Registration No:

Total Number of Pages : 2   AR-17   B.TECH

3rd Semester (BACK PAPER) Examination-2019

BMEPC3030

INTRODICTION TO PHYSICAL METALLURGY AND ENGINEERING MATERIALS

MECHANICAL

Time : 3 Hours   Maximum : 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) 10 x 2=20 Mark

Q.1. Answer *All* Questions

a   The angle between [111] and [11−2] directions in a cubic crystal is (in degrees)
     (a) 0   (b) 45   (c) 90   (d) 180

b   Metal with hexagonal close packed structure is
     (a) silver   (b) Iron   (c) Magnesium   (d) Aluminium

c   Stainless steel is so called because of its
     (a) High strength   (b) High corrosion resistance
     (c) High ductility   (d)Brittleness

d   Which transformation starts after the nucleation of ferrite phase?
     a. Bainite transformation   b. Pearlite transformation   c. Both a. and b.   d. None of the above

e   The process of decomposing martensitic structure, by heating martensitic steel below its critical
     temperature is called as
     a. Austenitizing   b. Quenching   c. Tempering d. None of the above

f   What is meant by corrosion?
     a. Chemical reaction between anode, cathode and electrolyte, which leads to loss of metal
     b. Deterioration of metals due to reaction with its environment
     c. Both a. and b.   d. None of the above

g   The fastest cooling rate is achieved when steel is quenched in
     a) air   b) oil   c) water   d) brine

h   Which one of the following is not correct
     a) Martensite has a BCC structure   b) Austenite has FCC structure
     c) Martensite is a solid solution of carbon in BCC iron
     d) The martensite which is formed during quenching is too brittle

i   Visible light's wavelength range _____.
     (a) 0.39 – 0.77 mm (b) 0.39 – 0.77 μm   (c) 0.39 – 0.77 nm (d) 0.39 – 0.77 cm

j   Sum of these is unity
     (a) Reflectivity (b) Reflectivity + Refractivity
     (c) Reflectivity + Refractivity + Transmitivity (d) Any

PART – B: (Short Answer Questions) 10X2=20 Marks

Q.2. Answer *ALL* questions

a   What is a line defect (or) a one dimensional defect?

b   What is meant by polymorphism and allotropy?

c   What are point defects? (or) Zero dimensional defects?

d   What is an isomorphous system?

e   Write down the allotropy forms of pure iron.

f   What is meant by eutectic, hypo eutectic, hyper eutectic cast iron?

g   What is TTT diagram?

h   What is Critical Cooling Rate (CCR)?

i   What is a reinforced composite?

j   Why ceramics have a very high hardness and strength?

PART – C: (Long Answer Questions) 4X15=60 Marks

Answer *ALL* questions

Q.3

a   Aluminum has FCC structure and its density is 2700kg/m^3. Calculate the unit cell dimension and atomic diameter. (A_w of Al =26.98 g/mol).   7

b   Classify bonding in solids and explain briefly.   8

OR

c   What is meant by crystal defects? Describe in detail the point, line and surface defects and Burger vector.   7

d   Copper has FCC structure and its atomic radius is 1.273 *A*, find the lattice parameter and the density of copper.   8

    (i) Atomic weight of copper =63.5gm (ii) Avogadro's number = $6.023*10^{26}$ atoms/Kilomole.

Q.4

a   Explain Phase transformation with a suitable example.   5

b   A binary alloy having 28 wt% of Cu and balance Ag solidifies at 779^0C. The solid consists of two phases α & β. Phase α has 8% Cu whereas phase β has 8% Ag at 779^0C. At room temperature these are pure Ag and Cu respectively. Sketch the phase diagram. Label all fields & lines. Melting points of Cu and Ag are 1083^0C and 960^0C respectively. Estimate the amount of α & β in the above alloy at 779^0C & at room temperature.   10

OR

c   What is allotropy? Explain briefly with cooling curve for iron-allotropy.   7

d   Draw the Bi-Cd alloy phase diagram & explain with proper labeling.   8

Q.5

a   Explain the concept of plastic deformation by slip and twinning mechanism with neat diagrams. Also write the difference between the two mechanisms.   7

b   Explain about various type of annealing.   8

OR

c   What is CRSS? Derive an expression for CRSS.   7

d   Define hardenability. What is common criterion of hardenability of steel and why? Enumerate five factors effecting hardenability of steel.   8

Q.6

a   Explain the working principle of Ruby Laser with proper diagram.   7

b   Explain fibre optic communication system with a block digram.   8

OR

c   The fraction of the nonreflected radiation that is transmitted through 5mm thickness of a transparent material is 0.95. If the thickness is increased to 12 mm what fraction of light will be transmitted?   7

d   What are Optical fibres? And explain the structure and working principle of optical fibre.   8

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