

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2018

Subject Code: 2152108
Date: 07/12/2018
Subject Name: Steel Making
Time: 10:30 AM TO 01:00 PM
Total Marks: 70
Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) What is the basic difference between steel making and iron making? 03
 (b) Name various Integrated and Mini Steel Plants in India. 04
 (c) With the help of schematic show different routes of steelmaking. 07

- Q.2** (a) Discuss briefly Basic Oxygen Furnace (BOF). 03
 (b) Explain in brief, the effect of Sulphur, Phosphorous in Steel. 04
 (c) Explain: Reaction at slag metal interface. 07

OR

- (c) Explain briefly (i) Carbon Reaction, (ii) Phosphorous Reaction, (iii) Silicon Reaction, (iv) Manganese Reaction, (v) Sulphur Reaction. 07
- Q.3** (a) List the purposes of secondary steel making. 03
 (b) Discuss the main requirements of “Deoxidizer” in steel making. 04
 (c) Explain construction & working principle of single nozzle oxygen lance with neat sketch. 07

OR

- Q.3** (a) What is tundish metallurgy? Briefly explain. 03
 (b) What are the effects of inclusions on mechanical properties of steel? 04
 (c) Explain AOD process in detail. 07

- Q.4** (a) What are the environmental issues related to steel making? 03
 (b) Calculate the p_{CO_2} / p_{CO} ratio in a CO–CO₂ gas mixture at equilibrium with $p_{O_2} = 10^{-6}$ atmosphere at 1600°C 04

. Standard free energy of formation (J. mol⁻¹) of some compounds as a function of temperature (at the indicated temperature range)

Reaction **Temperature, K** ---- **A, J . mol⁻¹** ---- **B, J . mol⁻¹.K⁻¹**

C(gr) + (1/2)O₂(g) = CO(g) 1500–2000 –111800 –87.65

C(gr) + O₂(g) = CO₂(g) 1500–2000 –394200 –0.84

- (c) Explain Ladle Furnace principle for secondary refining with neat sketch. 07

OR

- Q.4** (a) With figure briefly explain R-H degasser. 03
 (b) A slag of CaO, SiO₂ and Al₂O₃, having mole fraction of alumina as 0.15, has Si₂O₇⁶⁻, AlO₄⁵⁻ anions. Calculate the slag composition. 04
 (c) Compare and contrast AC and DC electric arc furnace. 07

- Q.5** (a) Calculate the activation energy for viscosity for a liquid slag, whose viscosities are 10 and 2 kg.m⁻¹.s⁻¹ at 1510 and 1610°C respectively. 03

- (b) Explain VOD process. 04
 (c) List the types of Continuous-Casting (C.C.) machines and explain any one. 07

- Q.5 (a)** A liquid slag has 50 wt. % CaO, 10 wt. % MgO, 25 wt. % SiO₂, and 15 wt. % Al₂O₃. **03**
Calculate its sulphide capacity at 1900 K with the help of the following equation:
$$\log C_s = 3.44 (X_{\text{CaO}} + 0.1 X_{\text{MgO}} - 0.8 X_{\text{Al}_2\text{O}_3} - X_{\text{SiO}_2}) - 9894/T + 2.04$$
- (b)** List the ingot defects and give their remedies. **04**
- (c)** List the defects in Con-cast products & Discuss briefly about Near Net Shape casting. **07**

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