Code No:R2022031 **R20** **SET - 1**

II B. Tech II Semester Regular/Supplementary Examinations, July - 2023

MATERIAL SCIENCE & METALLURGY

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions, each Question from each unit
All Questions carry **Equal** Marks

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UNIT-I

1 a) What is metallic bonding? Describe various properties of metallic bond. [7M]

b) Draw a typical equilibrium diagram for two metals completely soluble in both liquid state and solid state. [7M]

Or

2 a) What is crystallization? Describe in detail, the mechanism of crystallization in detail. [7M]

b) What do you understand by the term equilibrium diagram? List various experimental methods used for construction of equilibrium. Explain any one of the methods with an example. [7M]

UNIT-II

3 a) Mention the composition of white cast iron. Explain the malleablizing treatment is given to white cast iron. Draw the microstructure of the malleable cast iron and explain each phase of it. [7M]

b) What are tool steels? Explain in detail about hot and cold working tool steels. [7M]

Or

4 a) What is grey cast iron? Draw the microstructure of the grey cast iron and explain each of the phasein detail. Give its properties. [7M]

b) What are the different types of alloying elements added to steels? What are the common elements added to the steels? How each of the elements affects the properties of steel? [7M]

UNIT-III

5 a) Define an alloy. Explain the effect of alloying on Fe-Fe_3C system. [10M]

b) Why normalized steels are stronger than annealed steels? Explain in detail. [4M]

Or

6 a) What is annealing? Explain the following types of annealing in detail. [8M]
   i) Full Annealing
   ii) Speroidize annealing
   iii) Stress relief annealing
   iv) Process annealing.

b) Differentiate nitriding and carburizing. [6M]
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UNIT-IV

7 a) Explain the procedure of manufacturing parts by powder metallurgy. [10M]

b) Give the applications of powder metallurgy. [4M]

Or

8 a) Explain briefly the following compacting and shaping processes employed in powder metallurgy: [9M]
   i) Metal injection moulding
   ii) Pressureless compaction
   iii) Extrusion.

b) What is spark discharge sintering? Explain in brief. [5M]

UNIT-V

9 a) Explain the filament winding process and resin transfer moulding methods with neat sketches. Also give their advantages and applications. [7M]

b) What are ceramics? Explain the following properties of ceramics: [7M]
   i) Mechanical
   ii) Chemical
   iii) Electrical
   iv) Thermal
   v) Optical and
   vi) Magnetic properties in detail.

Or

10 a) Explain about the metal matrix, ceramic matrix and fiber reinforced composite materials. Mention their advantages, disadvantages and applications. [7M]

b) What is a glass? Give the detailed classification of glasses. Also give the applications of each of the classification. [7M]

Code No:R2022031 **R20** **SET - 2**

II B. Tech II Semester Regular/Supplementary Examinations, July - 2023
MATERIAL SCIENCE & METALLURGY
(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions, each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) What is alloy? What is necessity of alloying? What are its advantages and limitations? [7M]

b) Draw the iron-iron carbide diagram and write the eutectoid reaction in detail. Also find the amount of different phases at the eutectoid point. [7M]

Or

2 a) What are the four basic crystal lattice? Give the relation between lattice parameter 'a' and atomic radius 'r' for all basic crystal lattice with examples. [7M]

b) What is an isomorphous alloy system? Construct an isomorphous alloy system using the cooling curves. [7M]

UNIT-II

3 a) What is steel? Give the composition of steel. Explain in detail, the classification of steels. [7M]

b) Why alloying of metals is necessary? What is the effect of alloying on carbides and ferrites. [7M]

Or

4 a) What is spheroidal cast iron? Draw its microstructure and explain each of the phase in detail. Write its characteristics. [7M]

b) What are tool steels? What are the various properties that tool steels should possess for practical applications? [7M]

UNIT-III

5 a) What is normalizing? What is the effect of normalizing on steels? Explain in detail. [7M]

b) What is cryogenic treatment of metals? Why Cryogenic treatment relieves residual stresses in metal and when to use it. [7M]

Or

6 a) Define hardening. Describe in detail about flame hardening and induction hardening. [7M]

b) What is the principle and procedure in hardening and tempering of hypereutectoid steels? [7M]

UNIT-IV

7 a) Compare the features of powder metallurgy with casting and forging manufacturing methods. [7M]

b) Define the process of sintering. Explain about the continuous-conveyor-type sintering furnace. Also mention the finishing operations for powder metallurgy products. [7M]

Or
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8 Explain briefly the following methods of production of metal powders: [14M]
i) Atomization
ii) Granulation
iii) Reduction
iv) Electrolytic Deposition

UNIT-V

9 a) What are particulate composites? How the steps involved in the production. Give the classification of particulate strengthened composite materials. Give their applications. [8M]

b) What are refractories? What are the requirements and properties of refractories? [6M]

