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

Question Paper Code : 20809

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third/Fourth Semester

Mechanical Engineering

ME 6403 — ENGINEERING MATERIALS AND METALLURGY

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

(Regulations 2013)

(Alco Common to PTME 6403 – Engineering Materials and Metallurgy for
B.E. (Part-Time) Third Semester – Mechanical Engineering (Regulations – 2014))

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw a typical phase diagram of Isomorphous alloy system.

2. Write a typical peritectoid reaction.

3. What is the difference between stress relief and recrystallisation?

4. What makes nitriding different from rest of case hardening process, besides composition?

5. What is the difference between malleable and spheroidal cast iron?

6. What are the characteristics of a super alloy?

7. What are outstanding properties of PSZ?

8. List the typical applications of PTFE.

9. What are the characteristic features of ductile fracture surface?

10. Under what condition, twinning is the preferred mechanism of plastic deformation?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Draw Iron-Iron carbide phase diagram, name the various field, line and reactions. (10)

(ii) Draw the room temperature microstructure of eutectiod steel. (3)

Or

(b) (i) Discuss on substitutional solid solution with an example. (10)

(ii) What type of solid solution is Fe-C, interstitial or substitutional? Where does C atoms occupies in Ferrite? (3)

12. (a) Brief on various phase transformation with continuous cooling transformation diagram super imposed on Time-Temperature-Transformation (TTT) diagrams.

Or

(b) (i) Brief on Jominy end quench test and interpretation of results. (9)

(ii) Brief on the tempering process. (4)

13. (a) (i) Brief on the influence of alloying elements : Co, Ni, Mo and V. (4)

(ii) List the types and their typical applications of Tool steel. (9)

Or

(b) Brief on the precipitation hardening and ageing treatment of Al-Cu alloy.

14. (a) Classify composite materials and list properties and application of FRP and Metal Matrix.

Or

(b) (i) Classify engineering ceramics and list properties and applications of SiC and Si_3N_4. (5)

(ii) Brief on properties and applications of any TWO polymers from the list : PTFE, PC, PET, ABS and PS. (8)

15. (a) (i) Compare Charpy and Izod Impact test. (4)

(ii) Draw a typical creep curve and brief on the mechanism. (9)

Or

(b) (i) Compare Rockwell and Brinell hardness test. (4)

(ii) Draw a typical S-N curve of fatigue testing and brief on the mechanism. (9)

PART C — (1 × 15 = 15 marks)

16. What is the material choice, type of processing, microstructure and mechanical properties, of any Three sub components of a typical lathe machine?

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Question Paper Code : 80658

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Third Semester

Manufacturing Engineering

ME 6403 — ENGINEERING MATERIALS AND METALLURGY

(Common to Fourth Semester Automobile Engineering, Mechanical and Automation Engineering and Mechanical Engineering)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the term solid solutions.
2. How will you classify steels?
3. When will you prefer annealing?
4. Define the term Cementite.
5. List the important properties of HSLA.
6. What are Bronzes? List the uses of Bronzes.
7. Define the term degree of polymerization.
8. State any four applications of Bakelite.
9. Define the term Fatigue.
10. List any four mechanical testing methods of metals.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the various micro constituents present in steel. (8)

(ii) With a neat sketch, label the reactions of $Fe - Fe_3C$ diagram. (5)

Or

(b) (i) Discuss the classification of cast iron and draw its microstructure. (9)

(ii) State the properties and applications of plain carbon steel. (4)

12. (a) (i) Distinguish between annealing and tempering. (4)

(ii) Explain in detail the flame and induction hardening with neat sketches. (9)

Or

(b) Explain the principle and procedure of Jominy end quench test with a diagram. Also sketch the graph hardness Vs distance from quenched end. (13)

13. (a) (i) With a neat sketch, explain precipitations hardening. (8)

(ii) State the compositions, properties and uses of bearing alloys. (5)

Or

(b) Write short notes on the following :

(i) Maraging steels (4)

(ii) SS (5)

(iii) HSS. (4)

14. (a) Explain the following.

