

PMM204: MATERIALS PROCESSING

L	T	P	Cr
3	1	2	4.5

Course Objective: Understanding the influence of different processing parameters on microstructures and properties. To learn about available methods for metals, and ceramics processing. To use fundamentals of materials science and engineering to perform basic materials selection and to determine processing conditions needed to achieve desired shapes and properties.

Solidification from Liquid and Vapour Phase: Nucleation and growth, Homogeneous and heterogeneous nucleation, Interface stability, Development of micro structure, Faceted and non-faceted structure, Super cooling, Equilibrium phase diagrams, Eutectic and peritectic solidifications and their microstructures, Foundry techniques such as sand casting, Permanent mould casting, Investment casting and die casting, Casting defects and their inspection.

Forming Processes: Fundamentals of metal forming, Hot working process; Rolling, Forging, Extrusion, Piercing, Cold working processes; Bending, Shearing, Squizing etc.

Metals Joining: Welding, Brazing, and soldering: Conventional and Laser techniques and their application

Ceramic Processing / Powder Processing: Synthesis of common ceramic powders such as Al_2O_3 , ZrO_2 , Si_3N_4 , and SiC , Powder characterization, Binders, Lubricants, Defloculants and flocculants as processing aids, shaping techniques such as powder compaction, Extrusion, Injection moldings, Slip casting, Solid state and liquid phase sintering.

Laboratory Work:

Observation of Nucleation phenomenon in some organic and inorganic salts, Observation of Growth phenomenon of dendrites in transparent liquid, Estimation of cooling rates in different metallic systems, Structural analysis of different metals and alloys after mechanical working, Observation of weld zone in different metallic specimen, Synthesis of different ceramic powders, Observation of green density and sintered density in different metallic and ceramic compacts at different loads.

Course Learning Outcomes (CLO):

Student will be able to:

1. Adopt proper working conditions for a particular material to be used in different engineering components;
2. Process different ceramic powders and bulk by different processing techniques.

Recommended Books:

1. Chalmner, B., *Principles of Solidification*, Wiley (1977).
2. Degarmo, E.P., Black, J.T. Kosher R.A, *Materials and Processing in Manufacturing*, PHI (1986).
3. Martin, D.H. & Jones, *Polymer Processing*, Chapman and Hall (1989).
4. Fleming, M.C., *Solidification Processing*, McGraw Hill (1974)
5. Richerson, B.W., *Modern Ceramic Engineering: Properties, Processing and Use in Design*, Marcel Dekker (1983).