



**SECOND SEMESTER 2021-2022**

Course Handout Part II

Date: 15-01-2022

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* : Karthik Chethan V.  
*Instructor* : Prabhakaran Saravanan

**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 polymers (thermoplastic and thermoset), biomaterials and composites (FRP), carbon materials, metals and ceramics. The goal is to provide hands-on learning and activities in processes such as, extrusion, injection molding, 3D-printing, electrospinning, compression molding, sol-gel (both polymers and biomaterials for making bioplastics and microencapsulation prototypes), lithography, pultrusion, filament winding, ball milling, casting, sintering, welding, forging etc.

**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.
4. G. J. Morton-Jones, Polymer Processing, Chapman and Hall, 1<sup>st</sup> edition, 1989.

**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
2-11	Polymer Processing	Intro to polymer flow, extrusion, blow molding, injection molding and compression and transfer molding	RB4- 2, 4, 6, 8 and 9 and class notes
12-	Electrospinning	Intro, principles, formulation and operation, optimization of	Class notes



14		material and processing parameters, troubleshooting and applications	
15-16	3D-Printing of single and multi-component prototypes	Intro, principles, hardware, design, operation, optimization of material and printing parameters, troubleshooting and applications	Class notes
17-20	Polymer Composites (FRP) Processing	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 and Autoclave (pregreg-layup). Case study: Glass-PP, carbon-Nylon, Carbon-Phenolic composites	TB 2-5/ TB1-20 / Notes
21-29	Metal Processing	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 RB3 -14 &15, RB3-9, RB5-2 and lecture notes
30-35	Ceramic Processing	Synthesis of powders, powder characterization, powder compaction, Sintering of ceramics, Theory of solid state sintering, Liquid phase sintering	TB1-16, RB-2
36-38	Porous Materials Processing	Porous Materials: Bubbling of gas in molten metal, $TiH_2$ decomposition, replication techniques, hollow sphere synthesis and sintering.	Class notes
39-40	Carbon Based Materials Processing	Manufacturing of Carbon fibers (PAN & Pitch based), Controlled pyrolysis to make nanofibers, Graphene & CNT.	TB2-2/Notes

### Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Nature of Component
Midterm	90 mins	25%	16/03 11.00am to 12.30pm	Open Book
Continual Evaluation*	NA	35 %		NA
Comprehensive Exam	2 hours	40 %	19/05 AN	Open Book

\*Continual evaluation will involve hands-on materials processing activities, optimization and troubleshooting, materials processing demos, video presentations and class discussions and reading and presenting materials processing case studies.

**Chamber Consultation Hour:** Time will be announced later.

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

**Make-up Policy:** Make-up will be granted for genuine cases with prior approval.

**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.



Karthik Chethan V.  
INSTRUCTOR-IN-CHARGE