(i) Engineering ceramics. (5)

(ii) Formaldehydes (4)

(iii) PMMA. (4)

Or

(b) (i) Explain the Engineering polymers in detail. (7)

(ii) State the properties and uses of reinforced composites. (6)

15. (a) (i) What are the different hardness tests performed in metallic natural? Specify the indenter and hardness measurement scale of the same. (4)

(ii) Explain the procedure of tensile test for metals. (9)

Or

(b) (i) Explain the mechanism of plastic deformation with suitable illustrations. (8)

(ii) Discuss about the creep test with a typical creep curve. (5)

PART C — (1 × 15 = 15 marks)

16. (a) Discuss the effects and characteristics of alloying elements in steel. (15)

Or

(b) Name the suitable alloys, polymers and ceramics for manufacturing the following items. (15)

(i) Bush

(ii) Furnaces heating element

(iii) Lathe bed

(iv) Coins

(v) Girders for Airship

(vi) Big end bearing

(vii) Turbine blades

(viii) Conduit pipes

(ix) Knobs

(x) Windshields

(xi) Touch screens

(xii) Furnace linings

(xiii) Grinding (abrasive) wheels

(xiv) Coatings on cutting inserts

(xv) Cutting inserts for ferrous alloys.

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

Question Paper Code : 50863

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Third/Fourth Semester
Mechanical Engineering
ME 6403 – ENGINEERING MATERIALS AND METALLURGY
(Common to Automobile Engineering/Manufacturing Engineering/Mechanical and Automation Engineering)
(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A

(10×2=20 Marks)

1. Draw a typical isomorphous phase diagram.
2. Why carbon content in austenite is higher than ferrite ?
3. What is difference between stress relief and recrystallization heat treatment process ?
4. Which has higher critical cooling rate: eutectoid steel or hypereutectoid steel ? Justify.
5. Which type of stainless steel is non magnetic ?
6. What is the role of boron in steel alloying ?
7. What are outstanding properties of PTFE ?
8. List the typical applications of SiC.
9. What are the characteristic features of brittle fracture ?
10. State hardness whether corresponds to ultimate tensile strength or yield

PART – B (5×13=65 Marks)

11. a) i) Draw Iron-Iron carbide phase diagram, name the various field, line and reactions. (10)

ii) Find the wt. fraction of ferrite and cementite of eutectoid steel. (3)

(OR)

b) Compare the microstructure and properties of various cast iron.

12. a) Brief on hardening and tempering of steel.

(OR)

b) Compare different types of case hardening process.

13. a) Brief on the influence of alloying elements in steel under classification of α and γ stabilisers.

(OR)

b) i) What are the classification of aluminium alloys and state the applications of any THREE alloy. (7)

ii) Brief on the mechanism of ageing treatment of Al-Cu alloy. (6)

14. a) i) Classify composite materials based on the type of reinforcement and state an example of each. (7)

ii) State the properties and applications of two ceramics from the list : PSZ, Si_3N_4, Al_2O_3 and SIALON. (6)

(OR)

b) i) List properties and applications of any three type of ceramics. (7)

ii) Brief on properties and applications of any two polymers from the list.

PP, PC, PEEK, ABS and PS. (6)

15. a) i) Compare slip and twinning. (4)

ii) Draw a typical creep curve and brief on the mechanism. (9)

(OR)

b) i) Draw a typical tensile test curve of metallic sample, mark the different points/ regions that represent different mechanical properties. (4)

ii) Draw a typical S-N curve of fatigue testing and brief on the mechanism. (9)

PART – C (1×15=15 Marks)

16. a) i) Explain why certain alloys are heat treatable, some are castable and other wrought ? (8)

ii) Suggest an material of choice for application as orthopaedic implant (or) brake drum of automobile. Justify your choice, based on the properties of materials and method of production. (7)

(OR)

b) Compare and contrast Brinell, Vickers and Rockwell hardness test technique, advantages and disadvantages. 15

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Question Paper Code : 41394

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Third/Fourth Semester
Mechanical Engineering
ME 6403 – ENGINEERING MATERIALS AND METALLURGY
(Common to Automobile Engineering, Manufacturing Engineering and Mechanical and Automation Engineering)
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL the questions.

PART – A **(10×2=20 Marks)**

1. What is an equilibrium phase diagram ?
2. Define Cementite and Pearlite in Fe-C alloys.
3. What are the needs of annealing process ?
4. What are the factors should be considered while selecting a quenching medium ?
5. What are three primary groups of plain carbon steels ?
6. What is meant by precipitation hardening ?
7. Distinguish between thermoplastics and thermosetting plastics.
8. What is meant by PSZ ?
9. Differentiate between Brittle and ductile fracture.
10. What are the factors affecting fatigue ?

