



# MECHANICS OF MATERIALS

## **PROF. SARAVANAN U**

Department of Civil Engineering  
IIT Madras

**PRE-REQUISITES** : Engineering Mechanics, Basic Calculus

**INTENDED AUDIENCE** : Any Interested learners

### **COURSE OUTLINE :**

This first course in mechanics of deformable bodies introduces the four concepts – Force, stress, strain, displacement – and the four equations that connect them, namely equilibrium equations, constitutive relation, compatibility condition and strain displacement relation. Systematic procedure to solve problems of engineering interest is outlined. In particular, force and displacement relation of structural elements subjected to uniaxial stress, bending, twisting and inflation is studied. Estimation of possible modes of failure of these structural elements and the failure load is outlined.

### **ABOUT INSTRUCTOR :**

Prof. Saravanan U is a professor in the department of civil engineering at IIT Madras. He regularly teaches this mechanics of materials course to undergraduate students in their third semester. He has authored a NPTEL web course on advanced solid mechanics. He is passionate about students learning solid mechanics in the correct way. His research focus is on the foundations of continuum mechanics and its applications. He is the recipient of young faculty recognition award (2017) from IIT Madras and Mathematics research impact centric award (2018) from Science and Engineering Research Board.

### **COURSE PLAN :**

**Week 1:** Mathematical Preliminaries

**Week 2:** Concept of Force, Displacement and stress

**Week 3:** Transformation of stress and equilibrium equation

**Week 4:** Concept of strain

**Week 5:** Governing equations in mechanics

**Week 6:** Displacement due to uniaxial loading, temperature and bending

**Week 7:** Stresses and deflection in homogeneous beams loaded about one principal axis

**Week 8:** Stresses and deflection in beams loaded about principal axis

**Week 9:** Stresses and deflection in beams not loaded about principal axis

**Week 10:** Stresses and displacement due to torsion

**Week 11:** Pressure vessels and Failure criteria

**Week 12:** Buckling