ENGINEERING MATERIALS
(MECH 3103)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i)   A key feature of an ionic bond is that it is:
   (a) Strongly directional (b) Completely non-directional
   (c) Acts between identical atoms (d) Non-polarized.

   (ii) Which out of the following cannot be removed from materials?
   (a) Point defect (b) Time defect
   (c) Grain boundary defect (d) Dislocation.

   (iii) An eutectoid steel contains
   (a) Wholly pearlite (b) Austenite
   (c) Pearlite and Ferrite (d) Martensite.

   (iv) Brass consists of
   (a) Copper and Tin (b) Copper and Zinc
   (c) Copper and Lead (d) Copper and Nickel.

   (v)   Eutectoid steel has C % of
   (a) 0.25 (b) 0.54 (c) 0.76 (d) 1.20.

   (vi) Primary objective of annealing
   (a) Increase toughness and yield point
   (b) Reduce ductility and resilience
   (c) Remove foreign impurities and improve surface finish
   (d) Increase ductility and machinability.

   (vii) Strain hardening improves
   (a) Fatigue strength (b) Static tensile strength
   (c) Steady state creep rate (d) none of this.

   (viii) The formation of a glass during ceramic production is called:
   (a) Vitrification (b) Sintering
   (c) Glass–ceramic formation (d) Polymerization.

(ix) Fatigue corrosion occurs
   (a) Along the grain boundary line
   (b) Due to moisture and traces from ammonia
   (c) Due to crack formed between surfaces
   (d) Due to cyclic stresses.

(x) Polystyrene is an example of
   (a) An addition polymer   (b) A condensation polymer
   (c) An elastomer   (d) A monomer.

Group – B

2. (a) What do you mean by recovery, recrystallization and grain growth?

   (b) FCC is a more close packed structure yet solubility of carbon in austenite which is FCC is higher than that in ferrite which is BCC. Why it is so?

   6 + 6 = 12

3. (a) Calculate the atomic density (number of atoms per unit area) in (111), (110) and (100) planes of copper (FCC) with the lattice parameter of 3.61 Å.
   Explain why the properties of polycrystalline materials are most often isotropic

   (b) What is phase diagram? What is its importance?

   6 + (3 + 3) = 12

Group – C

4. (a) Name the different allotropic forms of Iron (Fe) stating their crystal structure and temperature range. Also draw Iron carbon diagram and show eutectic, eutectoid and peritectic point.

   (b) Why alloying is done? What are the effect of tungsten, chromium and nickel alloying element in steel?

   6 + (3 + 3) = 12

5. (a) What is meant by hardenability? Explain the process through which steel can be hardened.

   (b) Give classification of Plain Carbon Steel. Discuss on the properties of different types of plain carbon steels.

   6 + 6 = 12

Group – D

6. (a) Differentiate between engineering strain and true strain and also draw neat sketch of engineering strain and true strain.

   (b) A bar of 5 meter in length having a stress strain diagram whose yield strength is 250 MPa and the slope of initial stress strain curve is 200 GPa. Bar is loaded

axially until it elongates 7.5 mm and then load is removed. How does the final length of the bar compare with its original length?

6 + 6 = 12

7. (a) What is Austempering and Martempering? Explain with reference to T-T-T diagram.

   (b) Differentiate between Full annealing and Normalising process.

   6 + (3 + 3) = 12

Group – E

8. (a) What is ceramic? What are the characteristics of ceramics? Briefly describe the process of vitrification and sintering in ceramics.

   (b) Explain in brief, the different ways of corrosion prevention.

   (3 + 4) + 5 = 12

9. (a) How do you distinguish between matrix and dispersed phase in composite material?

   (b) Define polymerization. Differentiate between the two different types of polymerization.

   6 + 6 = 12

Department & Section	Submission link:
ME A	https://classroom.google.com/c/Mjc0NzQxNjg0OTky/a/Mjc0NzQxNjg1MDk3/details
ME B	https://classroom.google.com/c/MTI2NTk0MzU0OTk3/a/Mjc0NDM1MTQ2NzM0/details