



BASICS OF MATERIALS ENGINEERING

PROF. RATNA KUMAR ANNABATTULA

Department of Mechanical Engineering
IIT Madras

Industries that might find this course interesting: Automotive industries, Heavy machinery, Product development and Process industries

PREREQUISITES : Basic strength of materials, Basic Engineering Mathematics (Matrices, Calculus)

INDUSTRIES SUPPORT : Caterpillar India Private Limited, Sundaram Clayton, Mahindra & Mahindra, TVS Motors, Lam Research, Siemens Gamesa

COURSE OUTLINE :

The objective of this course is to introduce the basic concepts of materials science and failure theories for design to undergraduate mechanical engineering students. The course is a first level course and hence various concepts such as structure of crystalline materials, defects and their implications to mechanical behavior, the processing of materials through phase diagrams, a detailed discussion on iron-iron carbide equilibrium diagram and heat treatment of steels will be introduced at the introductory level.

ABOUT INSTRUCTOR :

Prof. Ratna Kumar Annabattula is currently an Associate Professor in the department of Mechanical Engineering at Indian Institute of Technology Madras, Chennai. He received his PhD (micromechanics of materials) in 2011 from the University of Groningen, The Netherlands. He obtained his ME in 2004 from Indian Institute of Science, Bengaluru and BE in 2002 from College of Engineering, Andhra University both in Mechanical Engineering. Prior to starting his PhD, he worked for about a year with General Electric India Technology Center, Bangalore. Before joining as a faculty at IIT Madras, he was a postdoc researcher at Karlsruhe Institute of Technology, Germany. His research interests are in the area of mechanics of stimuli-responsive materials, granular materials and multi physics modeling of materials with applications to lithium ion batteries and nuclear fusion.

COURSE PLAN :

Week 1: Introduction, Crystal Structure

Week 2: Imperfections in solids

Week 3: Imperfections in solids (Contd)

Week 4: Mechanical properties of materials

Week 5: Failure of Materials

Week 6: Failure of Materials (Contd)

Week 7: Basics of Fracture Mechanics

Week 8: Fatigue failure theories

Week 9: Fatigue failure theories (Contd)

Week 10: Phase diagrams

Week 11: Phase diagrams (Contd)

Week 12: Thermal Processing and Heat Treatment of Steels