

II B. Tech I Semester Regular Examinations, March - 2021
MATERIAL SCIENCE & METALLURGY
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 75

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

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- 1 a) Discuss different methods for determination of Grain size. [8M]
b) Explain in detail about the Twinning deformation Mechanism [7M]
- Or
- 2 a) Explain about congruent melting intermediate phases using respective phase diagrams? [9M]
b) What are the basic factors that can be known from a binary phase diagram? Explain. [6M]
- 3 a) Describe briefly about the entire process involved in preparing the malleable iron from white cast iron? [9M]
b) Discuss Hadfield steels with respect to composition, properties and applications?? [6M]
- Or
- 4 a) What is the Necessity of alloying? List out the various changes that occur in properties of steels and explain them? [10M]
b) Explain how the grains and grain boundaries are formed during the solidification of plain carbon steel? [5M]
- 5 a) Explain effect of Alloying elements on Iron- Iron carbide diagram showing phase diagram? [8M]
b) Differentiate between Annealing and Normalizing? [7M]
- Or
- 6 a) What is annealing? Explain different types of annealing processes? [7M]
b) What is surface hardening? Differentiate between carburizing and nitriding? [8M]
- 7 a) Explain in detail about different methods of producing metal powders? [9M]
b) Explain the factors effecting production of metal powders [6M]
- Or
- 8 a) What is sintering and explain various stages of sintering? [9M]
b) Explain applications of powder metallurgy? [6M]
- 9 a) Describe the following terms in detail:
i. Crystalline ceramics.
ii. Glass transition temperature
iii. Pultrusion. [9M]
b) Derive the magnitude of load & Young's modulus of the fibre reinforcement in composite under iso-stress condition? [6M]
- Or
- 10 a) Explain the importance of Nano materials over bulk materials? [7M]
b) Explain in details about polymer based matrix composite materials? [8M]

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- 1 a) Classify various solid solutions present and explain in detail? [8M]  
b) Derive the packing factor for HCP structure in metals? [7M]
- Or
- 2 a) Explain briefly about the Cu-Ni isomorphous diagram and state the reasons for purpose of using these equilibrium diagrams? [9M]  
b) What are various invariant reactions in Fe-Fe<sub>3</sub>C phase diagram? Explain. [6M]
- 3 a) Classify different forms of Cu alloys and explain them in detail and also list out common properties & applications of these alloys? [8M]  
b) List out the properties and applications in technical view point of the following : [6M]  
i. Hadfield magnetic steels ii. Medium carbon steels
- Or
- 4 a) Classify different forms of Al alloys and explain them in detail and also list out common properties & applications of these alloys? [10M]  
b) List out the properties and applications in technical view point of the following : [5M]  
i. Plain carbon steels ii. Castirons
- 5 a) Explain briefly about any two surface hardening treatments? [7M]  
b) How the TTT curves are drawn? Explain the construction of TTT curve. [8M]
- Or
- 6 a) Classify various types of annealing treatments and explain them? [7M]  
b) Describe how Martensite is formed during solidification and give an overview of the factors affecting its formation? [8M]
- 7 a) Classify various types of atomization techniques and explain? [9M]  
b) Explain mechanism of powder production into ligaments and fragments? [6M]
- Or
- 8 a) List out reasons, Why powder metallurgy is more advantageous over other manufacturing methods and explain those reasons? [9M]  
b) Explain about various compaction methods in sintering? [6M]
- 9 a) Describe about Metal Matrix composites and list out their applications? [7M]  
b) Explain in detail about various types of reinforcements used in making composite structures? [8M]
- Or
- 10 a) Describe about carbon- reinforced composites and list out their applications? [7M]  
b) Define Nano materials and Discuss about their important properties? [8M]

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- 1 a) What are the different types of defects present in metals/alloys and discuss them in brief? [8M]
b) Explain in detail different types of bonds present in solids using examples? [7M]
- Or
- 2 a) Discuss about different phases that are formed in equilibrium cooling of Fe-C solid solution? [8M]
b) Discuss the rules which are used to satisfy the conditions for the formation of solid solution briefly? [7M]
- 3 a) Write down in detail about structure, properties and applications of Magnesium and its alloys? [8M]
b) What are the salient features of Grey Cast Iron and White Cast Iron? Describe their structure and properties in brief. [7M]
- Or
- 4 a) What are various types of super alloys present and mention their applications and properties? [8M]
b) Give a brief note on tool and Die steels. [5M]
- 5 a) What are Heat treatable and Non-Heat treatable Al alloys? Explain different heat treatments provided for these alloys? [7M]
b) Discuss briefly about cryogenic treatment of alloys. [8M]
- Or
- 6 a) Define Induction hardening? Classify various types of surface hardening treatment and explain in brief? [7M]
b) What is Diffusion annealing? Explain diffusion annealing process for both hypo eutectic and hyper eutectic alloyed steels using figures. [8M]
- 7 a) Differentiate between hot isostatic pressing and cold isostatic pressing [5M]
b) What are the various factors causing effecting powder metallurgy and explain them? [6M]
c) Explain powder production by atomization technique? [4M]
- Or
- 8 a) Draw the relation between densification and sintering time and explain importance of sintering time? [9M]
b) Explain the concept of mixing and blending in powder metallurgy? [6M]
- 9 a) Explain in detail about glass formation and importance of glass transition temperature ? [8M]
b) What are cermets? Discuss about their usage [7M]

Or

- 10 a) Describe various methods of the manufacturing composites? [7M]
- b) How ceramics & composites are superior over metals? Explain. [8M]



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- 1 a) Derive the relation between 'a' and 'r' for FCC, BCC structures? [5M]
b) Explain in detail about the Slip deformation mechanism? [5M]
c) Discuss about the importance of Grain boundaries in metals and alloys? [5M]
- Or
- 2 a) Derive the Gibbs phase rule for any equilibrium diagram in condensed phase? [8M]
b) What is lever rule? Explain about the rule in detail [7M]
- 3 a) List out various types of tool and die steels and write their applications and characteristics? [8M]
b) List out the properties and applications in technical view point of the following : [7M]
i. Spheroidal castiron ii. superalloy
- Or
- 4 a) Classify different forms of Al alloys and explain them in detail and also list out common properties & applications of these alloys? [6M]
b) Classify various types of steels based on their application and list out some examples? [9M]
- 5 a) Draw heat treatment curves for ausforming & cryoforming and explain them in detail. [9M]
b) Explain in detail about precipitation hardening? [6M]
- Or
- 6 a) What is called tempering treatment and give a detailed analysis on how the properties get developed? [7M]
b) What are various types of quenching medium used in quenching process? Explain about their importance. [6M]
c) What is Bainite? [2M]
- 7 a) Discuss how binders are used in powder metallurgy? [6M]
b) Explain the process of coining in powder metallurgy? [5M]
c) Write any four applications of powder metallurgy? [4M]
- Or
- 8 a) Describe briefly about the secondary operations in powder metallurgy and their technical applications? [8M]
b) Give an outlined view of electrolytic deposition of powder production? [7M]
- 9 a) Classify and explain in detail about various types of composites. [10M]
b) Explain about C-C composites and discuss why they widely used in aerospace industry? [5M]

Or

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- 10 a) Classify the most common types of glasses and explain them in detail using their structures? [8M]
- b) Explain properties and applications of Ceramic materials? [7M]

