

Even Semester Mid-term Examination, 2022-23

**ALTERNATIVE ROUTES OF IRON MAKING****MME 612***Full Marks : 25**Time : 90 Minutes**The figures in the margin indicate full marks.**Answers of a particular group and a particular question  
to be written sequentially and to the point.**State all assumptions clearly.**Answer all the questions.*

Question No.	Body of the Question	Marks	Mapped CO
1.	(a) What are the reasons for development of DRI processes?	2	
	(b) Discuss about the reformer unit of Midrex process.	2	CO2
	(c) Explain the reduction mechanism of very dense iron ore particle by a reducing gas.	2	
	(d) Explain the effect of pressure and temperature on Boudouard reaction.	2	CO1
	(e) In a DRI producing unit, the charge material contains $Fe_T = 66.4\%$ . The DRI contains $Fe_T = 87.3\%$ . Calculate the amount of raw materials required to produce one ton of DRI.	2	CO3

2. Calculate the equilibrium gas composition of Boudouard at 900K. Provided  $\Delta G^\circ = -40800 + 41.77 \text{ cal}$  and total pressure of the system is 1 atmosphere. 3 CO1
  3. Explain the plot of %CO vs temperature plot of Fe-C-O diagram. 3 CO2
  4. Describe the raw material selection criteria for direction reduction processes. 3 CO3
  5. An iron ore contains 66.1%  $\text{Fe}_T$  was reduced to a product containing 86% total iron. If product contains 11% FeO, calculate the following:
    - i. Degree of reduction of iron ore
    - ii. Metallization (%)
    - iii. Metallic iron (%) 3 CO2
  6. Calculate the temperature at which wustite decomposes into metallic iron and magnetite:  $4\text{FeO(s)} = \text{Fe(s)} + \text{Fe}_3\text{O}_4\text{(s)}$ ; Provided,  $\text{Fe (s)} + 1/2 \text{ O}_2 \text{ (g)} = \text{FeO (s)}$ ,  $\Delta G_1^\circ = -62845 + 15.393T \text{ cal}$  and  $3\text{FeO (s)} + 1/2 \text{ O}_2 \text{ (g)} = \text{Fe}_3\text{O}_4\text{(s)}$ ,  $\Delta G_1^\circ = -74800 + 29.573T \text{ cal}$  3 CO1
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Even Semester Mid-term Examination, 2022-23

**METAL JOINING PROCESSES**

**(Depth Elective 2)**

**MME 617**

*Full Marks : 25*

*Time : 90 Minutes*

*The figures in the margin indicate full marks.*

Answer *all* the questions.

Question No.	Body of the Question	Marks	Mapped CO
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|----|---|--|--|
| 1. | State whether the following statements are FALSE or TRUE, JUSTIFY all the statements. |  |  |
|----|---|--|--|

(i) Gas welding is mainly suited for welding of thin sheets, small diameter pipes and tubes.

(ii) In gas welding, the joint can be made even much stronger than the original.

(iii) Which flame is suitable for welding of ferrous metals, Cu and Al alloys?

(iv) In arc welding, the length of the arc is directly related to the .....

(v) Almost no smoke is produced in .....welding process.

2+2+2+1+1 CO1

- |    |  |  |  |
|----|--|--|--|
| 2. | Explain the mechanical properties of welded joint. |  |  |
|----|--|--|--|

4 CO3

3. In arc welding, what are the three elements to be controlled to obtain satisfactory welding operation?  
1 CO1
4. Describe the chemical reactions and temperature distribution in a neutral oxyacetylene flame. 3 CO2
5. In case of arc welding of steel with a potential of 20V and current of 200 A, the travel speed is 5mm/s and the cross sectional area of the joint is 20 mm<sup>2</sup>. The heat required for melting steel may be taken as 10 J/mm<sup>3</sup> and heat transfer efficiency as 0.85. Calculate the melting efficiency.  
4 CO2
6. Define the term related to welding joint:
- (i) Toe,
  - (ii) Reinforcement and root,
  - (iii) DCEN and DCEP
- 5 CO1

### COURSE OUTCOMES

CO1:

CO2:

CO3:

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