Code: ME3T4

II B.Tech - I Semester – Regular/Supplementary Examinations November 2018

METALLURGY AND MATERIAL SCIENCE
(MECHANICAL ENGINEERING)

Duration: 3 hours   Max. Marks: 70

PART – A

Answer *all* the questions.   All questions carry equal marks
$$11x\ 2 = 22\ M$$

1. a) Define toughness.

   b) Sketch miller indices for planes (110) and (101) for a cubic unit cell.

   c) Derive packing factor for BCC unit cell.

   d) Write Gibb's phase rule and write about each term.

   e) Write short notes on interstitial solid solutions.

   f) Explain how the phase diagrams are constructed?

   g) How steels are classified based on Carbon Percentage?

   h) How the aluminium alloys are designated? Explain with an example.

   i) What is the necessity of tempering after hardening heat treatment?

   j) List the potential applications of powder metallurgy .

   k) Explain the role of fiber and matrix in the composite materials.

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.   3 x 16 = 48 M

2. a) Draw the seven basic crystal structures with the unit cell parameters (a, b, c and α, β, γ)   4 M

   b) Define slip system and discuss deformation by slip in FCC metals.   4 M

   c) Explain crystallization and grain growth during solidification of pure metals with the help of cooling curves.   8 M

3. a) Consider the phase diagram of Pb – Sn as given in Figure 1 and calculate the composition and phase fractions of eutectic alloy at eutectic temperature.   4 M

   b) Referring to Figure 1, what are the composition and phase fractions of an alloy 80%Pb -20%Sn at room temperature.   4 M

   c) Draw iron-iron carbide equilibrium diagram and label all regions. Explain the three invariant reactions.   8 M
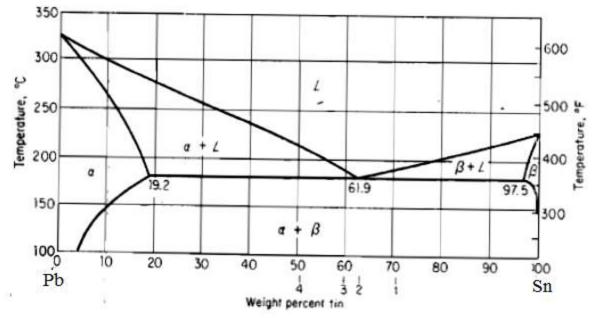
Figure 1. Phase diagram of Pb-Sn binary alloy system

4. a) Write brief points about stainless steels. Differentiate
ferritic stainless steels with austenitic stainless steels.   8 M

b) Classify copper and its alloys and write applications for
each of them.   8 M

5. a) Explain in detail about annealing, normalizing and
hardening by indicating the heat treatment zones in
Fe-Fe$_3$C diagram.   8 M

b) Why the strength of a metal is increased with reduction in
grain size? Also explain strain hardening mechanism.   8 M

6. a) What is sintering? Explain liquid phase sintering. Write briefly the limitations and applications of sintering in manufacturing industry. 8 M

   b) Write brief notes on applications of composite materials and explain manufacturing of composites by pultrusion method. 8 M