

**II B. Tech I Semester Supplementary Examinations, May - 2018**  
**METALLURGY & MATERIALS SCIENCE**

(Com to ME & AME)

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
 2. Answer **ALL** the question in **Part-A**  
 3. Answer any **FOUR** Questions from **Part-B**
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**PART -A**

1. a) Define Space Lattice. (2M)
- b) What is the significance of liquidus, solidus and solvus lines in phase diagram? (3M)
- c) Compare nodular cast iron and malleable cast iron. (3M)
- d) When will you prefer annealing? (2M)
- e) What are the properties of Titanium alloys? (2M)
- f) List abrasive materials. (2M)

**PART -B**

2. a) Explain point defect, Line defect and plane defect. (7M)
- b) Mention the types of solid solutions with examples (7M)
3. a) Write equations for the following invariant reactions: eutectic, peritectic, monotectic, eutectoid and peritectoid. How many degrees of freedom do exist at invariant reaction points in binary phase diagram? (7M)
- b) Draw iron-carbon equilibrium diagram and mark on it all salient temperatures, composition and phases involved. (7M)
4. a) Classify different types of cast iron. Why silicon is added to cast iron? Explain the effects of any four alloying elements on the properties of cast iron. (7M)
- b) Explain the structure and properties of plain carbon steels. (7M)
5. a) Discuss different types of annealing processes. (7M)
- b) Define hardenability of a material and list the factors affecting hardenability. (7M)
6. a) What are the types of copper alloy, their composition, properties and applications? (7M)
- b) Enlist the properties of pure Aluminum and mention the composition, specific properties and applications of any one aluminum alloy. (7M)
7. a) What are Nano materials? What are their advantages? (7M)
- b) What is a Composite material? How it is classified? Explain briefly. (7M)



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**PART -A**

1. a) Aluminium is FCC, and has an atomic radius of 0.143nm. Calculate its lattice parameter. (3M)
- b) What is the difference between Lever rule and phase rule for a metal system? (2M)
- c) State the composition, Characteristics and applications of Malleable iron. (3M)
- d) What is tempering? List the classification of various tempering process. (2M)
- e) Write any four non ferrous metals (2M)
- f) List the various types of ceramic materials. (2M)

**PART -B**

2. a) Discuss the effect of grain boundaries on the mechanical properties (7M)
- b) What is Gibb's phase rule? Explain its importance. (7M)
3. a) Explain Al-Cu phase diagram with various reactions in it. (7M)
- b) Draw a neat labeled Iron-Iron Carbide diagram and explain eutectic and eutectoid reaction in it. (7M)
4. a) What is stainless steel? How are they classified? Give their applications (7M)
- b) What is Plain Carbon Steel? Also explain all type of plain carbon steel with the composition and specific application. (7M)
5. a) Write full name of TTT diagram and explain how it is constructed. (7M)
- b) Explain the processes of Nitriding. When do you use it (7M)
6. a) Write a short note on the copper and its alloys. (7M)
- b) Explain the properties and applications of phosphor bronze and aluminium bronze. (7M)
7. a) List the various types of glasses, enumerate its properties and applications. (7M)
- b) Explain the term composite materials with examples. State their advantages and limitations of composites in practice. (7M)



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**PART -A**

1. a) Write the important characteristics of metals and alloys? (3M)
- b) Sketch Al- Cu phase diagram (2M)
- c) Write the applications of malleable cast iron? (2M)
- d) What are surface - hardening methods? (2M)
- e) List the applications of aluminium? (2M)
- f) Name any two examples of cermets? (3M)

**PART -B**

2. a) What important factors control the type of structure developed in Ionic solids and covalent solids. Explain them. (7M)
- b) Explain ASTM representation of grain sizes (7M)
3. Draw a neat sketch of Fe-Fe<sub>3</sub>C diagram and indicate all points, lines and areas. Explain the various phase transformation reactions in Fe -Fe<sub>3</sub>C diagram. (14M)
4. a) Explain structure and properties of grey cast iron. (7M)
- b) Write the properties and applications of tool and die steels. (7M)
5. a) Explain the various stages in heat treatment cycle. (7M)
- b) Describe cryogenic treatment of alloys? (7M)
6. Explain the importance, characteristics, applications of any two non-ferrous metals and alloys. (14M)
7. a) Describe the applications of abrasive materials in detail? (7M)
- b) Explain the typical material properties of nanomaterials? (7M)



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**PART -A**

1. a) Write the types of bonds in solids? (2M)
- b) Write about Eutectoid reaction? (3M)
- c) Write the applications of white cast iron? (2M)
- d) Define hardening? (2M)
- e) List the applications of copper? (2M)
- f) What is the role of the matrix in a composite material? (3M)

