



FUNDAMENTALS OF MATERIAL PROCESSING - I

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PRE-REQUISITES : Under graduate level mathematics, thermodynamics

INTENDED AUDIENCE : Undergraduate Students and first year graduate students of following discipline:
Materials Engineering, Mechanical Engineering, Metallurgical Engineering,
Industrial Engineering, Electrical Engineering

INDUSTRIES APPLICABLE TO : Manufacturing Companies, Iron and Steel companies, Automobile companies, Equipment manufacturers

COURSE OUTLINE :

Various materials processes are used in variety of industries to create and form materials for wide range of applications. There are some commonalities behind all these processes and the aim of this course is to go through these fundamental physics and materials science behind these processes so as to be able to understand, design and predict the outcome of these methods. At the end of this course, students should be able to answer the following questions: (a) What are the various fundamental material processing techniques and the science behind it; (b) What processing method to use for a given material and a given application. This course is offered in two parts of 20 hours each. First part of the course deals with Solidification and Powder Metallurgy, while the second part deals with Metal processing and Thin film fabrication.

ABOUT INSTRUCTOR :

Prof. Shashank Shekhar is an Associate Professor at IIT Kanpur. He joined IITK in 2010 and has since taught manufacturing related courses to 2nd year, 3rd year as well as 4th year UG students. His research interest lies in thermomechanical processing, particularly severe plastic deformation using techniques like machining and constrained groove pressing.

COURSE PLAN :

Week 1: Introduction to Solidification, Thermodynamics and Kinetics (Homogeneous Nucleation)

Week 2: Heat Flow (Single Crystal; Unidirectional Heat flow)

Week 3: Composition Variation- Plane Front Solidification

Week 4: Composition Variation- Cellular solidification in Single phase alloys

Week 5: Plane front solidification of polyphase alloys; Fluid Flow

Week 6: Introduction to Powder Processing; Powder characterization

Week 7: Powder Characterization; Powder Fabrication; Powder Consolidation

Week 8: Powder compaction; Sintering