PART – B (5×13=65 Marks)

11. a) Draw the Iron-Carbon equilibrium phase diagram and discuss the different phases that takes place in it. (13)

(OR)

b) Discuss the classification, properties and application of steel. (13)

12. a) What is hardenability ? Describe a test that is used for determination of hardenability of steel. (13)

(OR)

b) What is case hardening ? Explain in details the carburizing processes. (13)

13. a) Write a short notes on :

i) HSLA steel
ii) Maraging steel
iii) Stainless steel. (5+4+4)

(OR)

b) Discuss the characteristics of copper and its alloys, their properties and applications. (13)

14. a) Explain the properties and applications of the following polymer materials.

i) Polystyrene
ii) Polyethylene
iii) Polypropylene. (5+4+4)

(OR)

b) How engineering ceramics are classified ? Explain their properties and applications. (13)

15. a) Explain testing procedure for Rockwell hardness test. (13)

(OR)

b) Explain the testing procedure of Tensile Test of Material. (13)

PART – C (1×15=15 Marks)

16. a) What type of failure is occurring when a circular rod is subjected to a constant load at high temperature ? Explain the testing procedure. (15)

(OR)

b) What are the different types of cast irons ? Explain with neat sketch of the microstructure of any four types of cast irons. Give application for each. (15)

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Question Paper Code : 57553

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fourth Semester

Mechanical Engineering

ME 6403 – ENGINEERING MATERIALS AND METALLURGY

(Common to Automobile Engineering, Mechanical and Automation Engineering and also common to Third Semester Manufacturing Engineering)

(Regulations 2013)

Maximum : 100 Marks

Time : Three Hours

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. State Gibbs phase rule.
2. Give the typical eutectic and eutectoid reactions.
3. What is austempering ?
4. Name any two shallow hardening processes.
5. Give the effects of Silicon on steel.
6. What are bearing alloys ? Give an example.
7. What is polymerization ?
8. State the advantages of fiber reinforced composites.
9. List the applications of engineering ceramics.
10. Distinguish between elasticity and plasticity.

PART – B (5 × 16 = 80 Marks)

11. (a) Explain with a neat sketch of iron-iron carbide equilibrium diagram and indicate all the phases. Also write the three important invariant reactions. (16)

OR

(b) Explain the various classification of steels and Cast Iron with microstructure, properties and applications. (16)

12. (a) What is hardenability ? How is Jominy end quench test used to measure hardenability ? (16)

OR

(b) Explain TTT diagram with neat sketch and indicate all the phases with microstructure. (16)

13. (a) Discuss the properties and the applications of the following :
(i) Tool steels (ii) HSLA (8 + 8)

OR

(b) Explain age hardening of Al-Cu with the help of phase diagram. (16)

14. (a) What is polymerization ? Explain addition polymerization and condensation polymerization with examples. (16)

OR

(b) What is strengthening mechanism ? Explain the strengthening mechanism of fiber-reinforced composites. (16)

15. (a) Define hardness. Explain Brinell and Rockwell hardness test with neat sketches. (16)

OR

(b) Explain the mechanism of plastic deformation by slip and twinning with neat sketches. (16)

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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?

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.

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:

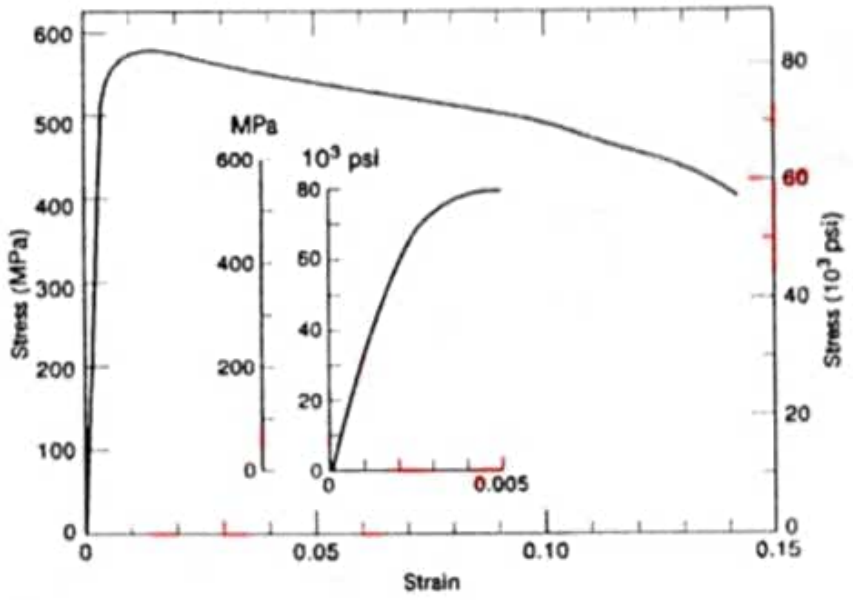
(i) The modulus of elasticity.

