

II B. Tech II Semester Regular Examinations, June/July - 2022
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 bonds in solids and crystallization of metals in detail. [7M]  
b) Analyze the binary phase diagram of Cu-Ni with neat sketch. [7M]

**Or**

- 2 a) Draw a neat sketch of BCC crystal structure and calculate its packing factor and effective number of atoms. [7M]  
b) Explain relationship between equilibrium diagrams and properties of alloys. [7M]

**UNIT-II**

- 3 a) Explain the structure and properties of white cast iron. [7M]  
b) Analyze super alloys and its applications in detail. [7M]

**Or**

- 4 a) Discuss the structure and properties of low alloy steels. [7M]  
b) Explain the structure and properties of copper and its alloys. [7M]

**UNIT-III**

- 5 a) Explain one important technique/method to determine the hardenability of steels. [7M]  
b) Discuss the process of normalizing in detail. [7M]

**Or**

- 6 a) Explain stages and significance of annealing process. [7M]  
b) Discuss the process of tempering in detail. [7M]

**UNIT-IV**

- 7 Analyze the milling atomization, granulation reduction and electrolytic deposition processes? [14M]

**Or**

- 8 Explain the compacting methods used in powder metallurgy in detail. [14M]

**UNIT-V**

- 9 Analyze manufacturing methods, properties and applications of metal – matrix composites and C – C composites? [14M]

**Or**

- 10 Discuss manufacturing process, properties and applications of glasses and metal ceramic mixtures? [14M]

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UNIT-I

- 1 a) Explain the effect of grain boundaries on the properties of metals and alloys. [7M]
b) Analyze the binary phase diagram of Fe-Fe₃C with neat sketch? [7M]

Or

- 2 a) Draw the close packed planes and directions in Simple Cubic and FCC crystals and find out the miller indices of the planes? [9M]
b) Explain lever rule and coring miscibility gaps. [5M]

UNIT-II

- 3 a) Explain the structure and properties of malleable cast iron. [7M]
b) Evaluate the classification of steels with applications? [7M]

Or

- 4 a) Discuss the structure and properties of tool and die steels? [7M]
b) Explain the structure and properties of aluminium and its alloys. [7M]

UNIT-III

- 5 Analyze the process of heat treatment of alloys in detail? [14M]

Or

- 6 Illustrate about the surface hardening methods? [14M]

UNIT-IV

- 7 Discuss the methods of manufacturing sintered parts? [14M]

Or

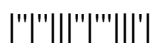
- 8 Explain the factors determining the use of powder metallurgy in detail. [14M]

UNIT-V

- 9 Analyze manufacturing techniques, properties and applications of particle reinforced materials and fiber reinforced materials? [14M]

Or

- 10 Discuss the manufacturing process, properties and applications of crystalline ceramics? [14M]



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UNIT-I

- 1 a) Explain the necessity of alloying, intermediate alloy phases, and electron compounds. [7M]
b) Analyze the experimental methods of construction of equilibrium diagrams. [7M]

Or

- 2 a) Evaluate the determination of grain size and imperfections. [7M]
b) Explain the various transformations in the solid state and phase rule. [7M]

UNIT-II

- 3 a) Illustrate the structure and properties of grey cast iron. [7M]
b) Discuss the structure and properties of Hadfield manganese steels. [7M]

Or

- 4 a) Explain the structure and properties of alloy cast iron. [9M]
b) Discuss the structure of titanium and its alloys? [5M]

UNIT-III

- 5 Draw and explain TTT diagrams in detail. [14M]

Or

- 6 Explain the process of age hardening treatment in detail. [14M]

UNIT-IV

- 7 Discuss the methods of producing metal powders. [14M]

Or

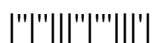
- 8 Explain the applications of powder metallurgy process in detail. [14M]

UNIT-V

- 9 Illustrate various methods of component manufacture of composites. [14M]

Or

- 10 Explain manufacturing process, properties and applications of cermets and abrasive materials. [14M]



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**UNIT-I**

- 1 a) Analyze Hume Rotherys rules in detail. [7M]  
b) Explain equilibrium cooling and heating of alloys. [7M]

**Or**

- 2 a) Discuss the types of solid solutions and concept of twinning. [7M]  
b) Explain isomorphous alloy systems, eutectic systems, and congruent melting intermediate phases. [7M]

**UNIT-II**

- 3 a) Illustrate the structure and properties of spheroidal graphite cast iron. [7M]  
b) Discuss the structure and properties of magnesium and its alloys. [7M]

**Or**

- 4 a) Explain the structure and properties of plain carbon steels. [9M]  
b) Explain in brief about Cryogenic treatment of alloys? [5M]

**UNIT-III**

- 5 Analyze the effect of alloying elements on Fe-Fe<sub>3</sub>C system in detail. [14M]

**Or**

- 6 Explain cryogenic treatment of alloys in detail. [14M]

**UNIT-IV**

- 7 Discuss the basic processes involved in powder metallurgy. [14M]

**Or**

- 8 Explain the secondary operations of sintering in detail. [14M]

**UNIT-V**

- 9 Discuss the classification of composites with examples. [14M]

**Or**

- 10 Define nanomaterials and explain the properties and applications of nano materials. [14M]

