INDIAN INSTITUTE OF ENGINEERING SCIENCE & TECHNOLOGY, SHIBPUR

B.E. 4th SEM (Metallurgy Engg.) Final Examination – 2014

Principles of Electrochemistry in Metallurgical Applications
(CH-401)

Time : 2 hours **(F.M. – 35)**

(Answer any FIVE questions)

1.(a) Give account of the mechanism of electroplating.
(b) Describe the factors that affect the quality of electroplating.

[3+4]

2.(a) Explain why a potential difference is created at the metal-solution interface.
(b) Give a schematic representation of the Stern model of the electrode-solution interface and illustrate the potential variation across the interface.

[2+5]

3.(a) How would you express the total capacitance of the electrode-solution interface?
(b) Show that in dilute solution the capacitance is essentially that for the Guoy-Chapman region and in concentrated solution it is for the Helmholtz-Perrin region.

[2+5]

4.(a) Express the half cell reaction for a fuel cell operating in acid medium. What is the function of membrane in a PEMFC?
(b) Explain the role of crystalline structure and inclusion on the oxidation behavior of a metal.

[(2+2) + 3]

5.(a) What is sacrificial anode and describe the role of it in controlling galvanic corrosion of a material.
(b) Illustrate the following variation:
(i) Oxidation rate of a metal with dissolved oxygen concentration and temperature of the environment.
(ii) Oxidation rate of a metal with the relative velocity of the environment.

[3 + (2x2)]

6.(a) Write short note on mixed potential theory.
(b) Write down the final form of 'Butler-Volmer' basic electrodics equation and explain the different terms involved in it. Show that the Tafel equation is a special consequence of Butler–Volmer equation.

[3+ (2+2)]