MTPE3003 SECONDARY STEEL MAKING (3-0-0)

Course Objectives:
This course introduces the principles and practices of secondary steel making.

Module-I (06 hours)
Introduction to Ironmaking, Primary steelmaking and Secondary Steelmaking. Steel plant overviews-final products: Primary steelmaking, Raw Materials, Product details, etc.

Module-II (06 hours)
Secondary Steelmaking: Objective, techniques like vacuum degassing processes. Ladle degassing processes (VOD, VAD), steam degassing processes, and circulation degassing processes (RH, DH). Process and reaction details.

Module-III (06 hours)
Mixing, mass transfer, kinetics, and reaction mechanism study in Steel melts in Ladles. Role of slag and powders in inclusion control, Thermodynamics, and reaction kinetics with preferable conditions for Deoxidation, Desulphurization, Dephosphorization, and Inclusion modification morphologies.

Module-IV (06 hours)
Concept of ultra-low carbon, ultra-low sulfur, ultra-low phosphorous, and inclusion-free steels. Stainless steel production through VOD, AOD, and CLS processes.

Module-V (06 hours)
Post-solidification treatments (VAR, ESR) for ultraclean steel production. Refractories used in secondary steelmaking furnaces with their properties and selection criteria. Identification, Modification, Cleanliness Assessment of steel, Origin of non-metallic inclusions and its modification, Tundish Metallurgy for Clean Steel.

Course Outcomes:
After completing this course, the student should be able to:
CO1: Describe the physical and chemical processes that take place during steel making.
CO2: Analyse the effect of inclusion control on steel properties.
CO3: Describe process selection in secondary steel making.

Text Books:

1. Ghosh A., Secondary Steelmaking- principle & Applications, CRC Press.
2. Ghosh A., Principles of Secondary Steelmaking Processing and Casting of Liquid Steel, Oxford & IBH Publication.
3. Yogeshwar Sahai, Toshihiko Emi, Tundish Technology for Clean Steel Production, World Scientific, 2008

Reference Books:

1. Ghosh Ahindra, Chatterjee A., Iron making and Steel making Theory and Practices, PHI
2. Dipak Mazumder, James W. Evans, Modeling of Steelmaking Processes, CRC Press