

IV B.Tech. I Semester Regular Examinations, November -2005
ELECTROMETALLURGY AND CORROSION
(Metallurgy & Material Technology)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain modern electrode kinetic theory.
(b) Explain about the electrode kinetic theory of any pure metal in any acid solution. [8+8]
2. (a) Distinguish between decomposition Potential and discharge Potential.
(b) Explain the importance of EMF and NERNST Equation. [8+8]
3. (a) Draw the potentiostatic anodic polarization curve of any metal in acid solution.
(b) Explain the phenomenon of concentration polarization considering the hydrogen evolution reaction. [7+9]
4. Describe methods to measure the following.
(a) Coating thickness
(b) Adhesion of plated object. [8+8]
5. (a) Explain the differences between dry corrosion and wet corrosion.
(b) What is Hydrogen over potential? What is its effect upon the rate of corrosion? Explain. [8+8]
6. (a) What probable changes occur in passive film when a metal changes from passive to transpassive state.
(b) What are inhibitors? What are their mechanisms to prevent corrosion? If the amount of inhibitor added is less, it can be more aggravating than not having it at all, Explain. [6+10]
7. (a) What are typical changes in the medium that are often employed for reducing corrosion? Explain.
(b) What are the different types of metal coatings? Explain. [8+8]
8. (a) Briefly describe the two techniques that are used for galvanic protection.
(b) Tins cans are made of a steel the inside of which is coated with a thin layer of tin. The tin protects the steel from corrosion by food products in the same manner as zinc protects steel from atmospheric corrosion. Briefly explain how this cathodic protection of tin can is possible since tin is electrochemically less active than steel in galvanic series. [9+7]

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1. (a) Explain the factors that affect conductivity of electrolytes.
(b) Show the basic potentiometric circuit and explain how electrode potential are measured. [8+8]
2. (a) What is Equivalent conductance? Explain the significance of Equivalent conductance
(b) Explain how equivalent conductance at infinite dilution determined. [8+8]
3. (a) Draw the potentiostatic anodic polarization curve of any metal in acid solution.
(b) Explain the phenomenon of concentration polarization considering the hydrogen evolution reaction. [7+9]
4. Explain the following methods of polishing of the articles during of polishing of the articles during the anodizing process.
(a) Mechanical polishing
(b) Chemical polishing. [8+8]
5. (a) Explain the differences between dry corrosion and wet corrosion.
(b) What is Hydrogen over potential? What is it's effect upon the rate of corrosion? Explain. [8+8]
6. Discuss the following
(a) Corrosion - Erosion
(b) De Zincification
(c) Fretting corrosion
(d) High temperature corrosion. [4x4=16]
7. (a) what are the different methods of cathodic protection? Explain them.
(b) List some of the most important applications of anodic protection and explain them. [8+8]
8. (a) What is selective leaching of an alloy? Which types of alloys are especially susceptible to this kind of corrosion?
(b) Describe the mechanism for the dezincification of a 70-30 Brass. [8+8]

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1. (a) Explain the following terms
 - i. Current efficiency
 - ii. Energy efficiency.
- (b) Suppose that a certain current passes for a given time through three baths connected in series
 - i. An acid copper bath used as a coulometer and assumed to have an efficiency of 100%.
 - ii. A Nickel bath and
 - iii. A Zinc bath. The respective weights of the 3 metals deposited were 35.6 gm of copper, 29.2 gm of Ni & 34.8 gm of Zinc. What are the cathode efficiencies of Ni & Zn deposition (Hint: 1 amp Hr deposits 1.86 g of Cu, 1.095 gm of Ni & 1.22 g of Zinc). [6+10]
2. (a) If 5 gm of Ni^{2+} are dissolved in 1000cc of water to act an electrolyte, calculate the Electrode potential of Nickel half cell.
(Assume if any necessary data)
- (b) What is flade potential? Explain how you can decrease the flade potential of metal like Iron to have easy passivation. [8+8]
3. (a) Discuss copper plating from a cyanide bath commenting on the nature of the deposits , advantages and disadvantages of the above bath.
- (b) Explain about combined Polarization.
- (c) Explain about single electrode potential and hall cell potential. [6+5+5]
4. (a) What are the properties required of an electro deposit? Describe the tests for measuring thickness and corrosion resistance of electro deposits.
- (b) What is anodizing? Explain in detail the steps involved in anodizing of aluminium. [9+7]
5. (a) Explain the mechanism of the growth and breakdown of passive films.
- (b) Illustrate the important kinetic factors in determining the corrosion behavior of a metal. [8+8]
6. (a) A widely used measure of corrosion is the weight loss per unit area per unit time. Contrast the usefulness of this measure when applied to uniform. Corrosion and when applied to pitting.

- (b) Differentiate between galvanic corrosion and stress corrosion cracking. Give some examples and remedies. [8+8]
7. (a) How alterations of environment influence corrosion? Explain how the corrosion can be minimized.
- (b) Discuss the various organic & inorganic coatings used for prevention of corrosion. [8+8]
8. (a) How does electrochemical corrosion differ from other types of corrosion? Explain.
- (b) What possible control measures does the mechanism of electrochemical corrosion suggest? Explain them. [8+8]

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1. (a) What are reference electrodes and why are they preferred to standard hydrogen Electrode? Explain the principle of working of calomel Electrode.
(b) Discuss the factors affecting efficiency of Electrode processes. [10+6]
2. (a) Draw a neat figure of standard hydrogen Electrode. Name the various parts in it.
(b) Explain the working principle of standard hydrogen Electrode. [8+8]
3. (a) Explain the effect of
 - i. Current density
 - ii. Metal Ion concentration and
 - iii. Temperatures on deposition of metals(b) Discuss the different types of baths used for plating of copper. Discuss their advantages & limitations. [9+7]
4. Describe in detail the procedure you will adopt to plate chromium on a steel plate. How would you test the thickness, Strength and porosity of electroplated chromium? [16]
5. (a) Explain the significance of the following terms. I_{cr} ; $I_{passive}$; $E_{passive}$ & $E_{transpassive}$.
(b) What is meant by redox potential? Explain how it predicts the corrosion behavior. [8+8]
6. (a) Which metal corrodes in sea water if the following couples are in electrical contact & why?
 - i. Copper and Zinc
 - ii. Zinc and steel
 - iii. Magnesium and lead
 - iv. Copper and iron.(b) What is passivity? Can it be used for protecting the metals from corrosion? Explain [10+6]
7. What are the various methods of applying metallic coatings? Explain all of them in detail. [16]
8. (a) Briefly describe the two techniques that are used for galvanic protection.

- (b) Tins cans are made of a steel the inside of which is coated with a thin layer of tin. The tin protects the steel from corrosion by food products in the same manner as zinc protects steel from atmospheric corrosion. Briefly explain how this cathodic protection of tin can is possible since tin is electrochemically less active than steel in galvanic series. [9+7]

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