MTPC3001 SOLIDIFICATION AND CASTING OF METALS AND ALLOYS (3-0-0)

Course Objectives :

This course aims to provide a comprehensive understanding of metal casting processes, emphasizing their advantages and practical applications. It equips students with knowledge of special casting techniques and industrial melting practices for various alloys. The course explains the principles of gating, risering, and solidification mechanisms in metals and alloys. It also focuses on identifying casting defects and learning methods for their prevention. Overall, it prepares students to design and troubleshoot efficient casting systems in industry

Module-I: (06 hours)

Introduction: Casting as a process of Manufacturing. Advantages of casting over other forming processes. A brief mention about mould and its components etc. with special reference to mould factors in metal flow and moulding factors in casting design.

Module-II: (06 hours)

Industrial melting practices as adopted for a few metals and alloys such as; Cast-iron; Copper; etc. Principles of Gating and Risering: Types of gates and Risers; Chowrinov rule; Gating ratio, Wlodawer system of determining feeder head requirements. Casting Yield: Various considerations for improving casting yield

Module-III: (06 hours)

Special Casting Methods: Investment casting, Die casting, Centrifugal casting, continues casting, Shell moulding, Slush casting etc.

Module-IV: (06 hours)

Casting Defects and Their Remedies: Various casting Defects; Their causes and remedial measures.

Module-V: (06 hours)

Solidification of Metals and Alloys: Nucleation and growth processes; planar growth and factors hindering planar growth; Dendritic growth; Cellular growth; Heat flow and interface stability in pure metals; Alloy solidification: Solidification of single-phase alloys and solute redistribution during the solidification, Eutectic and Peritectic solidification.

COURSE OUTCOME:

CO1: Describe the fundamentals of casting processes and explain the role of mould design and metal flow in determining casting quality.
CO2: Identify and compare various special casting methods such as die casting, investment casting, and centrifugal casting.
CO3: Explain industrial melting practices and apply gating and risering principles for efficient casting design.
CO4: Analyse the solidification mechanisms of metals and alloys including nucleation, dendritic growth, and phase transformations.
CO5: Identify common casting defects, evaluate their causes, and suggest appropriate remedial measures to improve casting yield and quality.

Books:

1. Solidification Processing by M.C. Flemings, McGraw Hill.
2. Physical Metallurgy edited by R.W.Cahn and P.Hassen, North Holland.
3. Casting by J. Campbell, Butterworth - Haneman, London

Reference book:

1. Principles of Metal Casting by Hein R.W., Loper C. R. & Rosenthal P.C, T.M.H.
2. Foundry Engineering by Taylor H.F., Flemming M.C. & Wulff, Wiley Eastern.
3. Foundry Technology by Beeley P.R., Butterworth, London.