Registration No: | | | | | | | | | | |

Total Number of Pages: 02

B.TECH
PCME4203

3rd Semester Regular / Back Examination 2015-16
INTRODUCTION TO PHYSICAL METALLURGY AND ENGG. MATERIALS
BRANCH: AUTO,MANUTECH,MECH, PE

Time: 3 Hours
Max Marks: 70
Q.CODE: T556,T557

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

a) Distinguish between unit cell and primitive cell.
b) Draw $[1\bar{2}0]$ and $[\bar{2}\bar{1}\bar{1}]$ in cubic crystal system.
c) Why do materials having FCC structure offer high formability?
d) At 910°C the γ-Fe transforms to α-Fe. What is the percentage of volume expansion?
e) The microstructure of an iron-carbon alloy consists of pro-eutectoid ferrite and pearlite. The micro-constituents of these two are 0.286 and 0.714 respectively. Determine concentration of carbon in this alloy.
f) What do you mean by super colling?
g) What is Zener pinning effect?
h) What is incubation period? Why incubation period increases both above and below the nose of T-T-T curve?
i) FCC crystals have more packing density than BCC crystal yet why solubility of carbon in FCC form of iron is higher than in its BCC form?
j) Why does the fractured surface of white cast iron appear "white"?

Q2 **a)** A binary alloy having 28 wt % Cu & balance Ag solidifies at 779°C. The solid consists of two phases α & β. Phase α has 8% Cu whereas phase β has 8% Ag at 779°C. At room temperature these are pure Ag & Cu respectively. Sketch the phase diagram. Label all fields & lines. Melting points of Cu & Ag are 1083° & 960°C respectively. Estimate the amount of α & β in the above alloy at 779°C & at room temperature. **(5)**

b) Show and describe in detail the development of microstructure on slow cooling in different regions of Pb-Sn phase-diagram. **(5)**

Q3 **a)** Draw Fe-Fe_3C phase diagram labelled with different temperature, compositions and phase-fields. Write down the different reactions occurring at each invariant point. **(5)**

b) For a 0.35 wt% C plain carbon steel at a temperature just below the eutectoid temperature determine: **(5)**
(i) Fraction of total ferrite and cementite phase.
(ii) Fraction of the pro-eutectoid ferrite and pearlite.
(iii) Fraction of eutectoid ferrite.

Q4 **a)** What is composite? Explain briefly how continuous-glass fibres are made. What is the difference between fibre and whisker? **(5)**

b) What is sintering process? What occurs to the ceramic particles during sintering? **(5)**

Q5 **a)** Derive $^{c}/_{a}$ratio of HCP crystal. Find out its APF. **(5)**

b) What is tempering? Why is it done? Explain briefly the microstructural and property changes that take place in steel during various stages of tempering. **(5)**

Q6 **a)** What is CRSS? Derive an expression for CRSS. **(5)**

b) Determine tensile stress that is applied along $[1\bar{1}0]$ axis of a silver crystal to cause slip on the $(1\bar{1}\bar{1})[0\bar{1}1]$ system. Given CRSS = 6 MPa. **(5)**

Q7 **a)** Define hardenability? What is common criterion of hardenability of steel and why? Enumerate five factors effecting hardenability of steel. **(5)**

b) What is yield-point phenomenon? Describe it with a neat sketch of load-elongation curve of low carbon steel. **(5)**

Q8 **Write short notes on any two:** **(5 x 2)**

a) Refraction

b) Sensitization

c) Intersection of dislocations

d) Ductile Iron