Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech**
PCMT4201

3rd Semester Back Examination 2016-17
INTRODUCTION TO PHYSICAL METALLURGY
BRANCH(S): METTA,MME
Time: 3 Hours
Max Marks: 70
Q.CODE: Y641

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) In an edge dislocation the burgers vector is _____ to the dislocation line and in a screw dislocation it is _____ to the dislocation line.

b) _____ and _____ cause hot shortness and cold shortness in steels respectively.

c) The combination of a _____ nucleation rate and a _____ growth rate yields a fine grain size.

d) Draw the plane (100) and (010) in two different unitcells.

e) Determine the relationship between lattice parameter, a,and atomic radius, r, in a BCC unit cell.

f) Calculate the number of atoms in 100g of aluminium. Atomic weight of aluminium is 26.98 g/mol and Avogadro's number is 6.023×10^{23} mol^{-1}.

g) What is critical cooling rate?

h) On what factor does the hardness of martensite depend?

i) Why are high speed steels subjected to subzero treatment?

j) What is malleable cast iron?

Q2 With a neat diagram describe about age hardening of Al-4.5wt% Cu alloy. **(10)**

Q3 **a)** Draw FCC and BCC unit cells and find out their atomic packing factor. **(5)**

b) What is solid solution? Discuss about Hume-Rothery rules. **(5)**

Q4 **a)** Explain the invariant reactions taking place in Fe-Fe_3C phase diagram with suitable sketches. **(5)**

b) A 0.2 wt.% steel is cooled slowly from austenitic region to room temperature.Calculate the proportions of the different phases at room temperature and draw the microstructure **(5)**

Q5 **a)** What is homogeneous nucleation? Derive the expression for the free energy change accompanying the formation of a spherical new phase particle. **(5)**

b) Draw and compare the T-T-T curves for 0.5 and 1.0 wt% C steel. **(5)**

Q6 **a)** What is hardenability? Describe the Jominy end quench method of determining hardenability of steels. **(5)**

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

Q7 Describe briefly a binary isomorphous phase diagram with required labelling. Explain how todetermine the composition of each of the phases within a two phase region of the binary phase diagram at a given temperature. And also explain how one can determine the mass fractions of each phase in equilibrium. **(10)**

Q8 **Write Short notes on (Any TWO)** **(5 x 2)**

a) Constitutional super cooling

b) Yield point phenomena

c) High speed steel

d) Gray cast iron