



Indian Institute of Science

Department of Bioengineering



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Course Title: Fundamentals of Bioengineering 2

Course Code: BE 214

Course Schedule: Jan Semester

Credits: 2:0

Course Coordinator: Prof. Siddharth Jhunjunwala and Prof. G. K. Ananthasuresh

Pre-Requisites: None

Description

This course covers essentials of biomaterials and mechanics. It caters to those who want to get first exposure to the topics that lay the foundation for advanced courses in these two topics. Biomaterials: Basics of polymer science, polymeric materials in the body; non-polymeric implantable materials; biological responses to implants; an introduction to drug delivery systems; principles of tissue engineering. Biomechanics: Rigid-body mechanics in the context of motion of limbs and locomotion; elastic-body mechanics of living matter; stress, strain, constitutive relationships, and balance laws; introduction to viscoelasticity; a brief overview of mechanics of muscles and mechanotransduction in cells

Course eligibility

The course is open to doctoral and master's students from all disciplines; and undergraduate students who have completed their second year.

Course outcomes

- Describe concepts in polymer science and engineering
- Discuss fundamental principles in biomaterials and explain the Vroman effect
- Write diffusion equations and describe basic transport phenomena in solids and liquids
- Model the motion of rigid bodies and write equilibrium equations for statics and dynamics
- Analyze the deformation of bars and beams and be able to interpret stress and strain in continuum elastic bodies as per the constitutive relationships for living matter
- Solve simple problems in viscoelasticity and muscle mechanics
- Follow introductory literature in cell mechanotransduction

Resources

1. Biomaterials Science, B.D. Ratner et. al., 3rd Edition, Academic Press, 2012
2. A Textbook of Biomechanics, S. Pal, Viva Books, New Delhi, India, 2009
3. An Introduction to Biomechanics, J. D. Humphrey and S. L. O'Rourke, Springer, 2015
4. Viscoelastic Solids, R. S. Lakes, CRC Press, Boca Raton, FL, USA, 1998
5. Muscles, Reflexes, and Locomotion, Princeton University Press, Princeton, NJ, USA, 1984