Or

10 a) What are abrasive materials? Explain in detail about the natural and synthetic abrasive materials. [6M]

b) What are C-C composites? Describe the method of processing of C-C composites? Give their applications. [8M]

Code No:R2022031 **R20** **SET - 3**

II B. Tech II Semester Regular/Supplementary Examinations, July - 2023
MATERIAL SCIENCE & METALLURGY
(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions, each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Define grain and grain boundary. Describe various characteristics of grain boundary in detail. [7M]
b) Describe the transformations that occur in eutectoid and peritecoid reactions. [7M]

Or

2 a) Define crystallization? What are different types of crystal defects? Explain each of the defects with neat sketch. [7M]
b) Explain coring and miscibility gaps in detail. [7M]

UNIT-II

3 a) What is Hadfield manganese steel? Write its structure and composition in detail. Write its applications. [7M]
b) Discuss the structure and properties of copper and its alloys. [7M]

Or

4 a) Discuss the structure and properties of aluminum and its alloys. [7M]
b) Explain the effect of nickel, nickel chromium, manganese and molybdenum on steels. [7M]

UNIT-III

5 a) What is surface heat treatment or case hardening? Explain the following surface hardening methods elaborately: [8M]
i. Carburizing
ii. Flame hardening
iii. Cyaniding
iv. Nitriding
b) What do you mean by critical cooling rate? What are the factors that influence the cooling rate? Elaborate. [6M]

Or

6 a) What is austenitizing temperature of steel? Explain the importance of austenitizing temperature and the homogeneity of austenite. [7M]
b) What is tempering? Explain various stages of tempering in detail. [7M]
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UNIT-IV

7 a) Define powder metallurgy. State the advantages, disadvantages and applications of powder metallurgy. [8M]

b) What are self-lubricating bearings? Elaborate. [6M]

Or

8 a) Discuss briefly the following processes for obtaining full density products: [7M]
i) Ceracon process
ii) Osprey process.
Mention their advantages.

b) Compare the features of powder metallurgy with hot extrusion and machining manufacturing methods. [7M]

UNIT-V

9 a) What are crystalline ceramics and cermet glasses? Explain in detail about the two materials in detail. Write their advantages, disadvantages and applications. [7M]

b) What are metal matrix composites? Briefly explain the classification of MMC. [7M]

Or

10 a) What are fiber reinforced composites? Explain any three methods that are used to manufacture the FRC. [9M]

b) Discuss the physical and mechanical properties of metal matrix composites. Also give their applications. [5M]

Code No:R2022031 **R20** **SET - 4**

II B. Tech II Semester Regular/Supplementary Examinations, July - 2023

MATERIAL SCIENCE & METALLURGY

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions, each Question from each unit
All Questions carry **Equal** Marks

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UNIT-I

1 a) Explain in detail different types of bonds in solids. [7M]

b) What are the different basic types of binary alloy systems? Illustrate each type in detail with a neat sketch. [7M]

Or

2 a) What is an alloy? How do you classify alloys? Explain each of the classification in detail. [7M]

b) What is Gibb's phase rule? Define and explain in detail each term of the rule. [7M]

UNIT-II

3 a) Write the classification of cast iron in detail. Mention the composition and properties of each of the classification. [7M]

b) What are super alloys? Give the reason why they are called super alloys? Explain the properties, applications of super alloys. [7M]

Or

4 a) What are high speed steels? What is the typical composition of high speed steels? How each of the alloying elements affects the high speed steel? [7M]

b) Discuss the structure and properties of titanium and its alloys. [7M]

UNIT-III

5 a) Write about age hardening treatment in detail. [7M]

b) Define cryogenic treatment. Explain how the cryogenic treatment affects the alloys in detail. [7M]

Or

6 a) What is hardenability? What are the factors that affect the hardenability in heat treatment of alloys? [8M]

b) What are residual stresses? How do they affect the strength of the metals or alloys? [6M]

UNIT-IV

7 a) Define powder metallurgy. Mention the design considerations for powder metallurgy. [7M]

b) Explain briefly the particle size, distribution and shape in powder metallurgy technique. How all the above elements affect the powder metallurgy manufacturing techniques? [7M]

Or
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8 a) What is sintering process? How the sintering temperature effects the density of pressed metal powder. Mention the advantages and disadvantages of the process. [7M]

b) Explain briefly how tungsten carbide used for making tools and dies by powder metallurgy process. [7M]

UNIT-V

9 a) What are ceramics? Elaborate the classification of ceramics. [7M]

b) Describe the composition, properties and applications of various abrasive materials in detail. [7M]

Or

10 a) What is a nano material? What are various properties and applications of ceramics? Explain in detail. [7M]

b) What are laminated composites? Explain the autoclave moulding and the SMC method that are employed in the preparation of laminated composites. [7M]