Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80231

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third/Fourth Semester

Mechanical Engineering

ME 8491 — ENGINEERING METALLURGY

(Common to Automobile Engineering/Manufacturing Engineering/Mechanical and Automation Engineering/Production Engineering)

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate an alloy from pure metal.

2. State the reaction that initiates the formation of Austenite in iron-iron carbon diagram.

3. Define hardenability of a material.

4. Why is the full annealing of a steel component performed?

5. List two important types of fracture.

6. What is the prominent mechanism of plastic deformation in metals and define it?

7. List the major alloying elements of the aluminium alloys 6061 and 7075.

8. Cite two reasons for the extensive usage of ferrous alloys in engineering applications.

9. List two important engineering ceramics used in the high temperature applications.

10. Why is the use of composites increasing over metallic alloys in aerospace industries?

STUCOR APP

PART B — (5 × 13 = 65 marks)

11. (a) State what is a solid solution in alloys and with the help of neat sketches explain the isomorphous, eutectic, eutectoid, peritectic and peritectoid reaction of alloys.

Or

(b) With the help of a neat sketch of a Iron-carbon diagram for steel, explain the various phases in the iron-carbon phase diagram.

12. (a) Though the polymers are neither as strong nor as stiff as metals, why are they used largely in engineering applications? Explain in detail the property and application of any five commonly used Engineering Polymers.

Or

(b) Explain in detail various types of composites.

13. (a) A gears surface should resist wear and tear, but the core material remains soft to withstand the shock loads. Explain in detail the various types of heat treatment process suitable to get such a property in the gear.

Or

(b) What will be the resultant microstructure and hardness of a 0.76% carbon steel which is heated to approximately 800°C followed by air cooling, furnace cooling, oil quenching and water quenching?

14. (a) Sketch the microstructure in different types of cast iron and explain in detail how the affects the property of cast iron.

Or

(b) Explain in detail the effect of major alloying element in copper alloys, state the name, properties and applications of those alloys formed.

15. (a) Draw neatly the stress-strain diagram of a ductile material and discuss the salient mechanical properties and features of the curve along with their physical significance.

Or

(b) Define fatigue and discuss briefly the steps involved in the construction of a S-N curve.

STUCOR APP

PART C — (1 × 15 = 15 marks)

16. (a) From the tensile stress-strain behavior for the plain carbon steel alloy shown in figure, determine the following:

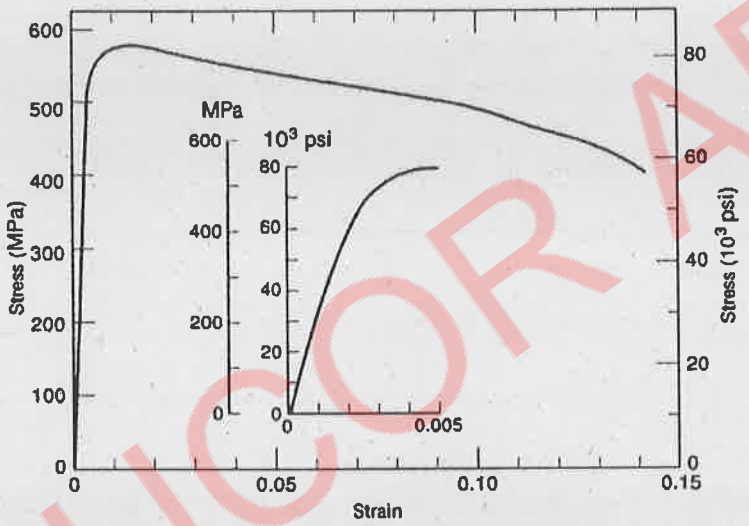
(i) The modulus of elasticity.

(ii) The ultimate tensile strength

(iii) The yield strength at a strain offset of 0.002.

(iv) The maximum load that can be sustained by a cylindrical specimen having an original diameter of 10 mm.

(v) The change in length of a specimen originally 250 mm long that is subjected to a tensile stress of 300 MPa.



Or

(b) Rank the following iron-carbon alloys and associated microstructures from the highest to the lowest tensile strength:

(i) 0.3 wt%C with spheroidite

(ii) 0.3 wt%C with coarse pearlite

(iii) 0.65 wt%C with fine pearlite

(iv) 0.65 wt%C with coarse pearlite

(v) 0.20 wt%C with spheroidite

Justify this ranking.

