



**SECOND SEMESTER 2020-2021**

Course Handout Part II

Date: 16-01-2021

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **MST F332**  
Course Title : Materials Processing  
Instructor-in-Charge : **Prof. Ramesh Adusumalli**  
Instructor : **Dr. Sujith R**

**Scope and Objective of the Course:** This course is aimed at providing insight into various materials processing techniques that are commonly employed in industrial manufacturing. The course is intended to cover aspects of processing techniques of metals, ceramics, carbon materials, plastics and composites (FRP) and Metal matrix composites. Brief overview of 3-D printing of polymers and polymer composites for various applications will conclude the course.

**Textbooks:**

1. E. Paul De Garmo, J. T. Black, Ronald A. Kohser. Materials and Processes in Manufacturing, 8<sup>th</sup> Edition, Prentice Hall, New Jersey 2002.
2. Krishan K. Chawla. Composite Materials: Science and Engineering, Second edition. Springer-Verlag, New York, 1998.

**Reference books**

1. HS Ray and A Ghosh. Principles of Extractive Metallurgy. New Age International Publishers. 1991.
2. MN Rahman, Ceramic Processing and Sintering, 2<sup>nd</sup> Edition.
3. R. Abbaschian, L. Abbaschian, R. E. Reed-Hill, Physical metallurgy principles, Fourth edition, Cengage learning. 2010.

**Course Plan:**

Lect. No.	Learning objectives	Topics to be covered	Chap. in the Text Book
1	Introduction	Course overview. Introduction to Materials processing.	TB1- 1
2-10	Processing techniques in metals	Solidification: Homogeneous and Heterogeneous, Nucleation and Growth, Zone refining, Nanostructured materials, Bulk metallic glasses, Cold working and Hot working, Strengthening mechanisms, Dynamic Recovery and recrystallization, Weldability of steel, Cast Iron and aluminium alloys	TB 1-5 RB4 -14 &15, RB3-9, RB5-2 and lecture notes
11-	Processing	Synthesis of powders, powder characterization, powder	TB1-16,



16	techniques in ceramics	compaction, Sintering of ceramics, Theory of solid state sintering, Liquid phase sintering	RB-2
17-23	Processing of Porous & 2D materials	Porous Materials: Bubbling of gas in molten metal, $TiH_2$ decomposition, replication techniques, hollow sphere synthesis and sintering, Leaching. 2D Materials: Mechanical Exfoliation, Liquid phase exfoliation, Epitaxial growth, CVD, Etching and electrochemical transfer.	Class notes
24-27	Processing of Carbon Based Materials	Manufacturing of Carbon fibers (PAN & Pitch based), Controlled pyrolysis to make nanofibers, Graphene & CNT.	TB2-2/Notes
28-33	Processing of Polymer Composites (FRP)	Processing and properties of Glass fibers, Aramid fibers and Viscose fibers. Sizing and Preforming. Overview of Polymer & their Composites. Processing of FRP: Filament Winding, Pultrusion, Resin transfer moulding, Autoclave (prepreg-layup), Injection moulding, Compression moulding. Case study: Glass-PP, Nylon-Carbon, Carbon-Phenolic composites	TB 2-5/ TB1-20 / Notes
34-38	Processing of Ceramic and Metal matrix Composites	Overview of ceramics composites, metal composites. Hot pressing, Liquid infiltration, Sol-gel process, CVD, etc. ex: Al-SiC composites, Carbon-Carbon composites	TB 2-7 & 8

### Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid-Semester Exam	90 min	30 %	01/03 11.00 - 12.30PM	Open book
Projects* (one)-uploading through google forms	-----	20 %	(To be completed by April 15, 2021)	Open book
Class Quizzes (two)-google forms	30 minutes	10%	One before and one after (To be completed by April 15, 2021)	Open book
COMPREHENSIVE EXAM	2 hours	40 %	01/05 AN	Open book

\*One project will be given to one student from the following list (Based on the student numbers, projects will be added to the list)

**Chamber Consultation Hour:** Friday, 4-6 PM

**Notices:** All notices related to the course will be uploaded in CMS.

**Make-up policy:** Make-up will be granted with prior permission from IC and has genuine reasons not to appear in the regular test. **50 % attendance is mandatory for any make-up request.**

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the Students throughout the semester and no type of academic dishonesty is acceptable.

**Dr. Ramesh Adusumalli**  
**INSTRUCTOR-IN-CHARGE**



**Tentative list of projects:**

- 1. 3D printing of polymer matrix composites**
- 2. Synthesis of graphene**
- 3. Injection molding, compression molding of polymers and composites**
- 4. Stir casting of metal matrix composites**
- 5. Powder processing and sintering**
- 6. Soft lithography**
- 7. Processing and testing of Coatings**

