

Iron Making

(No. of Credits: 4)

Unit – I: History of Iron making; Principles of Iron Making – Reduction, Smelting, Direct Reduction, Smelt Reduction; Raw materials for Iron making, their distribution, occurrence in India and in the world. Coke Making: Rank of coal, Coking and non coking coals, Coal blends for coke making, coking ovens, cooling of coke, coke size distribution, coke quality and strength of coke.

Unit – II: Preparation of iron ores: Agglomeration of Iron ore fines, Sintering: Principles, Factors affecting sintering, sintering mechanism, sintering machines; Pelletisation: Theory of pelletisation, Water-particles system. Production of green pellets; disk and drum pelletizers, Induration of pellets: Shaft and traveling grate; Quality demands for the blast furnace burden.

Unit – III: Physical chemistry of Iron making; Blast furnace reactions; Physical and chemical factors affecting reduction of ores; Thermodynamics of the C-O reaction; C-O, Fe-C-O and H-O, Fe-H-O system; Factors affecting composition of slag and hot metal; Internal zones in blast furnace; Thermal and chemical reserve zones; Types of Pig Irons & Blast furnace Slags.

Unit – IV: Blast furnace profile and design considerations; B.F. Stoves; Furnace lining: Types of refractories, Physical and chemical characteristics of refractories. Refractories for blast furnace and stoves; Furnace cooling system; Hoisting equipment; Blast furnace products and Utilization: Handling hot metal and slag, Blast furnace slag utilization, BF gas cleaning system and its utilization.

Unit – V: Blast furnace non-routine operations and difficulties; Modern Trends in Blast furnace; Burden calculation; Blast furnace productivity and efficiency; RAFT calculations; Limitations of Blast furnace Iron production;

Unit – VI: Alternate Routes of Iron Making, Principles of Sponge Iron Making, Degree of Metallization, Percentage Reduction, Classification of Sponge Iron making methods. Sponge Iron Production: Midrex process, HYL, Kiln Krupp-Renn; SL/RN process; Smelt Reduction: COREX, INRED, ELRED, Plasma Smelting; Sponge iron production in India.

TEXT BOOK;

1. Principles of Blast furnace Iron making – A.K Biswas
2. Beyond Blast furnace – Amit Chatterjee
3. Modern Iron Making – R H Tupkary
4. Iron making and steel making: Theory and Practice – Ahindra Ghosh, Amit Chatterjee
5. A Treatise on Process Metallurgy: Volume III - Seshadri Seetharaman
6. Hand book of Extractive Metallurgy: Vol. 1 - Fathi Habhashi
7. Hot metal Production by Smelting Reduction of Iron Oxides – Amit Chatterjee