(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.

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 ?

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)**

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 ?

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.

ME 3392 – ENGINEERING MATERIALS AND METALLURGY

(Common to: Mechanical Engineering/Mechanical Engineering (Sandwich and Mechanical and Automation Engineering)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Calculate the relative amount of ferrite and cementite in steel containing 0.8%.

2. In the pure water pressure-temperature phase diagram, name the phases that are in equilibrium: (a) along the fusion curve, (b) along the vapourization curve and (c) at the triple point.

3. Why are ferritic and austenitic stainless steels not heat treatable?

4. Why heat treatment is done on engineering materials?

5. Suggest a suitable metal or alloy for high-temperature furnace elements to be used in oxidizing atmospheres.

6. Write down the differences between 'Invar' and 'Elinvar'.

7. Enumerate the factors that affect the crystallinity of the polymers.

8. PZT are considered superior to $BaTiO_3$ piezoelectric materials. Give reasons.

9. How does the dislocation influence the yield strength of a material?

10. What is the effect of grain size on the creep strength of a material?

PART B — (5 × 13 = 65 marks)

11. (a) Draw the steel region of the Fe- Fe_3C phase diagram and make neat sketches of the microstructures expected for 4 compositions between 0.1 % and 1.2 % C.

Or

(b) What are solid solutions? Explain with neat sketches the types of solid solutions.

12. (a) Draw and explain the CCT diagram of eutectoid steel. In what way it differs from the TTT diagram of eutectoid steel?

Or

(b) Explain the following heat treatments with neat thermal cycle diagrams:

(i) Austempering (6)

(ii) Carburising (7)

13. (a) Compare gray and malleable cast irons with respect to

(i) composition and heat treatment (4)

(ii) microstructure (3)

(iii) mechanical characteristics (3)

(iv) applications (3)

Or

(b) Write down the differences between phosphor bronze and aluminium bronze with respect to composition, properties and application.

14. (a) (i) Differentiate between addition polymerisation and condensation polymerization. (7)

(ii) Write the properties, structure and applications of any two polymers. (6)

Or

(b) (i) Make comparisons of thermoplastic and thermosetting polymers on the basis of mechanical characteristics upon heating and according to possible molecular structure. (6)

(ii) Discuss the applications of composite materials. (7)

15. (a) What is Creep? Describe the different stages of a Creep curve with a neat sketch.

Or

(b) (i) What are the sources of residual stresses? Explain briefly the various ways by which the residual stresses can be eliminated. (8)

(ii) Distinguish between dendrite, columnar and equiaxed grains. (5)

PART C — (1 × 15 = 15 marks)

16. (a) Construct the hypothetical phase diagram for metals A and B between room temperature (20° C) and 700° C. Given are the following information. And Explain the various invariant reactions.

(i) The melting temperature of metal A is 480°C.

(ii) The maximum solubility of B in A is 4 wt% B, which occurs at 420°C.

(iii) The solubility of B in A at room temperature is 0 wt% B.

(iv) One eutectic occurs at 420°C and 18 wt% B-82 wt% A.

(v) A second eutectic occurs at 475°C and 42 wt% B-58 wt% A.

(vi) The intermetallic compound AB exists at a composition of 30 wt% B -70 wt% A, and melts congruently at 525°C.

(vii) The melting temperature of metal B is 600°C.

(viii) The maximum solubility of A in B is 13 wt % A, which occurs at 475° C.

(ix) The solubility of A in B at room temperature is 3 wt % A.

Or

(b) Below is a list of metals and alloys: (5 × 3 = 15)

Plain carbon steel, Nickel Metal Hydride, Magnesium, Duralumin, Brass, Zinc, Gray cast iron, Tool steel, Aluminum, Stainless steel, Tungsten and Titanium alloy. Select from this list any 5 metal or alloy that is best suited for each of the following applications and cite two reason for your choice:

(i) The block of an internal combustion engine

(ii) Condensing heat exchanger for steam

(iii) Jet engine turbofan blades

(iv) Drill bit

(v) Cryogenic (i.e., very low temperature) container.

