MSE-318 Iron and Steel Making

Credit Hours: 3-0

Pre-requisites: Nil

Course Description

The purpose of the course is to provide students with a fundamental knowledge of modern methods of producing iron and steel, and the materials involved in these processes. The environmental impacts of iron and steelmaking will also be discussed. Additionally, the students will also study the latest developments in this field such as green steel production.

Course Contents

- Mineral processing of iron ores, agglomeration processes for iron ores, blast furnace process and reactions, blast furnace gas cleaning system and blast furnace stoves. Recent developments in BF process. Alternate iron making processes.
- Introduction to steelmaking, fundamentals, oxidation reactions in steelmaking processes. Primary steelmaking processes: basic oxygen furnace (BOF) and electric arc furnace (EAF), design and process description, latest trends in BOF and EAF Processes. Induction furnace, design, and process description.
- Secondary steelmaking processes: argon purging, ladle de-oxidation, degassing, and emerging ladle metallurgy processes.
- Continuous casting of steel. Charge calculations for iron and steel making processes.
- Environmental impacts of steel industry. Green steel making processes.
- Concepts of standards and specification of ferrous alloy systems.

Weekly Plan

Week	Topics
1	Introduction to iron and steelmaking, Mineral processing of iron ores I
2	Mineral processing of iron ores II, agglomeration processes for iron ores
3	Blast furnace process and reactions
4	Blast furnace gas cleaning system and blast furnace stoves
5	Charge calculations for iron making
6	Recent developments in BF process.
7	Alternate iron making processes
8	Introduction to modern steelmaking, fundamentals, oxidation reactions in steelmaking processes

9	**Mid-Semester Exams**
10	Primary steelmaking processes (basic oxygen furnace)
11	Primary steelmaking processes (EAF & Induction Furnaces)
12	Secondary steelmaking processes
13	Charge calculations for steelmaking
14	Continuous casting of steel
15	Concepts of standards and specification of ferrous alloy systems
16	Environmental impacts of steel industry. Green steel making processes
17-18	**End Semester Exams**

Course Outcome

At the end of the course, students will be able to:

- describe the general features of iron and steel-making processes.
- analyse the developments in processes aimed at improving the efficiency of iron and steelmaking.
- evaluate the harmful impact of iron and steel-making industries on the environment and suggest suitable measures to reduce that.

Suggested Books

- *Iron and Steel Making: Theory and Practices* by A. Ghosh and A. Chatterjee, Eastern Economy Edition, PHI Learning Private Limited (2008)
- *An Introduction to Modern Iron Making* by R.H. Tupkary and V.R. Tupkary. 4th ed. Khana Publications India, (2013).
- *An Introduction to Modern Steel Making* by R. H. Tupkary and V. R. Tupkary. 7th ed. Khana Publications India, (2008).
- *Wills' Mineral Processing Technology: An Introduction to the Practical Aspects* by A. James and Barry Alan. 8th ed. Butterworth-Heinemann, (2016).
- *Modern Blast Furnace Ironmaking an introduction*, M. Geerdes, R. Chaigneau, O. Lingiardi, R. Molenaar, R.V, Opbergen, Y. Sha, J. Warren, 4th ed., IOS press (2023)
- *Basic Concepts of Iron and Steel Making* by S. K. Dutta and Y. B. Chokshi, Springer Nature, (2020).
- *Principles of Steel Making* by Greg Mayhew, Larsen and Keller Education, (2018).
- *Ironmaking and Steelmaking Processes: Greenhouse Emissions, Control, and Reduction* by Pasquale Cavaliere, Springer Nature, (2016).