

CH-105, MATERIALS TECHNOLOGY

Course Title: MATERIALS TECHNOLOGY	Course Code: CH-105
Semester: I YEAR	Core/ Elective: Core
Teaching Scheme in Periods (L:T: P) : 120:30:0	Credits: 3 Credits
Type of course: : Lectures, Self Study & Activities	Total Contact Periods: 150
CIE : 60 Marks	SEE : 40 Marks

Prerequisites:

This course requires the basic knowledge of Physics, Chemistry, structures of materials at Secondary school level

Course Outcomes

CO1 :	Demonstrate the mechanical properties of materials and destructive and non destructive testing of materials
CO2 :	Analyze the Structure of materials, basic concepts of crystalline materials like unit cell, FCC,BCC, HCP
C03	Analyze Iron carbon equilibrium diagram representing different phases
CO4 :	Explain different methods of manufacture of Iron and Steel
CO5 :	Discuss the need of alloying steel and non ferrous metals and select the alloys for specific applications
CO6 :	Study the various types of Miscellaneous materials and basic knowledge of corrosion

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE			
			R		U	A
1	Introduction, Mechanical properties of metals & Testing of materials	30	Q4	Q1	Q9(a)	Q13(a)
2	Structure of metals and alloys.	20				

3	Thermal equilibrium diagram	20		Q2		Q10(a)	Q14(a)
4	Production of Iron and Steel	30					
5	Plain carbon steels and alloy steels & Non ferrous metals and their alloys	25		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q14(b), Q15(a), Q15(b)
6	Miscellaneous materials and introduction to corrosion	25			Q7,Q8	Q10(b), Q12(a), Q12(b)	Q13(b), Q16(a), Q16(b)
Total		150	8		8	8	

COURSE CONTENTS

UNIT-1: INTRODUCTION, MECHANICAL PROPERTIES OF METALS

& TESTING OF MATERIALS Duration: 30 Periods (L: 25 – T: 5)

Definition of engineering materials, Classification of engineering materials - need and applications, Define the terms strength of materials, stress , strain ,elasticity , tensile and compressive strength, ductility, hardness, toughness, brittleness, impact strength, fatigue and creep strength- various destructive testing methods. Determination of Tensile strength & compressive strength by UTM - Hardness by Brinell & Rockwell testing machines-Impact strength by Izod and Charpy testing machines - various non destructive testing methods.

UNIT-2: STRUCTURE OF METALS AND ALLOYS

Duration: 20 Periods (L: 16– T:4)

Unit cell – space lattice – FCC, BCC, HCP space lattices – formation of grains by dendritic growth – effect of grain size on mechanical properties – factors promoting grain size – Phenomenon of crystallization.

UNIT -3: THERMAL EQUILIBRIUM DIAGRAM

Duration: 20 Periods (L: 14 – T:6)

Cooling curve of pure iron.-Allotropic forms of pure iron, Iron – carbon thermal equilibrium diagram – Peritectic, Eutectic and Eutectoid points in iron carbon Equilibrium diagram.

UNIT -4: PRODUCTION OF IRON AND STEEL

Duration: 30 Periods (L: 15– T:5)

Raw materials required for Production of iron- various methods of manufacture of steel and Iron
Production of Pig Iron by Blast furnace – Production of Steel by Bessemer converter and L-D
Converter.

UNIT 5: PLAIN CARBON STEELS AND ALLOY STEELS &NON FERROUS METALS AND THEIR ALLOYS

Duration: 25 Periods (L: 20 -T: 5)

Classification and application of plain carbon steels –Need for alloying the steels – industrial
applications of alloy steels-Selection of alloy steels for suitable engineering applications
Importance of various non ferrous metals and alloys of aluminum, copper, nickel, lead,tin, zinc,
titanium, zirconium, - properties of aluminum, copper, zinc, tin, lead and their applications
types of Nickel alloys (Monel, Hastalloy) and copper alloys(Brasses and Bronzes), their
properties and applications.

UNIT 6: MISCELLANEOUS MATERIALS AND INTRODUCTION TO CORROSION

Duration: 25 Periods (L: 20 – T:5)

Importance of glass - types and applications – properties and applications of Carbon and
Graphite –application of polymers – composition, properties, applications of stoneware –
applications of asbestos, rubber, Elastomers, Fibre glass, reinforced plastics, Refractories,
Ceramics, Composites, Nano- materials.-corrosion-causes of corrosion- Types of corrosion –
prevention methods of corrosion.

