

Ref. No. : Ex/Met/PC/B/T/312/2024

Name of the Examinations: B.E. METALLURGICAL AND MATERIAL ENGINEERING  
THIRD YEAR FIRST SEMESTER - 2024

Subject: ELECTRO-CHEMISTRY, CORROSION Time: 3hrs. Full Marks: 100

Instructions: Attempt all the questions answer from each "CO" is mandatory following  
given instruction

**CO I: (Answer any five questions from CO I)**

1. What are the conditions require for wet corrosion of a metal. Define half-cell and standard half-cell. 4+1=5
2. Consider reaction between Cu & Ag, what will be the reaction at anode and cathode and in which direction the reaction will occurs? What is the limitation of E-Ph diagram? 4+1=5
3. Consider a reaction between H<sub>2</sub> & Zn, what will be the two different half-cell reaction will occurs? Why Pt is used as inert electrode in this reaction? Explain. 2+3=5
4. What are the use of the E-Ph diagram? Define potentiometric titration? 3+2=5
5. What are the different types of titration process? Explain redox titration and precipitation titration process. 1+4=5
6. Write the Nearst equation? What is the application of Nearst equation? Explain the H<sub>2</sub> evolution type corrosion and Absorption of O<sub>2</sub> type corrosion? 1+1+3=5

**CO II: (Answer any five questions from CO II)**

7. Explain, what is happened when the cell which is contains Zn and H<sub>2</sub> is short circuited? 5
8. Show with graph, i) if we consider an electrode in which there is no activation polarization, then what will be the equation for concentration polarization? ii) Effect of environmental variables on concentration polarization curve. 2.5x2=5
9. Explain combined polarization. 5
10. What is the application of Tafel's equation? Draw a Tafel plot for an anodic process and explain. 1+4=5
11. What are the two different method for corrosion rate measurement? Explain. What is mixed potential theory? 3+2=5
12. What are the requirement of applying the Tafel extrapolation technique? Explain the Faraday's passivity experiments with Iron. 2+3=5

[ Turn over

**CO III: (Answer any five questions from CO III)**

13. Rearrange the metal-metal ions equilibrium according to their increments of electrode potential value at room temperature.  $Au-Au^{3+}$ ,  $Fe-Fe^{3+}$ ,  $Sn-Sn^{2+}$ ,  $Cu-Cu^{2+}$ ,  $Ag-Ag^{2+}$   
5
14. How environment can affect the galvanic corrosion? Explain with an example how area can affect the galvanic corrosion? 2+3=5
15. Explain with suitable figure the effects of high  $O_2$  pressure & PH on pitting corrosion of steel after 24hrs. in NaCl brine. 5
16. What are the factors affecting the erosion corrosion? Explain any one of them. 1+4=5
17. What is stress corrosion cracking (SCC)? How does SCC occurs in stainless steel? Show the rate of SCC in specimen extension as a function of time during constant load SCC test.  
1+2+2=5
18. How chromate coating can prevent the corrosion of a metal? What are the differences between anodic protection and cathodic protection? 2+3=5

**CO IV: (Answer any five questions from CO IV)**

19. What is atmospheric corrosion? Give one example. What are the factors that affecting the atmospheric corrosion? 2+3=5
20. How oxidation takes place at elevated temperature? What are the remedy process for atmospheric corrosion? 2+3=5
21. What is fuel cell? Explain. 1+4=5
22. What are the basic laws have been used to characterize oxidation rates of pure metals? Explain any one of them. 1+4=5
23. What are the differences between P-type metallic oxide and N-type metallic oxide? Give examples of corrosion for beneficial purpose. 3+2=5
24. What is batteries? Explain the functions of batteries with some examples. 1+4=5