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Total Number of Pages: 02

B.Tech
PCME4203

3rd Semester Back Examination 2016-17
INTRODUCTION TO PHYSICAL METALLURGY AND ENGINEERING MATERIALS
BRANCH(S): AUTO, MANUFAC, MANUTECH, MECH, PE

Time: 3 Hours

Max Marks: 70

Q.CODE: Y592

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) What is metallurgy? What are the divisions of metallurgy?
- b) Explain why metal is an engineering material?
- c) What are the types of bonding? Explain them in detail.
- d) At what temperature does time dependent deformation become measurable?
- e) What problem do you anticipate in measuring hardness of lead?
- f) A metal undergoes an allotropic transformation at room temperature at high pressure and at lower temperature at atmospheric pressure. Is the volume change associated with this transformation positive or negative?
- g) What is the effect of plastic deformation on lattice parameter?
- h) In which mode of plastic deformation atomic displacement could be less than inter atomic spacing?
- i) What is the effect of temperature on concentration of vacancy?
- j) What is the hydrostatic stress (or strain) field around a screw dislocation?

Q2 Explain how quenching carburized steel introduces residual compressive stresses at the surface. (2+8)

Q3 a) With a neat sketch of BCC structure, find effective number of atoms, packing factor and coordination number. (5)

b) What are the important characteristics of grain boundaries? Discuss the role of grain boundaries for low temperature and high temperature applications. (5)

Q4 a) What is allotropy? Discuss various allotropic forms of iron and their properties. (5)

b) Explain the phase changes that take place when an eutectoid steel is cooled from 900 C to RT. (5)

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Q5 a) Distinguish between steels and cast irons and highlight the importance of each of them as engineering materials. **(5)**

b) Differentiate between T-T-T diagrams and C-C-T diagrams. **(5)**

Q6 a) What is recrystallization? What are the factors affecting recrystallization temperature? **(5)**

b) If iron is kept at 1200°K in a carburizing atmosphere for 8hrs to obtain a carbon concentration of 0.75 at a depth of 0.5mm. Find the time it would take to reach same carbon concentration at depth of 7.5mm at 1250°K. (Given $D_0 = 0.2 \times 10^{-4} \text{ m}^2/\text{s}$ & $Q = 143 \text{ kJ/mole/}^\circ\text{K}$) **(5)**

Q7 Draw equilibrium diagram for two metals completely soluble in liquid state and solid state with suitable example. **(10)**

Q8 Write short answer on any TWO: **(5 x 2)**

a) Glass fiber reinforced plastics

b) Tefnol

c) thermoplastics

d) Eutectic system