GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: VI

Metallurgical Engineering

Subject Name: **Steel Making**
Subject Code: **162102**

Teaching Scheme				Evaluation Scheme		
Theory	**Tutorial**	**Practical**	**Total**	**University Exam (Theory) (E)**	**Mid Sem Exam (Theory) (M)**	**Practical (I)**
4	2	0	6	70	30	50

Sr. No	Course Content	Total Hrs.
1	**General** History of Steel Making, from Bessemer Steel Making to present day equipment and practices. Integrated and Mini Steel Plants in India. A present Scenario	03
2	**Physical Chemistry of Steel Making** Thermodynamic and Kinetics of Refining Reactions, Carbon Reaction, Phosphorus Reaction, Sulphur Reaction, Silicon Reaction, Refining Slags and its Properties. Importance and Mechanism of Decarburization Reaction. Reaction at Slag Metal interface	12
3	**Basic Oxygen Steel Making** BOF practice, Equipment, Operation and Process, slag Metal reactions in B.O.F. Raw material and flux practices. Modifications and further Development in Conventional BOF, Oxygen Lance: Design, Construction and Operation. Top and Bottom Blown processes, Its advantages and disadvantages	12
4	**Electric Steel Making** Details of Electric Arc Furnaces, Its Variations. Sequence of EAF Operations. Various additions at Different Stages, Slag Control. UHP Arc Furnaces. Arc Furnace practices for Carbon and Low Alloy Steels	08
5	**Quality Steel Making** Introduction, Sources of Inclusions, Sulphur, Phosphorus, and Gases In Steels, Development of Secondary Steel Making and its Importance Under Indian Conditions, Thermodynamics and Kinetics of Deoxidation of Molten Steel, Application of Ellingham Diagrams, Metallurgical Principles in Secondary Steel Making: Thermodynamics of Reaction During Degassing of Liquid Steel, Fluid Flow and Mixing in Ladle, Kinetics and Mass Transfer, Ladle Injection Metallurgy, Desulphurization & Dephosphorization	14

6	**Secondary Steel Making** Secondary Steel Making Processes, Ladle Furnaces (L.F.), Vacuum Systems and Vacuum treatment of Steel. Gases in steel. LF-VD processes and AOD, VOD, VAD techniques, R-H degasers. Ladle Stirring and its Advantages. ESR-Principle And Technology. Deoxidation – Theory and practice, Floatation's of products, Modifications of Inclusions. Injection Metallurgy	10
7	**Inclusions in Steel** Influence of Inclusions on Mechanical Properties of Steel, Inclusion Identification and Cleanness Assessment, Origin of Non Metallic Inclusions, Inclusion Control	03
8	**Continuous Casting (C.C.) and Ingot Casting** Ingot Casting: Types of Moulds, Advantages and Disadvantages. Ingot Defects and Remedies. Continuous casting: C.C. machines with its various units and types.C.C. of Blooms, Slabs and Thin slabs EM S of Moulds . Reoxidation prevention methods during Steel Casting. Advantage of C.C. Environmental issues related to Steel Making, Heat Transfer & Solidification Rate in Ingot Casting and Continuous Casting, Distinguishing Metallurgical Aspects of Continuous Casting of Steel	10

Text Book:

1. Manufacture of Iron And Steel Vol I & II Bashforth- Asia Publishing House, Mumbai.

Reference Books:

1. An Introduction To Steel Making Tupkary R.H.- Khanna Publishers, Delhi, 1980
2. Steel Making; Kudrin V. Mir Publisher, Moscow, 1985
3. Physical Chemistry of Metals (with a collection of problems), Darken and Gurry- Mc Graw Hill.
4. Electrometallurgy of Steel & Ferro.Alloys Vol I & II:- E.P.Edneral, MIR Publ; Moscow
5. Making,Shaping and Treating of steel:- H.M.Gannon, USS Pub. Pittsburg.
6. Introduction to Physical Chemistry of Steel Making :- R.G.Ward, ELBS.