Ex//MET/ES/H/T/325/2022

BACHELOR OF ETALLURGICAL AND MATERIAL ENGINEERING EXAMINATION, 2022

(3rd Year, 2nd Semester)

SURFACE ENGINEERING AND COATING TECHNOLOGY

Time : Three hours Full Marks : 100

Instruction: Answer question number 1 and any nine questions from the rest

1X10=10

1. i) What is the purpose of surface preparation?

   a) Surface roughening for the mechanical bonding

   b) Removal of dirt, rust and mill scale

   c) Removal of welding flux and other surface impurities

   d) All of the above

ii) What are the classifications of Engineering Materials?

iii) Metallic bondings are

   a) Directional

   b) Obtained in metallic materials

   c) Both a) and b)

   d) Only b)

iv) Which of the following is not a protective coating?

a) Metallic

b) Non metallic

c) Organic

d) Inorganic

v) An example of anodic coating is

a) Zinc

b) Copper

c) Nickel

d) Chromium

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vi) Which common application do anodizing and galvanizing serve?

a) Corrosion resistance

b) Improved surface

c) Zinc coating

d) Increased strength

vii) The stainless steels owe their resistance to corrosion to the presence of

a) Chromium

b) Carbon

c) Sulphur

d) Manganese

e) Nickel

viii) Corrosion is occur due to the presence of Iron and ----------

a) Sulphur

b) Nitrogen

c) Hydrogen

d) Oxygen

ix) What are the different types of Wear which occurs in complex interaction?

x) In brittle crystalline materials, fracture can occur as the result of ---------- stress acting normal to crystallographic planes with low bonding.

2. a) What are the different types of hardness measurement process? Explain one process of them? 1+4=5

   b) What are the different types of friction can be observed on the surface of a material? 5

3. a) Define the lubricity? What are the applications of lubricant? Give example of solid and liquid lubricant. 1+2+2=5

   b) What are the different characteristics by which surface topography can be defined? Why Silver and Gold obtain different color? 3+2=5

4. a) Define the passivation. What are the applications of Ion implantation in metal finishing?
   Write down two differences between chemical vapor depositions (CVD) and Physical vapor deposition (PVD) 1+2+2=5

   b) What is tribology and what are the tribological applications of surface engineering? 1+4=5

5. a) What is the importance of melting and casting process to make a solid material? Write down the three different processes of material processing in equilibrium condition. 2+3=5
   b) How the surface energy and surface tension influence the wettability of surface of a material? How the surface wettability is depend on the contact angle of a solid surface? 3+2=5

6. a) How the light reflection is dependent on the surface topography of material? How the thermionic emission dependent upon the ability to emit electron from the surface of a materials? 2+3=5
   b) Define the photoelectric effect, adhesion and cohesion property of a material. 2+3=5

7. a) Give an example of least reactive metal that cannot be oxidizes in air, even at high temperature. How metal surface can be degraded by oxidation process? Give one example. 1+4=5
   b) Define the catalysis with a suitable example of catalyst What are the applications of catalysts? 1+1+3=5

8. a) How surface can be degraded by wear? Explain any four types of wear of them. 1+4=5
   b) What are the differences between ductile fracture and brittle fracture? How relative humidity can influence the corrosion rate of a material? Give one example. 2+3=5

9. a) Explain the corrosion rate of steel in water as a function of water. What are the different ways to control the uniform corrosion of a material? 3+2=5
   b) How metal surface corroded by galvanic corrosion? How it can be prevented? 3+2=5

10. a) What are the factors that can affects the crevice corrosion of materials? What are the different ways to prevent the crevice corrosion? 3+2=5
    b) What is the importance pitting factor to evaluate the pitting corrosion of a material? AISI 304 stainless steel subjected to the arc welding, why corrosion rate is faster in heat affected zone as compare to the welded zone? 2+3=5

11. a) Explain the stress corrosion cracking. What is stress intensity factor? 3+2=5
    b) What is the kinetics of oxidation? Explain the properties and applications of two metallic elements used for metallic coating. 3+2=5