B. TECH
(SEM-III) THEORY EXAMINATION 2019-20
MATERIAL SCIENCE

Time: 3 Hours   *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1.   **Attempt *all* questions in brief.**   **2 x 7 = 14**

   a.   What is space lattice and unit cell?

   b.   Define creep and creep fracture.

   c.   Explain the phenomenon of strain hardening.

   d.   What is an equilibrium phase diagram? What are the advantages of the equilibrium diagrams?

   e.   What are bakelites? Also state their applications.

   f.   Define the term critical cooling rate. What are the factors affecting it?

   g.   What are the primary effects of chromium, and copper as alloying elements in steel?

SECTION B

2.   **Attempt any *three* of the following:**   **7 x 3 = 21**

   a.   Explain eutectic and eutectoid reaction. With help of diagram, identify all four mechanism reactions peritectic.

   b.   Choose the S-N curve for mild steel and aluminum and explain its features .Explain the procedure used to obtain S-N diagram

   c.   Explain unary phase diagram of iron and explain different phases formed with increase in temperature.

   d.   What are Ceramics? Write different types of ceramics.

   e.   What are the properties of aluminum? And what is the effect of different types of alloying elements such as copper, iron, manganese, magnesium used with aluminum and its application? Explain.

SECTION C

3.   **Attempt any *one* part of the following:**   **7 x 1 = 7**

   (a)   Derive an expression for number of atoms per unit cell and Atomic Packing Factor in case of Simple cubic, BCC, and FCC.

   (b)   There are 8.82×10^{12} atoms/mm^2 on certain plain in a strontium FCC unit cell. Its lattice constant is 6.08 A. Determine the Miller indices of the plain in question. Consider (100), (110) and (111) planes only.

4.   **Attempt any *one* part of the following:**   **7 x 1 = 7**

   (a)   Metal 'A' has melting point of 1000° C. Metal 'B' has melting point of 500° C. Draw one phase diagram (between the elements 'A' and 'B') for each of the following conditions.

      (i) The two elements exhibit unlimited solid solubility.

      (ii) The alloy system shows formation of two terminal solid solutions and a Eutectic point at 60% A at 700 ° C.

   (b)   Describe yield point phenomenon. How is Luder bands formed during deformation? What is Low cycle fatigue? Explain the method to estimate the fatigue damage in metals.

5.   **Attempt any *one* part of the following:**   **7 x 1 = 7**

  (a)   Explain TTT diagram for steel. Explain microstructural changes that take place in steel during cooling.

  (b)   Explain the procedure of constructing a phase diagram in which two metals are soluble in liquid state but fully insoluble in solid state. Also explain the solidification of hypoeutectoid alloy of your choice.

6.   **Attempt any *one* part of the following:**   **7 x 1 = 7**

  (a)   Sketch the creep curve and explain the changes in various stages. Distinguish between creep curve and stress rupture.

  (b)   Draw tin-lead equilibrium diagram. If, for soldering, 85% eutectic mixture is preferred, determine the composition limits of tin that will satisfy this condition.

7.   **Attempt any *one* part of the following:**   **7 x 1 = 7**

  (a)   What do you understand by polymerization? With the help of suitable examples, compare and contrast the process of addition polymerization and condensation polymerization.

  (b)   Write short notes about the following materials in terms of composition, properties and applications.
         (i) Maraging steels (ii) Alpha-beta brasses (iii) Austenitic stainless steels (iv) Ferrite stainless steels