

B.E. (MET) - 7th SEMESTER FINAL EXAMINATION, NOV-DEC, 2012
DEGRADATION OF MATERIALS AND THEIR PREVENTION (MT – 704)

Time: 3 hrs.

Full Marks- 70

Group-A:

(Answer Q. 1 and any three from the rest)

1. Explain why:
 - a) Copper does not corrode in an air-free acid, but corrodes in presence of oxygen.
 - b) Metal dissolution reaction is not affected by concentration polarization.
 - c) Zinc coating is preferred to tin coating for protection of steel.
 - d) Even a stabilized stainless steel can suffer from intergranular corrosion.
 - e) Passivators need to be used above a minimum critical concentration. (2 x 5)

2. (a) Draw the potential-pH diagram of Fe-H₂O system and write down the reactions represented by the lines.
(b) What are the uses and limitations of the diagrams? (7 + 3)

3. (a) How are the role of stress and specificity of environment explained in the mechanism of stress corrosion cracking?
(b) In what ways does corrosion fatigue differ from stress corrosion cracking? (7 + 3)

4. (a) Give examples of n-type and p-type semiconductor metal oxides. Why are they so called?
(b) Discuss the effect of alloying with higher and lower valency metals on the oxidation behaviour of both types of metals. (4 + 6)

5. (a) What is Pilling-Bedworth ratio? Why cannot it sufficiently predict the oxidation resistance of a metal?
(b) Describe the rate laws governing the oxidation of metals with equations and graphical representations. Which type is preferable and why? (4 + 6)

6. Describe briefly the phenomena of:
 - (a) Microbial corrosion
 - (b) Internal oxidation
 - (c) Hot corrosion (4 + 3 + 3)

Group –B:

(Answer any three questions)

7. (a) Describe briefly the types of hydrogen damage observed in metals and alloys, indicating the possible sources of hydrogen.
(b) Explain the techniques used for prevention of hydrogen blistering and hydrogen embrittlement. (5 + 5)

(P.T.O)

8. (a) What is an inhibitor? Classify inhibitors. What are their mechanisms to prevent corrosion?
(b) Name various methods used for applying metallic coatings on steels.

[(1+2+4) + 3]

9. (a) What are the various stages of wear.
(b) Describe briefly the mechanism of formation of adhesive and abrasive wears in materials.

(3 + 7)

- 10.(a) What are the various design considerations one should follow to minimize material degradation due to corrosion.

- (b) Describe briefly the various design rules which should be followed for best corrosion protection.

(3 + 7)

11. Write briefly on (**any three**):

- a) Cathodic protection.
- b) Mechanism of hydrogen embrittlement.
- c) Use of stainless steels as corrosion resistant material.
- d) Metal Cladding.
- e) Vapour phase inhibitor

(10)