(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0428 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. III) ODD SEMESTER THEORY EXAMINATION

2010-11

MATERIAL SCIENCE ENGINEERING

Time : 3 Hours *Total Marks : 100*

Note : (1) Attempt **all** questions.

(2) All questions carry equal marks.

(3) Be precise in your answer.

(4) Notations used have their usual meaning.

(5) Mention clearly the assumptions made, if any.

(6) Avogadro's number is $0{\cdot}6023 \times 10^{24}$.

1. Attempt any **four** out of the following : **(4×5=20)**

(a) Classify different types of chemical bonds with appropriate examples.

(b) Enlist the factors which change the equilibrium distance between the centres of two neighbouring atoms.

(c) A plane includes points at 0, 0, 0 and $\frac{1}{2}, \frac{1}{4}, 0$ and $\frac{1}{2}, 0, \frac{1}{2}$. What are its Miller indices ?

(d) X-rays of an unknown wavelength are diffracted 43·2° by copper whose lattice constant is 0·3615 nm. Diffraction line for copper is the first order line for d_{111}. What is the wavelength of the X-rays ?

(e) There can be 1·7 weight per cent carbon in solid solution with fcc iron at 1000°C. How many carbon atoms will there be for every 100 unit cells ? Atomic weight of iron is 55·85 amu and of carbon is 12·01 amu.

(f) With the help of neat sketch, illustrate the arrangement of atoms around a screw dislocation. Also indicate the Burgers vector.

2. Attempt any **two** out of the following : **(10×2=20)**

(a) Differentiate between ductile and brittle fracture. Explain the significance of ductile brittle transition temperature.

(b) Explain the method of measuring the grain size as recommended by ASTM. What are the microstructural variables within single phase metals ?

In a sample of micrograph of a metal taken for microstructural examination, there are 17 grains in an area of 0·056 mm^2. Assign an ASTM grain size number.

(c) In a lead-tin system, the following reaction takes place :

Liquid (61·9% Sn) $\overset{183°C}{\rightleftharpoons}$ α(19·2% Sn) + β(97·5% Sn).

The melting points of lead and tin are 327°C and 232°C respectively.

(i) Draw the phase diagram.

(ii) Using lead, make a materials balance for 600 g of 80 Pb-20 Sn solder at 250°C and calculate the amount of phases present.

3. Attempt any two out of the following : **(10×2=20)**

(a) Give composition, properties and uses of :

(i) Gray cast iron,

(ii) Nodular cast iron, and

(iii) White cast iron.

(b) Write down the purpose, procedure and phases present for the following transformation processes of steel :

Annealing, Quenching, Interrupted quench, Austempering and Tempering.

(c) What is difference between 'Invar' and 'Elinvar' ? What are the characteristics of aluminium ? Give composition and application of Babits.

4. Attempt any two out of the following : **(10×2=20)**

(a) What is meant by magnetic storages and why do we require them ? Give a brief description of different types of magnetic storages.

(b) On what basis the semiconductors and insulators are differentiated ? Why does the electrical conductivity of intrinsic silicon and germanium increase with increasing temperature ? Name different types of semiconducting devices.

(c) What is Meissner effect ? Distinguish between Type I and Type II superconductors with suitable curves and examples.

5. Attempt any two out of the following : **(10×2=20)**

(a) Explain the classification of ceramic materials with examples.

(b) What do you mean by linear polymers ? How are they formed ? Give three examples of linear polymers. Why do thermoplastic products have limitations on service temperature ?

(c) A glass-reinforced polyvinylidene chloride rod contains 25 weight per cent borosilicate glass fibres.All the fibres are aligned longitudinally. What fraction of load is carried by glass ?

Density of borosilicate glass 2·4 g/cm^3

Density of polyvinylidene chloride 1·7 g/cm^3

Modulus of elasticity of polyvinylidene chloride 350 MPa

Modulus of elasticity of borosilicate glass 70000 MPa.