Reference Text Books

1. Engineering Chemistry by Jain & Jain
2. Engineering Materials by Pakirappa
3. Engineering Metallurgy by Higgins.
4. Material Science by S.K Hazra Chowdary.
5. Material science and Metallurgy by O.P.Khanna
6. Engineering Materials by Rangawal S.C

SUGGESTED LEARNING OUTCOMES

CO1: Demonstrate the mechanical properties of materials and destructive and non destructive
testing of materials

- 1.1 Define Engineering material
- 1.2 Write the Classification of Engineering materials
- 1.3 What is the need of Engineering materials and their applications.
- 1.4 Define stress & strain.
- 1.5. Define Tensile and compressive strength
- 1.6 Define Hardness and Toughness
- 1.7. Define Brittleness
- 1.8 Define Impact strength
- 1.9. What are the various destructive methods of testing?
- 1.10. What are the various methods of non destructive testing?
- 1.11. Identify various non destructive testing.
- 1.12. Why testing of materials is required?
- 1.13 Distinguish between destructive testing and non destructive testing.
- 1.14 Explain the method of determination of tensile strength and compressive strength by universal testing machine (UTM).
- 1.15 How do you determine the hardness of the material by Brinell hardness testing machine.
- 1.16. Explain the method of determination of hardness by Rockwell hardness testing machine.
- 1.17. Write the determination of impact strength by Izod and Charpy's testing machines.

CO2: Analyze the Structure of materials, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP

- 2.1 Define unit cell.
- 2.2 Define space lattice
- 2.3 Draw the structures of F.C.C
- 2.4 Draw the structures of B.C.C, HCP
- 2.5 What are the factors that promoting grain size
- 2.6 Write the phenomenon of crystallization
- 2.7 What is crystallization?
- 2.8 What is the effect of grain size on mechanical properties?
- 2.9. What is Dendrite?

CO3: Analyze Iron carbon equilibrium diagram representing different phases

- 3.1 Sketch the cooling curve of a pure metal.
- 3.2 Draw Iron-carbon equilibrium diagram with salient points, phases and critical points
- 3.3 Draw the Iron –carbon thermal equilibrium diagram
- 3.4 Explain Allotropic forms of pure iron with a line sketch
- 3.5 What is pearlite?

CO4: Explain different methods of manufacture of Iron and Steel

- 4.1 What are the main functions of limestone in the charge of blast furnace?
- 4.2 What are the products of blast furnace?
- 4.3 What are the main raw materials used for production of iron
- 4.4 Draw the neat diagram of blast furnace.
- 4.5 Write the methods of manufacture of iron.
- 4.6 What is the function of coke in the production of Iron
- 4.7 Write the different methods of manufacture of steel.
- 4.8 What are the furnaces used for the production of iron?
- 4.9 Explain the production of Pig iron by using blast furnace with a neat sketch.
- 4.10 Write the process of making steel in L-D converter and write its advantages
- 4.11 Explain the process of production of steel by Bessemer converter.
- 4.12 What are the differences between acidic and basic Bessemer process
- 4.13 List out different types of cast iron.
- 4.14 Draw a neat diagram of L-D Converter.
- 4.15 Draw the neat diagram of blast furnace.
- 4.16 Explain the production of Pig iron by using blast furnace with a neat sketch.
- 4.17 Write the advantages of making steel in L-D Converter.
- 4.18 Write the process of making steel in L-D converter.

CO5: Discuss the need of alloying steel and non ferrous metals and select the alloys for specific applications

- 5.1 Write the classification of plain carbon steels.
- 5.2 What are plain carbon steels?
- 5.3 What is the effect of carbon on properties of steel?
- 5.4 Write the industrial applications of alloy steels
- 5.5 What is the purpose of adding alloying elements to steel?
- 5.6 Give the composition of Monel metal.
- 5.7 Write the applications of Zinc.
- 5.8 Write the importance of non ferrous metals
- 5.9 What are non- ferrous metals? Give Examples
- 5.10 Write the applications of non –ferrous metals?
- 5.11 What is the effect of carbon on properties of steel?
- 5.12 Name any two alloys with examples.
- 5.13 What is stainless steel? Give its composition
- 5.14 What are the impurities that effects the properties of steel.
- 5.15 What is an alloy steel?
- 5.16 What is stainless steel?
- 5.17 Write the composition of Gun metal.
- 5.18 Write the importance of Aluminium.
- 5.19 What is 18/8 stainless steel?
- 5.20 What is muntz metal? Give its composition?
- 5.21 What are the different types of copper alloys? Write any one of them with applications.
- 5.22 Name any two important alloys of nickel and write their properties and applications

