

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: STEEL MAKING
(COURSE CODE: 3352101)**

Diploma Programme in which this course is offered	Semester in which offered
Metallurgy Engineering	5 th Semester

1. RATIONALE

Different types of Steels are the most important engineering materials which find application in one or other form in almost every walk of life. Steels are produced from iron, scrap and other ferrous materials by adding alloying elements such as Manganese, Nickel, Chromium, and Vanadium, which are added to produce different grades of steels. Students should understand the different types of steelmaking processes to produce steels from raw materials and alloys.

2. LIST OF COMPETENCY

The course should be taught and implemented with the aim to develop required skills in students so that they are able to acquire following competency:

- **Supervise production of different types of steels.**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Differentiate between acid and basic steel making as well acid and basic bassemer process
- Compare steel making by crucible and cementation process.
- Explain open hearth process and electrical process with their merits and limitations
- Differentiate between Bessemer process, L.D. process, Kaldo process
- Identify ingot defects and suggest remedies.
- Explain secondary steel making

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
3	0	0	3	70	30	0	0	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE CONTENT DETAIL

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to Steel Making	1a. Define steel 1b. Classify steels as per IS standard 1c. Explain principle of steel making 1d. Differentiate between acid and basic steel making 1d. Classify various steelmaking processes.	1.1 Definition and types of steel as per IS standard. 1.2 Principle of steel making. 1.3 Difference between acid and basic steel making. 1.4 Classification of steel making processes – Blast , Electric arc ,.
Unit – II Cementation and Crucible Process	2a. Compare steel making by crucible and cementation process.	2.1 Principle and production of steel by crucible and cementation process. 2.2 Quality and limitation of steel produced by crucible and cementation processes.
Unit – III Pneumatic Processes	3a. Classify pneumatic steel making processes 3b. Differentiate between acid and basic Bessemer process. 3c. Describe the Bessemer process 3d. Explain L.D. process 3e. Explain Kaldo process	3.1 Classification of pneumatic processes. 3.2 Steel making by various pneumatic processes like (i) Bessemer processes (acid and basic) (ii) L.D. process (iii) Kaldo process 3.3 Discuss these processes with following details like ; Principle, Raw material selection, Furnaces used, Chemical reactions, Steps involved / procedure, Products obtained, Quality of the product, merits and limitations.
Unit – IV Open Hearth and Electric Arc Furnace Steel Making	4a. Explain working principle and procedural steps of open hearth process. 4b. Explain electrical process for steel making. 4c. Explain merits and demerits of open hearth process and electrical process 4d. State the Raw material selection parameters for the steel manufactured by Open Hearth processes and Electrical Processes 4e. State the chemical reactions for the steel manufactured by Open Hearth processes and Electrical Processes	4.1 Steel manufactured by Open Hearth processes and Electrical Processes with following details like : Principle, Raw material selection, Furnaces used, Chemical reactions, Steps involved / procedure, Products obtained, Quality of the product, Merits and limitations.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – V Continuous Casting of Steel	5a. Explain teeming method for steel ingots with merits and demerits 5b. Explain structure of steel ingot 5c. State the steps to identify ingot defects and remedies. 5d. Explain the process - continuous casting of steel with advantages.	5.1 Conventional methods of teeming steel ingots. 5.2 Structure of ingot and ingot defects. 5.3 Continuous casting of steel.
Unit – VI Secondary Steel Making	6a. Explain deoxidation of steel in ladle furnace. 6b. Describe Vacuum degassing for liquid steel 6c. Explain importance of desulphurisation in steel making	6.1 Deoxidation of Liquid steel 6.2 Degassing and Decarburisation of liquid steel 6.3 Desulphurising in secondary steel making

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I.	Introduction to steel making	04	04	02	02	08
II.	Cementation and crucible furnaces	06	06	03	03	12
III.	Pneumatic Processes	12	06	06	06	18
IV.	Open hearth and Electric arc furnace steel making	08	04	06	06	16
V.	Continuous casting of steel	08	02	04	04	10
VI.	Secondary steel making	04	02	02	02	06
Total		42	24	23	23	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's Revised Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- Students may prepare layout of integrated steel plant.
- Industrial visit of nearby steel plant.
- Exploring websites of reputed steel manufacturers to study the latest trends and range of their products
- Collect samples of different steel form the market with their rates and specification.

8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Industrial visit to steel manufacturing industry
- ii. Video film presentation
- iii. Seminar by group of students on different aspect of steel Production.

9. SUGGESTED LEARNING RESOURCES

A. List of Books:

S. No.	Title of Books	Author	Publication
1	Modern steel Making	R. H. Tupkari	Khanna publication
2	Iron making and Steel making	Ahindra Ghosh and Amit Chatterjee	PHI publication, 2011

B. List of Software/Learning Websites

Searching engine could be used to locate steel manufacturing related sites, such as:

- i. <http://www.industry.siemens.com/verticals/metals-industry/en/metals/steelmaking/ld-steelmaking/Pages/home.aspx>
- ii. http://www.carbonandgraphite.org/pdf/steel_production.pdf
- iii. <http://corporate.arcelormittal.com/who-we-are/from-ore-to-steel>
- iv. <http://www.topforge.co.uk/Processes.htm>
- v. <http://en.wikipedia.org/wiki/Steelmaking>
- vi. <http://www.steel.org/Making%20Steel/How%20Its%20Made/Processes/Processes%20Info/The%20Basic%20Oxygen%20Steelmaking%20Process.aspx>
- vii. http://www.steelconstruction.info/Steel_manufacture
- viii. <http://www.tatasteelindia.com/products-and-processes/processes/steel-making-process.asp>

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Dr I. B. Dave**, I/C Principal, Government Polytechnic, Vyara
- **Prof. V. N. Kaila**, I/C Head, Metallurgy Department, Government Polytechnic, Rajkot

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. C.K Chugh**, Professor, Department of Mechanical Engineering
- **Dr. K.K. Jain**, Professor, Department of Mechanical Engineering