

ENGINEERING MATERIALS
(MECH 2104)

Time Allotted: 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one 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) Cast iron normally contains
(a) 1 to 1.5% carbon (b) 2 to 4% carbon
(c) less than 1% carbon (d) more than 6.67%carbon.
- (ii) Crystal structure of metals is studied by
(a) Metallographic Technique (b) X-Ray technique
(c) Ultrasonic technique (d) Electron microscopy.
- (iii) Eutectoid composition in Iron-Carbon Equilibrium diagram has % of carbon and temperature respectively as,
(a) 0.25% & 712 °C (b) 0.52% & 720 °C
(c) 0.76% & 727 °C (d) 0.83% & 730 °C.
- (iv) The maximum percentage of carbon in ferrite is
(a) 0.025 (b) 0.1 (c) 0.17 (d) 0.5.
- (v) Slow elastic deformation of metals under a constant stress is known as
(a) fatigue (b) stress concentration
(c) creep (d) endurance limit.
- (vi) The composite material from the following is
(a) wood (b) steel (c)nylon (d) mica.

- (vii) Annealing is done
(a) to harden the surface (b) for surface smoothness
(c) for relieving stress (d) for changing grain size.
- (viii) Fatigue corrosion occurs in components
(a) along grain boundaries of a steel
(b) due to moisture and traces of ammonia
(c) due to cracks formed between mating surfaces
(d) which are subjected to cyclic stresses
- (ix) Thermal expansion of materials arises from
(a) strong bonds
(b) weak bonds
(c) thermal vibrations
(d) asymmetry of potential energy.
- (x) Major ingredient(s) of traditional ceramics is/are
(a) Silica (b) Clay (c) Feldspar (d) All of these

Group - B

2. (a) How do crystallization and grain growth affect the different mechanical properties?
(b) With the help of neat sketches explain how slip occurs by the movement of an edge dislocation and twin.
6 + 6 = 12
3. (a) Explain the procedure for finding Miller indices. Find the atomic packing factor of BCC crystal.
(b) Draw the phase diagram for the binary isomorphous alloy of Cu and Ni showing the regions of i) liquid phase ii) α -solid phase iii) α -solid + liquid phase. The melting temperatures for pure Cu and Ni are 1085 °C and 1453 °C respectively.
(3 + 3) + 6 = 12

Group - C

4. (a) Write down the carbon % present in low carbon steel, medium carbon steel, high carbon steel and cast Iron. Explain how Cast Iron differs from steel in respect to microstructure. What is Austenitic Stainless steel?
(b) Draw a neat sketch of Iron Carbon equilibrium diagram, showing the different phase fields at different temperature.
(3+2+1) + 6 = 12

5. (a) State the name of different Case Hardening methods that are used in Heat Treatment Process. Explain any one of the Case Hardening method.
- (b) Explain Full Annealing and Normalising process as applied to low carbon and medium carbon steels. What is tempering of high carbon steel?

(3 + 3) + (4 + 2) = 12

Group - D

6. (a) Write down the procedure to perform the Rockwell hardness test along with the type of indenter used. A 10-mm-diameter Brinell hardness indenter produced an indentation 2.50 mm in diameter in a steel alloy when a load of 1000 kg was used. Compute the Brinell Hardness Number (HB) of this material.
- (b) Draw the creep strain vs time diagram for a ferrous material subject to a constant load at a constant temperature greater than 0.4 times the melting point temperature. Describe completely the three zones of the diagram.

(3 + 3) + (2 + 4) = 12

7. (a) Define linear coefficient of expansion as the property of material. Write the expression of it. Explain how the heat capacity of a material changes with changing of temperature.
- (b) Write down the major similarities and differences between ferromagnetic and paramagnetic material.

(3+3) + 6 = 12

Group - E

8. (a) Define ceramic materials. State advantages and applications of ceramic materials.
- (b) What do you understand by polymerization? Explain the difference between addition and condensation polymerization.
9. (a) Briefly discuss various types of composite materials and its uses.
- (b) Define corrosion and explain the different mechanisms of corrosion.

(2+4)+ (2+4) = 12

6 + 6 = 12

Department & Section	Submission Link (for Backlog)
ME	https://classroom.google.com/c/Mjk0OTUxNjM5MDQ1/a/Mjk0OTUxNjM5MDU0/details class code : <u>5gkvy6l</u>