Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Corrosion Engineering — **Semester: VII**
Program: B. Tech (CERP) — **Time 03 hrs.**
Course Code: CHCE 3025P — **Max. Marks: 100**

SECTION A
Answer all the Questions

S. No.		Marks	CO
Q 1	Explain the following with neat diagrams a. Fretting and cavitation Corrosion b. Distance effect in Galvanic Corrosion	5+5	CO1
Q 2	List out various methods used in metallic and inorganic coatings. Describe any two techniques in detail	10	CO3
Q 3	Illustrate and Discuss the following a. Activation polarization, b. Concentration polarization, and c. Combined polarization	4+3+3	CO3
Q 4	a. Calculate the change of the Gibbs free-energy, ΔG, If one mole of tin is consumed in the corrosion cell $Sn/Sn^{2+}//Cu^{2+}/Cu$, $e°_{Sn^{2+}/Sn} = -0.138V$ vs. SHE $e°_{Cu^{2+}/Cu} = -0.337V$ vs. SHE b. Mention the advantages and limitations of Pourbaix diagram	5+5	CO2
Q 5	a. An engineer is designing a high-speed dental drill. The materials used for the drill must have high strength, good heat resistance, and thermal stability. What types of steel should the engineer consider for this application? Justify b. An engineer is designing a sheet metal frame for a small business machine. What mechanical properties would be important for this material? What materials should the engineer consider for this application? Justify	5+5	CO5
Q 6	Analyze and discuss the guidelines for investigating corrosion failure	10	CO4

SECTION B
Answer all the Questions

Q 7	Determine whether Fe is stable in 10^{-6} M aerated water solution of Fe^{2+} at a pH of 3, 5, 8. Estimate (a) The Gibbs free-energy change and (b) The cell potential of the corrosion cell. The activity coefficients are assumed to be 1. The hydrogen pressure is 1 atm. Half cell reactions: $Fe \text{ ------} \rightarrow Fe^{2+} + 2e$ $½\ O_2 + H_2O + 2e \text{ ----------} \rightarrow 2OH^-$ $Fe\ (s) + ½\ O_2\ (g) + H_2O\ (l) \text{ ----------} \rightarrow Fe(OH)_2$ $e°_{O2}/OH^- = 0.401$ $e°_{Fe/Fe2+} = 0.440$ **Instruction: Assume suitable values if any data is missing**	20	CO2

Q 8	List out various alloy systems. Describe Aluminum and copper alloys emphasizing environments in which they find extensive applications	**20**	**CO5**