CO6: Study the various types of Miscellaneous materials and basic knowledge of corrosion

- 6.1 What is glass? Give its composition.
- 6.2 What type of material is used as lining in glass manufacture?
- 6.3 Write the applications of polymers?
- 6.4 Write the applications stoneware.
- 6.5 What is glass ceramics?
- 6.6 Write the uses of asbestos

6.7 Write the applications of rubber.

6.8 Define refractory

6.9 Write the applications refractory.

6.10 Write the properties and applications of Graphite.

6.11 Write the properties and applications of carbon.

6.12 Write any two applications of asbestos

6.13 Write the applications of rubber.

6.14 What is Reinforced plastics?

6.15 Write the properties and applications of polymers and elastomers.

6.16 Write the properties and applications of ceramics.

6.17 What are Nano materials and composites?

6.18 Give the applications of Nano materials and composites

6.19 Define corrosion.

6.20. Explain the causes of corrosion.

6.21 known briefly about (a) Electrode potential b) passivity c) electro chemical series d) polarization.

6.22 Explain briefly about types of corrosion?

6.23 What are the various methods of prevention of corrosion?

CO- PO MAPPING matrix:

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	1	2	1	1	2	2
CO2	3	3	2	2	1	1	2	1	1	2	1
CO3	3	3	2	2	1	1	2	1	1	1	1
CO4	2	2	2	2	2	1	2	1	1	2	3
CO5	3	2	2	2	2	1	2	1	1	3	2
CO6	3	2	2	1	3	2	3	1	1	3	3
Average	2.83	2.3	1.83	1.7	1.83	1.2	2.2	1	1	2.17	2.0

MappingStrength:3=Strong|2=Moderate|1=Slight| Blank=No

Correlation

Suggested Student Activities for Induction Program

	Forenoon	Afternoon
Day1	Registration	Class work as per Time table Drawing and Basic workshop practice classes may be conducted
Day2	Rules and Regulations	
Day3	Getting acquainted with Head and faculty	
Day4	Familiarization with Institutional facilities	
Day5	Interaction with Class teacher and Seniors	
Day6	Introducing the mentor	
Day7	Parent –Teacher meeting	

Suggested Student Activities:

Other than the class room and laboratory learning following are the suggested student related co curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course

1. Enlist the different types of metals , non metals in Chemical Laboratories

2. Visit nearby metal foundry
3. Prepare the chart for various grades of steel
4. Draw the atomic structure of various metals. Display charts in Classroom/Laboratory and prepare models
5. Draw Iron - carbon equilibrium diagram and display chart in class room
6. Group discussion/Quiz
7. Surprise test

Suggested Software / E-Learning references:

- i. <https://en.wikipedia.org/wiki/materials-science>
- ii. <http://mse.stanford.edu>
- iii. <http://ocw.mit.edu/courses/materials-science> and engineering
- iv. www.nptel.ac.in

MID SEM-I EXAM

S.No	Unit Name	R	U	A	Remarks
1	Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

MID SEM –II EXAM

S.No	Unit Name	R	U	A	Remarks
1	Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

Semester End Examination

Sl No	Unit No.	Questions to be set for SEE				Remarks	
		R		U	A		
1	I	4	1		9(a)	13(a)	
2	II		2		10(a)	14(a)	
3	III		3		9(b)	13(b)	
4	IV		5, 6		11(a)	15(a)	
5	V						

				11(b)	15(b)	
6	VI		7,8	10(b)	14(b)	
				12(a)	16(a)	
				12(b)	16(b)	
Total Questions		8		8	8	

CO-PO MAPPING

State Board of Technical Education and Training, Telangana
Model Question paper
DCHE I YR Mid -I Examination