**PART -B**

2. a) Explain the necessity of alloying. Why alloys are more preferred over metals, for industrial applications? (7M)
- b) What are the types of solid solutions? Explain with example (7M)
3. a) Explain the transformations in the solid state. (7M)
- b) Describe the binary phase diagram of Bi-Cd? (7M)
4. Explain the properties, compositions and applications of Hadfield manganese steels (14M)
5. Explain the steps involved in age-hardening process, with the help of an example. Name a few materials that can be age hardening (14M)
6. Explain structure and properties of aluminium and its alloys in detail. (14M)
7. a) Describe the properties of abrasive materials? (5M)
- b) Write the applications of nano materials. (9M)



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**PART -A**

1. a) Write the types of solid solutions? (3M)
- b) What is Phase rule? (2M)
- c) Write the properties of malleable cast iron? (2M)
- d) Define normalizing? (2M)
- e) List the applications of titanium? (2M)
- f) Write the properties of cermets? (3M)

**PART -B**

2. a) Explain electron compounds (7M)
- b) Describe the effect of grain boundaries on the properties of metal / alloys? (7M)
3. Explain the experimental methods of construction of equilibrium diagrams. (14M)
4. Describe about structure, properties and applications of plain carbon steels and low alloy steels (14M)
5. a) Draw a neat sketch of T-T-T diagram for eutectoid steel and indicate all regions? (9M)
- b) Explain the effect of cooling rate on transformation products. (5M)
6. Explain structure and properties of copper and its alloys in detail? (14M)
7. a) Write the properties and applications of crystalline ceramics? (7M)
- b) Explain the importance and applications of C-C composites. (7M)



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**PART -A**

1. a) Write the mechanism of bond formation? (2M)
- b) What are the different types of phases that may exist in a binary phase diagram? (3M)
- c) Write the properties of white cast iron? (2M)
- d) What is the purpose of annealing? (2M)
- e) What characteristics of copper make it resistant to corrosion? (2M)
- f) Write the properties of glasses? (3M)

**PART -B**

2. a) Distinguish between grain and grain boundary. Explain the changes in physical and mechanical properties of metals due to the presence of grains and grain boundaries. (7M)
- b) Compare and contrast between intermediate phases and solid solutions? (7M)
3. a) Explain the relationship between equilibrium diagrams and properties of alloys. (7M)
- b) Write about Isomorphous alloy systems in detail? (7M)
4. a) Explain structure, properties and applications of spheroidal graphite cast iron. (9M)
- b) Write about the applications of alloy cast irons. (5M)
5. Why hardening of steels is followed by tempering? Discuss the different stages of tempering and draw the resulting microstructures? (14M)
6. Explain structure and properties of titanium and its alloys in detail? (14M)
7. a) Describe the structure and applications of nano materials? (7M)
- b) Write about metal matrix composites with regard to physical and mechanical properties and their applications? (7M)



**II B. Tech I Semester Supplementary Examinations, October/November - 2020****METALLURGY & MATERIALS SCIENCE**

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**PART -A**

1. a) Compare fine grain metal with a coarse grain metal. (2M)
- b) What is phase rule? (2M)
- c) State the applications of tool steel. (2M)
- d) What is meant by normalising? Explain the effects of normalising on metal. (3M)
- e) Write a note on Al-Si alloys. (2M)
- f) What is matrix? What are various types of matrices used in composite materials? (3M)

**PART -B**

2. a) Classify in detail the different types of crystal imperfections. Explain the edge dislocation with a neat sketch. (7M)
- b) Discuss selection criteria for materials used in engineering applications. (7M)
3. a) List and explain the methods of construction of phase diagrams. (7M)
- b) Explain Phase rule and cooling curves of pure metals. (7M)
4. a) Differentiate between grey cast iron and white cast iron with respect to microstructure, composition, properties and applications. (7M)
- b) Mention in brief the role of Nickel, Chromium, Molybdenum and vanadium as alloying element in steel. (7M)
5. a) Distinguish between Normalizing and Annealing. (7M)
- b) Explain the need of tempering in hardened steel. Describe the process of tempering. (7M)
6. a) Name at least four important copper base alloys. Give composition microstructure and their applications. (7M)
- b) Explain the properties and applications of duralumin and Hindalium. (7M)
7. a) Sketch and explain different methods of processing ceramics (7M)
- b) Explain the term composite material with examples. State their advantages and limitations of composites in practice. (7M)