

INDIAN INSTITUTE OF TECHNOLOGY KANPUR
SEMESTER 20019-2020 Sem-II

Course number : **MSE 305**
Course Title : **Materials processing**
Course Website : lattice.mse.iitk.ac.in/~shashank/MSE305
Credits : **(6) 2-0-0**
Instructor : **Prof. Shashank Shekhar**
Instructor email : shashank@iitk.ac.in
Office : **WL-304A**
Office Phone : **6528**
Schedule : **T/Th 3.00pm**
Venue : **L-15**
TAs : **Gyanendra Pratap Singh (pgyanend@iitk.ac.in)**

Description: 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.

Grading Scheme:

Mid-Semester Exam	:	30 Marks
End-Semester Exam (Mandatory)	:	30 Marks
Quizzes (2)	:	20 Marks
Project/ TICS/ Lecture Video	:	20 Marks
Pass Percentage	:	min 40%
Attendance	:	5 Marks (Bonus)

Attendance:

Students completing 85 % and above attendance will receive a bonus of 5 marks. Students missing more than 4 classes will lose bonus marks. Attendance will be taken at the beginning of the class, so, those coming late cannot claim attendance.

Unfair Means:

Any use of unfair means (in exam or quizzes) would lead to automatic 'F' grade or de-registration, and will be reported to SSAC. It is your responsibility to ensure that other students do not copy from you. If any use of unfair means is found, then all parties involved will be penalized. During exam, borrowing or sharing of any material (pen/ pencil/ eraser/ calculator etc.) is strictly not allowed. Bring your own stationaries.

Contents for MSE305

Solidification Processing (Introduction to solidification, casting, welding, mold, feeder and riser design, Fluidity Considerations, Heat Flow, Composition Variation, Cellular Solidification, Plane front solidification, Casting defects)

Mechanical Working (Intro to metal working, Basics of continuum mechanics, Plastic Instability, Superplasticity, Workability, Mechanics of Metal working, Rolling, Forging, Extrusion, Friction and Formability)

Metal and Ceramic Powder Processing (Powder production and Characterization, Powder Compaction, Solid State Sintering)

Thin-film and Coating Techniques (Intro to Vacuum Technology, Physical Vapor Deposition Process, Chemical deposition, Plasma Spray Coating)

References:

Solidification: (1) M.C. Flemmings, *Solidification Processing*, McGraw-Hill College, 1974.

Metal Working: (1) G.E. Dieter, *Mechanical Metallurgy*, McGraw Hill, Inc., London, UK, 1992.
(2) W.F. Hosford and R.M. Caddell, *Metal Forming- Mechanics & Metallurgy*, Prentice Hall, Englewood- Cliffs, NJ, USA, 1983.

Powder Metallurgy: (1) R.M. German, *Powder Metallurgy Science*, 2008.

Thin film and coating techniques: (1) *The science and Engineering of Microelectronic Fabrication* by Stephen A. Campbell