIENCE** : Anyone who is willing to understand the importance of group theory. These could be senior school students, undergraduates of science and engineering or anyone interested in knowing why abstraction is useful.

**COURSE OUTLINE :**

The purpose of this course is to motivate participants to explore and enjoy various aspects to groups. The course is not about group theory, but rather about why groups should be studied. The course would also give a glimpse into why abstraction in mathematics is an important tool that deserves its due attention.

**ABOUT INSTRUCTOR :**

Dr. Amit Kulshrestha is an Associate Professor in the Department of Mathematical Sciences at IISER Mohali, where he has been teaching mathematics for almost a decade. He works in the broader area of algebra and loves to interact with students and teachers at all levels.

**COURSE PLAN :**

- Week 1:** Introduction and purpose of the course, Action and motion, need of definition of a group, Burnside's lemma, counting of orbits
- Week 2:** Groups in parity checking, groups and puzzles, Rubik's group, 15-puzzle group, groups and graphs, Words on groups, free groups
- Week 3:** Introduction to GAP, revisiting Rubik's group, Groups and matrices, representations of groups, Linear transformations and groups
- Week 4:** Platonic solids and their symmetry groups, Groups across various branches of mathematics, From Kurovka's book