

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

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

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

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

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

1. Define electrochemistry and electrochemical cells. Explain what happen, when a steel structure contact with an aqueous environment or in underground soil. 2+3=5
2. Why Platinum is used as an inert electrode in place of Hydrogen in cells containing reversible Zn and H<sub>2</sub> electrodes? 5
3. What is a reference electrode? Give two examples of the reference electrode. How can we measure the electrode potential of a system in which reactants are not at unit activity? 1+1+3=5
4. Write down the use of the Pourbaix diagram along with drawing the graphical diagram. 3+2=5
5. Define potentiometric titration. What are the different types of titration process? Explain any one of the titration processes. 1+1+3=5
6. Explain what happens- a) if noble metals are in an acid solution.  
b) If noble metals are immersed in an acid solution in the presence of dissolved oxygen  
c) What are the differences between H<sub>2</sub> evolution type and absorption of O<sub>2</sub> type corrosion? 2+2+1=5

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

7. Explain the activation polarization with a suitable graph of a hydrogen electrode. 5
8. Define concentration polarization with a suitable example. If there is no activation polarization, then what will be the concentration polarization equation? Draw a concentration polarization curve for reduction process. 3+1+1=5
9. Explain combined polarization. 5
10. Define resistance polarization? Draw a Tafel plot for an oxidation process and explain. 1+4=5
11. What are the applications of Tafel extrapolation and Linear polarization? What is the mixed potential theory? 3+2=5

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12. What are the limitations of Tafel extrapolation technique? Draw the applied current cathodic polarization curve of a corroding metal showing Tafel extrapolation. 3+2=5

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

13. What happens, when two dissimilar metals are immersed in a corrosive or conductive solution? 5
14. How uniform attack and crevice corrosion can be prevented? 3+2=5
15. Explain with autocatalytic nature of pitting. 5
16. Explain Knife Line Attack (KLA). 5
17. What are the different methods to prevent stress corrosion cracking? 5
18. How metal can be protected by using the anodic protection? 5

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

19. How atmospheric corrosion can affect the iron and steel surface? What are the factors that affect the atmospheric corrosion? 2+3=5
20. How corrosion can affect the different properties of the metals? What are the different ways to prevent atmospheric corrosion? 2+3=5
21. What is a fuel cell? Explain. 1+4=5
22. Define kinetics laws of oxidation. How corrosion can be used for beneficial purposes? 2+3=5
23. Explain the characteristics and properties of batteries with two suitable examples. 3+2=5
24. Explain parabolic rate laws of oxidation. 5