Registration No:

Total Number of Pages: 02

7th Semester Regular / Back Examination 2015-16
CORROSION AND DEGRADATION OF MATERIALS
BRANCH: MM,MME

Time: 3 Hours
Max Marks: 70
Q.CODE: T648
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1   Answer the following questions: State your answers **True or False** and   **(2 x 10)**
justify it.

   a) A pure metal is more corrosion-resistant than impure ones?

   b) Tin provides galvanic protection to the steel.

   c) Zinc and magnesium will be used to protect a Cu-Al galvanic couple.

   d) Rate controlling for the concentration polarization is not oxidation
reactions.

   e) The presence of chromium in stainless steels protects it from corrosion
while chromium in plain carbon steels corrodes it.

   f) The corrosion rate will be higher for a small anode-to-cathode area
ratio compared to large anode-to-cathode area ratio.

   g) A brass bolt changed its color from yellow to red and became brittle in
acid solution.

   h) In polycrystalline alloys, the grain-boundary region is more chemically
reactive than the grain interior?

   i) The non-stoichiometric metals oxides, oxidize more rapidly than
stoichiometric metals oxides?

   j) The P.B. ratio alone does not determine if an oxide is to be protective.

Q2 Write down the principles of types of corrosion and what are the measures that may be taken to prevent or control it. **(10)**

Q3 a) Show using the E-pH diagram that copper will not corrode in deaerated acid but will corrode in aerated acid, both cases at pH=2. **(5)**

b) What is the galvanic series? Explain the conditions under which it was generated, and their application. **(5)**

Q4 a) A galvanic cell at 25°C consists of an electrode of zinc in a 0.10 M ZnSO, solution and another of nickel in a 0.05 M $NiSO_4$ solution. The two electrodes are separated by a porous wall and connected by an external wire. What is the emf of the cell when a switch between the two electrodes is just closed? $Zn/Zn^{+2}=0.763V$, $Ni/Ni^{+2}=0.25V$. **(5)**

b) State the difference between differences between the corrosion of metals and ceramics. **(5)**

Q5 a) For an iron immersed in sea water, the oxidation and reduction reactions are controlled by activation polarization reduction. Compute the corrosion current density, i_c and rate of corrosion of iron. Given:

$E_{oFe/Fe}{}^{+2}=$ -0.44eV, $i_{oFe}=$ 10^{-6}, $i_{oH}=$ 10^{-8}, $\beta_c =$ -0.10 V and $\beta_a =$ 0.040 V. **(5)**

b) State the difference between Galvanic cell and electrowinning cell. **(5)**

Q6 a) Draw a schematic polarization plot of electrochemical potential versus the logarithm of current density for a metal that exhibits passive behavior. Explain briefly how the metal exhibit both active and passive corrosion behaviors. **(5)**

b) Define current density? Explain briefly with difference between exchange current density and limiting current density. **(5)**

Q7 a) Discuss the mechanism of high temperature degradation by which an oxide layer forms on the surface of a metal. **(5)**

b) Define mixed potential theory? Draw a mixed potential diagram for a metal in an aqueous solution. **(5)**

Q8 Write short notes: **(5 x 2)**
a) Pourbiax diagram.
b) Sacrificial anode
c) Pilling-Bed worth ratio
d) Hydrogen embrittlement