ME 3392 – ENGINEERING MATERIALS AND METALLURGY

(Common to : Mechanical Engineering/Mechanical Engineering (Sandwich)/ Mechanical and Automation Engineering)

(Regulations – 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between substitutional and interstitial solid solution.

2. What is an equilibrium phase diagram?

3. List the different types of annealing.

4. What is the significance of TTT diagram in the heat treatment of steel?

5. List four important alloying elements added in alloy steels.

6. Why does the aluminium replace the copper as an electrical conductor?

7. What are the characteristics of plastics which account for their wide use as engineering materials?

8. Name any four thermoplastics and thermosetting plastics.

9. Differentiate between ductility and malleability.

10. List the main parameters which may be determined in a tensile test.

PART B — (5 × 13 = 65 marks)

11. (a) Draw iron-iron carbide phase diagram, name the various field, line and reactions.

Or

(b) Explain the following invariant reactions with reference to a phase diagram.

(i) Eutectic reaction (7)

(ii) Eutectoid reaction (6)

12. (a) Write a short notes on the following:

(i) Full annealing (4)

(ii) Recrystallation annealing (5)

(iii) Normalizing (4)

Or

(b) Write short notes on the following surface heat treatment operations:

(i) Carburising and its types (9)

(ii) Nitriding (4)

13. (a) Write an engineering brief about the following steels

(i) Tool Steels (7)

(ii) HSLA steels (6)

Or

(b) Discuss the properties of any four copper alloys.

14. (a) (i) Differentiate between thermosetting and thermos plastics. (7)

(ii) Write a short note on PVC. (6)

Or

(b) What are the properties and application of Al_2O_3, SiC and Si_3N_4.

15. (a) Define fracture. List and explain the different types of fracture.

Or

(b) What is meant by Plastic deformation? Discuss the role of slip and twinning in plastic deformation of materials. Also differentiate between slip and twinning.

PART C — (1 × 15 = 15 marks)

16. (a) Discuss the various types of titanium alloy, their composition, properties and applications.

Or

(b) Discuss the classifications of cast iron and draw its microstructure.

Question Paper Code : 70148

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Mechanical Engineering

ME 3392 — ENGINEERING MATERIALS AND METALLURGY

(Common to B.E. Manufacturing Engineering/B.E. Mechanical Engineering (Sandwich))

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compare peritectic and eutectoid reactions.
2. Define solid solution strengthening.
3. What is austempering?
4. Name any two shallow hardening processes.
5. Write the effects alloys adding on steel.
6. What are copper alloys? Give an example.
7. Distinguish between addition and condensation polymerization.
8. Describe metal matrix composites.
9. Define twinning process.
10. Distinguish between fatigue and creep.

PART B — (5 × 13 = 65 marks)

11. (a) Explain with a neat sketch of Eutectic phase equilibrium diagram.

Or

(b) Explain the various classifications of steel and cast iron with microstructure, Properties and applications.

12. (a) Describe Jominy end quench test and its applications and state the objectives of surface hardening.

Or

(b) Explain TTT diagram with neat sketch and indicate all the phases with microstructure.

13. (a) Explain the properties and the applications of the following :

(i) Tool steels

(ii) Maraging steels

(iii) HSLA

(iv) Grey cast iron.

Or

(b) Discuss in detail, the age hardening of Al-Cu with help of phase diagram.

14. (a) Explain the strengthening mechanism of fiber-reinforced composites.

Or

(b) Explain the properties and the applications of the following :

(i) PE

(ii) PET

(iii) PVC

(iv) PPO.

15. (a) Explain with neat sketch of Brinell and Rockwell hardness test.

Or

(b) Discuss characteristics of ductile fracture and brittle fracture with neat sketch.

PART C — (1 × 15 = 15 marks)

16. (a) List the important engineering ceramic materials and discuss its general applications of ceramic materials in various engineering fields. What are the advantages and disadvantages of ceramics?

Or

(b) Draw the binary phase diagram between A and B, if pure A melts at 1050°C, and pure B melts at 1900°C. At 1250°C, the solid solution α (50% B), the solid solution β (80% B) and liquid (30 % B) are in three-phase equilibrium. At room temperature, the minimum solubility of B in A is 30%, and the maximum solubility of A in B is 10%. Label all areas of the diagram. Explain the solidification of the eutectic alloy.

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