Registration No:

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B.Tech
PCMT4201

3rd Semester Back Examination 2017-18
Introduction to Physical Metallurgy
BRANCH : METTA, MME
Time: 3 Hours
Max Marks: 70
Q.CODE: B1188
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) Define coordination number and atomic packing factor.

b) Show schematically the (1 1 2), (0- 1 0) planes and [-2 1 -1], [-1 -1 -1] directions in cubic crystals.

c) Distinguish between crystalline and non-crystalline solids.

d) Define solid solution, Gibb's phase rule, phase diagram and lever rule.

e) What is peritectic reaction?

f) Why are grain boundaries favorable sites for nucleation and growth of precipitates?

g) Draw and show the difference in the micro structures formed after annealing and normalizing.

h) Draw a neat sketch of a cooling curve for pure metal.

i) What is the difference between TTT and CCT?

j) Draw phase diagram of pure Iron (from room temperature onwards).

Q2 **a)** State Hume-Rothery rule rules that favors substitutional solid solution.   **(5)**

b) Calculate the equilibrium number of vacancies per cubic meter of copper at 1000°C. The energy for vacancy formation is 0.9 eV/atom. The atomic weight and density at 1000°C for Cu is 63.5 g/mol and 8.4 g/cc respectively. Boltzmann constant k = 8.62 × 10^{-5}.   **(5)**

Q3 **a)** Differentiate between the following: **(5)**
   i) Hot working and Cold working.
   ii) Recovery and Recrystallization.

b) Discuss the mechanism of Age hardening of Al alloys.   **(5)**

Q4 **a)** What is tempering? What are the microstructural changes after tempering?   **(5)**

b) How do we correlate microstructure with mechanical properties of materials? How these two are related? Explain in brief by taking an example.   **(5)**

Q5 **a)** What is the effect of various alloying elements on TTT diagram? Draw a TTT diagram for a eutectoid steel.   **(5)**

b) What are the various factors that control the solubility in alloy systems?   **(5)**

Q6 **a)** Define hardenability. What is the common criterion of hardenability of steels **(5)** and why? Enumerate the five factors affecting the hardenability of the steel.

b) What is the composition, properties and applications of phosphor bronze? **(5)**

Q7 **a)** Explain the difference between resolved shear stress and critical resolved **(5)** shear stress. Derive the expression for critical resolved shear stress.

b) Discuss the Martensite characteristics and morphology of Martensite. **(5)**

Q8 **Write short answer on any TWO:** **(5 x 2)**
a) Phase rule and its importance
b) Physical metallurgy of copper alloys.
c) Stainless steels
d) Diffusion-less transformation