Course Code: CH -105

Course Name: MATERIAL TECHNOLOGY

Duration: 1 hour

Max.Marks:20

	CO		Mapped PO	Marks
CO1	Demonstrate the mechanical properties of materials and destructive and non destructive testing of materials	R/U	1,2,3	12
CO2	Analyze the Structure of materials, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, and Explain iron carbon equilibrium diagram with diagram presenting different phases	R/U/A	1,2	18
CO3	Explain different methods of manufacture of Iron and Steel	R/U	1,2	09
CO4	Discuss the need of alloying steel and non ferrous metals and select the alloys for specific applications	R/U/A	1,2,10	10
CO5	Select appropriate materials for specific engineering applications and suggest suitable materials for the modern world and discuss briefly about corrosion	R/U/A	1,2,5,6	11
CO6	Study the various types of Miscellaneous materials and basic knowledge of corrosion	R/U/A	1,2,5,7	09

PART-A

Answer all questions, Each Question carries one mark $4 \times 1 = 4$ Marks

1. What are Engg materials ? Give Examples.
2. Define Hardness and Brittleness
3. Define unit cell.
4. Draw the structures of F.C.C

PART-B

Answer two questions. Each question carries three marks

$2 \times 3 = 6$ Marks

5(a). Write the Classification of Engineering Materials

(or)

5(b). What is the difference between destructive testing and Non-destructive testing?

6(a). What are the factors that promoting grain size.?

(or)

6(b). What is the effect of grain size on mechanical properties?

PART-C

Answer two questions. Each question carries five marks

$2 \times 5 = 10$ Marks

7(a). Determine the hardness of the given sample using Brinell hardness testing machine.

(or)

7(b). Explain briefly about UTM with the help of a neat sketch with stress - strain diagram.

8(a). Explain the phenomenon of crystallization

(or)

8(b). what is space lattice? Draw the structure of BCC.

PART-A

Answer all questions, Each Question carries one mark $4 \times 1 = 4$ Marks

- 1) What is pearlite?
- 2) What is an alloy ?
- 3) What is the function of coke in the production of Blast furnace?
- 4) Draw a neat sketch of L-D converter.

PART-B

Answer two questions. Each question carries three marks

$2 \times 3 = 6$ Marks

5(a). Sketch the cooling curve of a pure metal.

(or)

5(b). What is Peritectic reaction ? Explain about the formation of austenite

6(a). Draw the neat diagram of blast furnace.

(or)

6(b). Write the advantages of making steel in L-D Converter.

PART-C

Answer two questions. Each question carries five marks

$2 \times 5 = 10$ Marks

7(a). Draw the iron –carbon thermal equilibrium diagram

(or)

7(b). Explain Allotropic forms of pure iron with a line sketch

8(a). Explain the method of manufacture of steel by acidic bessemer converter

(or)

8(b). Explain the method of manufacture of steel by L- D converter

DIPLOMA EXAMINATION(C-26)
D.CH.E -- I YR END EXAMINATION
MATERIALS TECHNOLOGY (CH- 105C)

Time: 2 Hours

[Total Marks: 40]

PART – A

08x01=08

Instructions: 1. Answer ALL questions.
2. Each question carries one mark

1. Define Engineering Materials?
2. What are the products of blast furnace methods?
3. What is the composition of glass.
4. Define space lattice.
5. What are non- ferrous metals?
6. What is an alloy steel?
7. What are Reinforced plastics?
8. Define corrosion?

PART-B

Instructions: 1. Answer ALL questions.
2. Each question carries three marks.

04x03=12

- 9 (a). What is the effect of grain size on mechanical properties?
Or
9 (b). What are the impurities that effect the properties of steel.
- 10 (a) what are the differences between acidic and basic Bessemer process
Or
10 (b) Write the properties and classifications of carbon
- 11 (a). Write the industrial applications of alloy steels
Or
11 (b).What is the effect of carbon on properties of steel?
- 12 (a). Write the applications of rubber
Or
12 (b) What are the causes of corrosion?

PART-C

INSTRUCTIONS: 1. Answer any FOUR questions
2. Each question carries FIVE marks.

04x5=20

- 13 (a). How do you determine the hardness of the material by Brinell hardness testing machine?

Or

13 (b). What are the different types of copper alloys? Write any one of them with applications.

14 (a). Write the advantages of making steel in L-D Converter.

Or

14 (b) . Write the properties and applications of ceramics.

15 (a). What are the different types of copper alloys? Write any one of them with applications

Or

15 (b). Name any two important alloys of nickel and write their properties and applications.

16 (a). Write the properties and applications stoneware.

Or

16 (b). What are the various types of corrosion? Classify them.