



FUNDAMENTALS OF MATERIAL PROCESSING - I

PROF. SHASHANK SHEKHAR
Department of Metallurgical
and Materials Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG/PG
COURSE DURATION : 8 weeks (17 Aug' 20 - 9 Oct' 20)
EXAM DATE : 18 Oct 2020

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

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

COURSE OUTLINE :

The aim of the course is to acquaint students with the fundamentals involved in the processing of materials. 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 assistant professor at IIT Kanpur. He joined IITK in 2011 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: Module-01 (solidification Processing)

Week 1: Introduction to Heat Flow

Week 2: Plane front single phase solidification

Week 3: Plane front poly phase alloy solidification

Week 4: Nucleation and Growth; Microstructures

Week 5: Mold, Feeder and Riser Design in Casting; Fluidity; Shrinkage; Casting Defects

Week 5: Module-02 (Powder Metallurgy)

Week 6: Powder characterization and fabrication

Week 7: Powder Compaction and Consolidation; Cold Isostatic Pressing

Week 8: Solid-State Sintering; Liquid phase sintering; Pressure-Assisted Sintering