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Question Paper Code: R1704

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2024

First Semester

Mechanical Engineering

R21UME204 - ENGINEERING MATERIALS AND METALLURGY

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- Alloys containing 2.0-6.7% carbon are considered as _____ CO1-U
(a) Steel (b) Cast-iron (c) Aluminum (d) Brass
- The existence of two or more crystal structures for any substance, depending on temperature, is known as _____. CO1-U
(a) Allotropy (b) Solidification (c) Solubility (d) Interstices
- Which of the following is not a stage of annealing? CO2-U
(a) Heating (b) Soaking (c) Tempering (d) Quenching
- Normalising is best used for is what kind of materials? CO2-U
(a) Steel castings (b) Steel wires
(c) High carbon steels (d) Low and medium carbon steels
- Slow plastic deformation of metals under a constant stress is known as CO3-U
(a) Creep (b) Fatigue (c) Gradual deformation (d) Endurance limit
- What kind of indenter is used in a Brinell test? CO3-U
(a) Diamond cone (b) Steel ball (c) Pen dot (d) Long tube
- Wear resistance of an alloy steel can be improved by adding CO4-U
(a) Tungsten (b) Vanadium (c) Manganese (d) Titanium
- Which of the following material is used for energy storage device (battery)? CO4-U
(a) Steel (b) Cast iron (c) Nickel (d) Aluminium

9. A polymer having rubber-like properties is known as _____ CO5-U
 (a) Thermoset (b) Thermoplastic (c) Elastomer (d) Polyisoprene
10. Alumina is a CO5-U
 (a) ceramic (b) Ferrous metal (c) Non-ferrous (d) alloy

PART – B (5 x 2= 10 Marks)

11. Explain equilibrium diagram. CO1-U
12. Explain the term heat treatment. CO2-U
13. Explain the purpose of conducting an impact test? CO3-U
14. Explain HSLA steels. CO4-U
15. Explain the term polymer? CO5-U

PART – C (5 x 16= 80Marks)

16. (a) Classify Iron-Iron carbide diagram and compare cast iron and steel and also distinguish cementite, ferrite and pearlite. CO1-U (16)
 Or
 (b) Distinguish the solid solution and compare substitutional and interstitial solid solution. CO1-U (16)
17. (a) Illustrate the process details of full annealing and spheroidising treatments for steels. Explain the microstructure and need for these treatments. CO2-U (16)
 Or
 (b) Choose suitable case hardening process for automobile engine components and explain the tempering and induction hardening processes. CO2-U (16)
18. (a) Explain the Izod test and Charpy test to determine the impact strength of a material. CO3-U (16)
 Or
 (b) Identify fatigue testing and methods for improving fatigue strength of the components. Draw the S-N curve for aluminum and Steel CO3-U (16)
19. (a) Describe the microstructure and properties of different types of steel. Explain how these properties influence their applications. CO4-U (16)
 Or
 (b) Discuss the composition properties and typical application of any four copper alloys? CO4-U (16)

20. (a) Explain the polymerization and its various types of polymers, CO5-U (16)
properties of polymers.

Or

(b) Discuss about the manufacturing methods for fibre reinforced CO5-U (16)
plastics (FRP)?

