

B.E. DEGREE EXAMINATIONS: APRIL / MAY 2009

Third Semester

MECHATRONICS ENGINEERING

U07MH 301 Engineering Materials and Metallurgy

Time: Three hours

Maximum Marks: 100

Answer ALL the Questions:-

PART A (20 x 1 = 20 Marks)

1. For a steel containing 0.8% carbon
 - A) There is no critical point
 - B) There is only one critical point
 - C) There are two critical points
 - D) There can be any number of critical points

2. Eutectoid reactions occur at
 - A) 600°C
 - B) 723°C
 - C) 1147°C
 - D) 1493°C

3. Any cooling rate equal or faster than the critical cooling rate (CCR) will only form
 - A) Bainite structure
 - B) Ferrite structure
 - C) Martensite structure
 - D) Pearlite structure

4. The smallest part of a compound that still retain the properties of the compound is
 - A) Crystalline structure
 - B) Molecule
 - C) Element
 - D) Mixture

5. Cold working is the plastic deformation done
 - A) above recrystallisation temperature but below melting point
 - B) above recrystallisation temperature & above melting point
 - C) below recrystallisation temperature
 - D) At 1150 °C

6. The temperature required for full annealing in hyper eutectoid steels is
 - A) 30-50 ° C above upper critical temperature
 - B) 30-50° C below upper critical temperature
 - C) 30-50° C above lower critical temperature
 - D) 30-50° C below lower critical temperature

7. The process which improves the machinability of steels, but lowers the hardness and tensile strength is
 - A) Normalizing
 - B) Full annealing
 - C) Process annealing
 - D) Spheroidising

8. In full annealing, the hypo-eutectoid steel is heated from 30-50 C above the upper critical temperature and then cooled.
 - A) In still air
 - B) Slowly in the furnace
 - C) Suddenly in a suitable cooling medium
 - D) Slowly in suitable cooling medium

9. Cast is having a property of
 - A) High tensile strength
 - B) Brittle end hence cannot be used in machine parts
 - C) Brittle but used in machine parts
 - D) Having malleability and ductility

10. In PH alloys precipitation hardening is achieved by adding elements such as
 A) Cobalt or nickel
 B) Titanium, aluminum or copper
 C) Molybdenum or tungsten
 D) Silicon or carbon
11. The following are $\alpha+\beta$ 1 brasses
 A) Yellow brass and cartridge brass
 B) Admiralty brass and Aluminum brass
 C) Forging brass and free cutting brass
 D) Red brass and manganese brass
12. High speed steels (HSS) contains mainly the alloying element such as
 A) Tungsten, cobalt, vanadium or molybdenum
 B) Aluminum, copper, chromium or nickel
 C) Sulphur, phosphorous, silicon or graphite carbon
 D) All the above.
13. The Thermosetting matrix materials present in FRP materials are
 A) Epoxy resin
 B) Phenolic resins
 C) Polyester resins
 D) All the above
14. The chemical used in salt glazing is
 A) MgSo4
 B) CaCl2
 C) Nacl
 D) NiSo4
15. Thermosetting plastic polymers are made of
 A) Ionic bond
 B) Covalent bond backbone & weak Vander Val's forces
 C) Covalent bond backbone and cross covalent bonds
 D) Covalent bond backbone only
16. Transformation Toughened alumina Material (TTM) is generally made by blending
 A) Zirconium and Alumina
 B) Silicon carbide and Alumina
 C) Alumina and calcium oxide
 D) Alumina and Nickel oxide
17. Which of the following test is an performed to determine endurance strength and limit of a metal?
 A) Impact test
 B) Hardness test
 C) Tensile test
 D) Fatigue test
18. Compression strength gives detail regarding
 A) Horse power
 B) Elastic property
 C) Plastic property
 D) Cracking tendency
19. Castability is also called as
 A) Mouldability
 B) Fuseability
 C) Weldability
 D) Workability
20. In rockwell hardness testing,
 A) The indenter is an iron ball
 B) The indenter is a diamond of a square based pyramid
 C) The indenter is a diamond cone
 D) The indenter is a cylindrical rod

PART B (5 x 16 = 80 Marks)

21. (a) What are the different types of solid solutions. Give a detailed explanation.

(OR)

21. (b) Draw iron- iron carbide equilibrium diagram. Explain the various phase transformation with neat sketch.

22. (a) Draw the neat sketch of the TTT diagram for a eutectoid steel and label the regions. Mark the products formed on this diagram.

(OR)

22. (b) (i) Describe the normalizing process of heat treatment. (10)

(ii) Differentiate between normalizing and full annealing. (6)

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23. (a) (i) What are the main classification of stain less steel? (6)

(ii) Compare grey and malleable cast irons with respect to micro structure and mechanical characteristics. (10)

(OR)

23. (b) (i) What are the necessary metallurgical characteristics required in a good bearing metal? (6)

(ii) Compare and contrast lead-base, tin-base, copper-base and aluminum-base bearing alloys. (10)

24. (a) (i) What do you understand by polymerization? With the help of suitable examples, compare and contrast the process of addition polymerization and condensation polymerization.

(OR)

24. (b) (i) Explain the strengthening mechanism of fibre- reinforced composites. (10)

(ii) List the advantages, limitations, and applications of composite materials. (6)

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25. (a) (i) Explain the two modes of plastic deformation in metals with neat sketches.

(OR)

(b) (i) Describe a brinell hardness test to determine the hardness of a metal. (8)

(ii) Discuss any two mechanism of creep fracture. (8)

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