

B.E. (Met) 7th Semester Part-IV Final Examination, Nov-Dec 2013
Degradation of Materials and their Prevention (MT-704)

Time: 3 Hours

Full Marks: 70

(Use single answer script for both Group-A and Group-B. Figures in the right hand side margin indicate full marks)

Group-A

Answer any four questions:

1. a) Describe the phenomenon of passivity of metals with the help of polarization diagram.
b) Elaborate the effect of temperature, oxidizer and chloride on passivity. [4+6]
2. a) Describe Tafel extrapolation method of corrosion rate measurement.
b) How is noble metal alloying of titanium effective in drastically decreasing its corrosion rate in acid media? [6+4]
3. a) What is 'weld decay'? What is the cause for its occurrence? What are its preventive measures?
b) In which ways do the microbiological organisms enhance corrosion of steels? [7+3]
4. a) Define 'stress corrosion cracking' and describe its characteristic features.
b) Discuss the proposed principal mechanisms of stress corrosion cracking. [4+6]
5. a) Establish the electrochemical nature of high temperature oxidation of metals.
b) Discuss the effect of alloying with higher and lower valency metals on the oxidation of metals having p-type and n-type semiconductor oxides. [3+7]
6. Describe briefly the phenomena of:
a) Cavitation damage
b) Catastrophic oxidation
c) Corrosion fatigue [3+3+4]

Group-B

Answer any three questions:

7. a) Describe with a neat sketch how an underground tank and/or pipeline are protected from corrosion by cathodic protection method.
b) What is stray current? Explain the effect of stray current on cathodic protection of underground pipeline.
c) What are the basic differences between cathodic and anodic protection methods? [4+3+3]

[P.T.O.]

8. a) Describe various forms in which hydrogen-induced degradation is observed in metals and alloys.
- b) Explain with a neat sketch, the differences between anodic Stress Corrosion Cracking (SCC) and cathodic Hydrogen Embrittlement (HE) in steels. [7+3]
9. a) Discuss briefly the operating variables related to environments which can be suitably modified to reduce corrosion.
- b) What is an inhibitor? Classify inhibitors and explain their mechanisms for prevention of corrosion. [3+7]
10. a) What are the various types of wear normally encountered in metals and alloys?
- b) Describe briefly the mechanism of formation of adhesive wear and abrasive wear. [3+7]
11. Write briefly on (*any three*):
- a) Pilling Bedworth ratio.
- b) Design considerations for corrosion prevention.
- c) Wear resistant materials.
- d) Anodic Protection Method.
- e) Corrosion by galvanic coupling in service. [10]