STUCOR APP

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 90361

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2019
Third/Fourth Semester
Mechanical Engineering
ME 8491 – ENGINEERING METALLURGY
(Common to Automobile Engineering/Manufacturing Engineering/Mechanical and Automation Engineering/Production Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Why are metal phase diagrams known as equilibrium phase diagrams ?
2. Classify steel based on its microstructure.
3. Stress relief annealing is an important Heat treatment process for engineering components-Comment.
4. How is Austempering differ from Martempering heat treatment process ?
5. What is the effect of addition of Manganese in steel ?
6. List the characteristics of Duralumin alloy.
7. Composite materials are replacing metallic materials in many engineering applications-comment.
8. List the characteristics of PMMA polymers and its advantageous over other transparent polymers.
9. Mention the various factors that affect the fatigue strength of material.
10. What do you mean by Ductile to Brittle Transition Temperature ?

STUCOR APP

PART – B (5×13=65 Marks)

11. a) Explain the factors that affect the formation of substitutional solid solution.

(OR)

b) Draw a neat sketch of Iron-Carbon Equilibrium diagram and label the various phase fields. Also explain the various invariant reactions.

12. a) Explain the various phase transformations that occur during tempering to achieve an optimum combination of strength and toughness.

(OR)

b) i) Why post carburizing heat treatment is necessary for case hardened parts ? (3)

ii) Discuss the three main types of carburising processes with the chemical reactions. (10)

13. a) How are Cast irons classified based on the fractured surface and phase constituents ? Explain its characteristics and microstructure.

(OR)

b) Write down the composition, properties and applications of the following:

i) Cupronickel (5)

ii) Nickel silver (4)

iii) Alpha Titanium alloy. (4)

14. a) i) Enumerate the parameters and conditions of the polymer molecular structure that affect the tribological characteristics of polymers. (4)

ii) Discuss the classifications of engineering polymer and explain its properties and application. (3×3=9)

(OR)

b) i) How are composites classified based on the forms of reinforcement ? (3)

ii) Discuss in detail the different forms of reinforcement. (10)

15. a) Explain the mechanisms of plastic deformation.

(OR)

b) i) Define fatigue. Why is this property important for materials with fluctuating load ? (3)

ii) Draw a typical SN curve and explain. (10)

PART – C (1×15=15 Marks)

16. a) Construct the hypothetical phase diagram for metals A and B between temperatures 600°C and 1000°C and explain the various phase fields. Given are the following information.

- The melting temperature of metal A is 940° C.
- The solubility of B in A is negligible at all temperatures.
- The melting temperature of metal B is 830° C.
- The maximum solubility of A in B is 12 wt% A, which occurs at 700° C.
- At 600°C, the solubility of A in B is 8 wt% A.
- One eutectic occurs at 700°C and 75wt% B-25 wt% A.
- A second eutectic occurs at 730°C and 60 wt% B-40 wt% A.
- A third eutectic occurs at 755°C and 40 wt% B-60 wt% A.
- One congruent melting point occurs at 780°C and 51 wt% B-49 wt% A.
- A second congruent melting point occurs at 755°C and 67 wt% B-33 wt%
- The intermetallic compound AB exists at 51 wt% B-49 wt% A.
- The intermetallic compound AB_2 exists at 67 wt% B-33 wt% A.

(OR)

b) i) Enumerate the methods that are used to obtain good surface hardness and impact resistance of the core ? (3)

ii) Suggest a suitable heat treatment for an alloy steel containing nitride forming element to get good surface hardness and explain the process. (12)

STUCOR APP

STUCOR APP

Reg. No. :

Question Paper Code : X10697

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020 AND APRIL/MAY 2021
Third/Fourth Semester
Mechanical Engineering
ME 8491 – ENGINEERING METALLURGY
(Common to Automobile Engineering/Manufacturing Engineering/Mechanical and Automation Engineering/Production Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What is the application of lever rule in phase diagram ?
2. What are the solid state analogue of the eutectic and peritectic reactions ?
3. What is martensite ? What are the two different morphologies of martensite ?
4. What is the use of time-temperature transformation (T-T-T) curves ?
5. From the galvanic series, cite three metals or alloys that may be used to galvanically protect nickel in the active state.
6. The thermal conductivity of a plain carbon steel is greater than for a stainless steel. Why is this so ?
7. How are fibers classified based on the diameter and the character ?
8. How will the crystallinity of a polymer be affected by the addition of a plasticizer ?
9. What are the factors that affect the Critical Shear Stress ?
10. What are Neumann bands ? How are they formed ?

