

ODD SEMESTER EXAMINATION, 2022 – 23
(IInd year B.Tech. – Mechanical Engineering)
Materials Science & Technology

Duration: 3:00 hrs

Max Marks: 100

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	<p>Answer any four parts of the following.</p> <ol style="list-style-type: none"> Define the term 'Atomic packing factor'. Differentiate between 'Body centered cube' and 'Face centered cube'. Explain true stress and true strain with the help of stress and strain diagram of mild steel. Differentiate between normalizing and annealing process. What is special about smart materials? Where these materials can be used in future? What do you understand by Messier effect? What is significance of this effect? Explain the procedure for grain size measurement. 	5x4=20
Q 2.	<p>Answer any four parts of the following.</p> <ol style="list-style-type: none"> Calculate the volume of FCC unit cell in terms of the atomic radius R. Show that the atomic packing factor for the FCC crystal structure is 0.74. Write down the phases and composition of phases present at point A and B. <div data-bbox="370 1136 1068 1818" data-label="Figure"> <p>The figure is a phase diagram for the Cu-Ni system. The x-axis represents Composition (wt% Ni) from 0 to 100, with 0 being pure Cu and 100 being pure Ni. The left y-axis represents Temperature (°C) from 1000 to 1600, and the right y-axis represents Temperature (°F) from 2000 to 2800. The diagram shows a liquidus line and a solidus line that are concave down. The region above the liquidus line is labeled 'Liquid'. The region between the liquidus and solidus lines is labeled 'α + L'. The region below the solidus line is labeled 'α'. Point B is located on the liquidus line at approximately 35 wt% Ni and 1250°C. Point A is located in the 'α' region at approximately 60 wt% Ni and 1100°C. Key temperature points are marked: 1085°C at 0 wt% Ni and 1453°C at 100 wt% Ni.</p> </div> <ol style="list-style-type: none"> Differentiate between composite and alloy. Define the term creep. Explain the creep testing. Differentiate between fine grain and coarse grain. How grain structure is related to mechanical behavior? Write down the various types of polymers and their applications. 	5x4=20

Q 3.	<p>Answer any two parts of the following.</p> <p>a) Draw Iron-Carbon Phase diagram. For a 99.65 wt% Fe-0.35 wt% C alloy at a temperature just below the eutectoid, determine the following:</p> <ul style="list-style-type: none"> (i) The fractions of total ferrite and cementite phase (ii) The fractions of the pro-eutectoid ferrite and pearlite (iii) The fraction of eutectoid ferrite. <p>b) Explain TTT diagram for eutectoid steel. Also explain different microstructures obtained by different modes of cooling (i.e. furnace/air/water). Explain martensite and its crystal structure.</p> <p>c) Explain flow diagram for production of Cast Iron and Steel.</p>	10x2= 20
Q 4.	<p>Answer any two parts of the following.</p> <p>a) Define Fatigue and mention two fatigue resistant materials. What is its effect on properties of material? What is the procedure of conducting 'Fatigue test'?</p> <p>b) Explain Type I and Type II superconductors. Also explain high T_c superconductor.</p> <p>c) Explain the following</p> <ul style="list-style-type: none"> (i) Screw dislocation (ii) Write name of seven crystal systems. (iii) Tempering (iv) Differentiate between brass and bronze (v) Differentiate between Dia, para and ferro-magnetic materials. 	10x2= 20
Q 5.	<p>Answer any two parts of the following.</p> <p>a) Explain ultrasonic non-destructive test and magnetic particle inspection method.</p> <p>b) Why is heat treatment imparted to steel? Name different heat treatment processes and explain their objectives.</p> <p>c) Discuss salient features and uses of the following;</p> <ul style="list-style-type: none"> (i) Nickel super alloys (ii) Nano materials (iii) Ceramics (iv) Adhesive (v) Corrosion resistance materials 	10x2= 20
