

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: IRON MAKING
(Code: 3342102)**

Diploma Programme in which this course is offered	Semester in which offered
Metallurgy Engineering	4 th Semester

1. RATIONALE:

Iron is one of the most important engineering materials which finds application in one or other form in almost every walk of life. Ferrous metals are an important group of metals for which the base material is iron. Extraction of iron from its ores is an important aspect of extractive metallurgy. A student of metallurgical engineering must be acquainted with the extraction of iron from its ore so as to be able to make its further use for any application.

2. COMPETENCY

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

- **Plan and Supervise Extraction of iron from the iron ore.**

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.

- Classify ferrous metals and alloys
- Describe the different methods of processing of iron ores.
- Enumerate modern trends in iron making blast furnace
- Explain brief principles of alternative methods and their advantages and limitations

4 TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			C	ESE	PA	ESE	PA	
03	00	00	03	70	30	00	00	100

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

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to iron	1a. Describe importance of iron as an engineering material. 1b. Classify ferrous metals and alloys 1c. Enlist locations of iron ore mines and integrated iron and steel plants of India.	1.1 Importance of iron as an engineering material 1.2 Classification of ferrous metals and alloys 1.3 Brief history of iron making. 1.4 Ores of iron. 1.5 Locations of iron ore mines and integrated iron and steel plants of India.
Unit – II Raw materials for iron making	2a. List the raw material for making iron in blast furnace. 2b. Explain the Properties required by burden 2c. Explain functions and properties of coke used in blast furnace. 2d. Explain types of fluxes used in iron making process. 2e. Describe the different methods of processing of iron ores.	2.1 Raw materials for making iron in blast furnace . 2.2 Properties required by burden 2.3 Functions and properties of coke used in blast furnace. 2.4 Importance and types of fluxes used in iron making. 2.5 Magnetic concentration methods of iron ore. 2.6 Roasting and calcining of iron ores 2.7 Agglomeration of iron ores.
Unit – III Iron Making by Blast Furnace	3a. Describe construction of blast furnace and its accessories. 3b. Describe blast furnace chemistry. 3c. Describe Blast furnace operations and explain chemical occurring therein. 3d. List the the blast furnace irregularities and their remedies. 3e. Enumerate modern trends in blast furnace 3f. List the grades of P.I. and their uses.	3.1 Construction of blast furnace. 3.2 Blast furnace accessories like stove, dust catcher. 3.3 Chemistry of the blast furnace. 3.4 Operation of the blast furnace. 3.5 Measures taken for control of the blast furnace irregularities. 3.6 Blast furnace refractories. 3.7 Modern trends in blast furnace. 3.8 Disposal of the iron and the slag 3.9 Types/grades of P.I. and their uses.
Unit – IV Alternative methods of iron making	4a. List various alternative methods 4b. Explain brief principles of alternative methods and their advantages and limitations 4c. Explain sponge iron with respect to composition, application and production.	4.1 Needs and types for alternative methods. 4.2 Principles of alternative methods of iron production 4.3 Advantages and limitations of alternative methods of iron making 4.4 Mini blast furnace for iron making 4.5 . Definition, composition and application of SI, comparison of pig iron and SI 4.6 Flow chart for production of sponge Iron.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		4.7 Principle and production of sponge Iron by gas base technology
Unit – V Environment, safety and conservation of energy in iron making	5a. Explain importance of Pollution control in Iron making plants. 5b. Enumerate safety rules in Iron making plant 5c. Describe the conservation of energy at various stages of Iron making.	5.1 Pollution control in Iron making plant. 5.2 Safety rules in Iron making plant. 5.3 Conservation of energy at various stages of Iron 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 iron.	04	04	02	00	06
II	Raw materials for iron making	08	06	02	04	12
III	Iron Making by Blast Furnace	20	12	08	10	30
IV	Alternative methods of iron making	08	06	08	04	18
V	Environment, safety and conservation of energy in iron making	02	02	02	00	04
Total Hrs		42	30	22	18	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 EXERCISES/PRACTICAL-

-----Not applicable

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will visit industries
- ii. Students in group prepare presentation and give seminar on selected topic.

9. SPECIAL INSTRUCTIONAL STRATEGIES (

- i. Arrange industrial visit
- ii. Show video/animation films depicting different iron extraction process
- iii. Give internet based assignments to students and ask them to present in class with the help of power point presentation by group of students

10. SUGGESTED LEARNING RESOURCES

A. List of Books:

S. No.	Title of Books	Author	Publication
1	Manufacture of iron and steel Vol. I, II	G.R.Bashforth	Chapman & Hall.
2	Iron making .	R.H.Tupkary.	Khanna Publishers
3	Elements of metallurgy	Dr.D.Swarup	Rastogi Publications
4	Principles of Extractive Metallurgy	Tarkel Rosenqvist	TapirAcademicPress,Tro ndheim

B. List of Major Equipment/Instrument/Materials

Not applicable

C. List of Software/Learning Websites-

- i. <http://www.steel.org/Making%20Steel/How%20Its%20Made/Processes/How%20A%20Blast%20Furnace%20Works%20larry%20says%20to%20delete.asp>
- ii. <http://www.calce.umd.edu/TSFA/iron>
- iii. <http://en.wikipedia.org/wiki/Steelmaking>
- iv. www.nptel.com
- v. <http://www.chemguide.co.uk/inorganic/extraction/iron.html>
- vi. http://www.youtube.com/watch?v=6hb_iUxoP3A

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. Mrs. B. H. Goyal**, I/c HOD (Met. Dept.), Dr S & S. S. Ghandhy college of Engg and Technology, Surat.
- **Dr. I. B. Dave**, I/c. Principal Government Polytechnic, Vyara.

Coordinator and Faculty Members from NITTTR Bhopal

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