STUCOR APP

PART – B **(5×13=65 Marks)**

11. a) i) What are the various allotropic forms of Pure iron ? Explain them with a neat cooling curve diagram. **(8)**

ii) Explain in detail the different micro-constituents of Fe-C system. **(5)**

(OR)

b) i) What is the effect of carbon percentage on the properties of steel ? Explain. **(5)**

ii) Classify steels based on carbon content and discuss on the properties and applications of the various types of steels. **(8)**

12. a) i) List down the objectives of Heat treatment. **(5)**

ii) What are the changes that take place at various temperatures during tempering ? Explain. **(8)**

(OR)

b) Compare and discuss on the different surface hardening processes.

13. a) What is a White Cast iron ? How is Malleable Cast iron produced from White cast iron ?

(OR)

b) Discuss on the various Aluminium and its alloys and their importance in engineering industry.

14. a) Briefly explain on the following :

i) Ultrahigh molecular weight polyethylene. **(6)**

ii) Liquid Crystal Polymers. **(7)**

(OR)

b) A continuous and aligned glass fiber-reinforced composite consists of 40 vol% of glass fibers having a modulus of elasticity of 69 GPa and 60 vol% of a polyester resin that, when hardened, displays a modulus of 3.4 GPa.

i) Compute the modulus of elasticity of this composite in the longitudinal direction.

ii) If the cross-sectional area is 250 mm^2 and a stress of 50 MPa is applied in this longitudinal direction, compute the magnitude of the load carried by each of the fiber and matrix phases.

iii) Determine the strain that is sustained by each phase when the stress in part (b) is applied.

15. a) Discuss in detail the two mechanisms of Plastic Deformation of a single crystal.

(OR)

b) Discuss in detail the various factors that affect the mechanical properties of materials.

PART – C **(1×15=15 Marks)**

16. a) Discuss in detail the heat treatment process involved to negotiate the effects of cold working in a material.

(OR)

b) Creep is extremely structure sensitive. Discuss on the factors that affect the creep and also throw some light on the mechanism of creep.

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STUCOR APP

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 20854

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Third / Fourth Semester

Mechanical Engineering

ME 8491 – ENGINEERING METALLURGY

(Common to : Automobile Engineering / Manufacturing Engineering / Mechanical and Automation Engineering / Production Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by equilibrium phase diagram?

2. Distinguish between substitutional and interstitial solid solution.

3. What is the purpose of spheroidising treatment?

4. Which hardening treatment yield large case depth, plasma hardening or induction hardening? Why?

5. List any two types of cast iron and their applications.

6. What is precipitation strengthening?

7. What is the unique property of PSZ?

8. State the fundamental differences between Phenol formaldehydes and Polystyrene.

9. Distinguish between Rockwell hardness test and Brinell hardness test.

10. Define a slip system.

STUCOR APP

PART B — (5 × 13 = 65 marks)

11. (a) Draw an eutectic phase diagram and name the various zones. Explain the microstructure evolution for a hypoeutectic, eutectic and hypereutectic composition.

Or

(b) Classify steel and brief on the properties and applications of any TWO types.

12. (a) Based on time-temperature-transformation (TTT) diagram, brief on austempering and martempering process.

Or

(b) Discuss on hardenability evaluation from Jominy end quench test.

13. (a) Classify copper alloys and state their properties and typical applications.

Or

(b) Classify tool steels and state their properties and typical applications.

14. (a) List the properties and applications of any six types of polymers.

Or

(b) (i) List the properties and applications of SiC and Al_2O_3.

(ii) Classify composites and give an example for each kind.

15. (a) Discuss on the failure mechanism of fatigue.

Or

(b) Draw the stress-strain curve and explain the various parameters and properties.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Suggest a type of alloy: cast alloy, heat treatable and wrought alloy, suitable for light weight structural application. Justify. (5)

(ii) Suggest material(s) for exhaust of diesel engine. (5)

(iii) Which types of testing are recommended for milling cutting tool development? Justify. (5)

Or

STUCOR APP

(b) (i) Suggest a type of heat treatment: annealing, normalizing and stress relieving , suitable for cold working operation. Justify. (5)

(ii) Suggest material(s) for marine structures. (5)

(iii) Which types of testing are recommended for helmets? Justify. (5)

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