

1/6/2016

FE sem II (CBGS) - App. Physics

QP Code : 28603

(2 Hours)

[Total Marks : 60

- N.B. : (1) Question no. 1 is compulsory.
(2) Attempt any three questions from Q.2. to Q. 6.
(3) Use suitable data wherever required.
(4) Figures to the right indicate full marks.

1. Attempt any five from the following:-

15

- (a) Draw (a) $(1\bar{1}2)$ (b) $(0\ 4\ 0)$ (c) $[0\ 4\ 0]$ with reference to a cubic unit cell.
(b) What is the probability of an electron being thermally promoted to the conduction band in diamond at 27°C , if the bandgap is 5.6 eV wide?
(c) Define drift current, diffusion current and mobility of charge carriers.
(d) What is dielectric polarization and dielectric susceptibility? Write the relation between them.
(e) State and explain Ohm's law in magnetic circuit.
(f) Write Sabine's formula and explain the terms used in it.
(g) Calculate the length of an iron rod which can be used to produce ultrasonic waves of 20kHz Given - $Y = 11.6 \times 10^{10} \text{ N/m}^2$, $\rho = 7.23 \times 10^3 \text{ kg/m}^3$
2. (a) Explain formation of energy bands in solids and explain classification on the basis of energy band theory. 8
(b) Zn has hcp structure. The nearest neighbour distance is 0.27nm. The atomic weight of Zn is 65.37. Calculate the volume of unit cell, density and atomic packing fraction of Zn. 7
3. (a) What is hysteresis? Draw a hysteresis loop for ferromagnetic material and explain various important parameters. 8
A magnetic material has a magnetization of 2300 A/m and produces a flux density of 0.00314 wb/m², Calculate magnetizing force and relative permeability of the material.
(b) Explain the statement "crystal act as three dimensional grating with X-rays". 7
Monochromatic X-ray beam of wavelength $\lambda = 5.8189 \text{ \AA}$ is reflected strongly for a glancing angle of $\theta = 75.86^\circ$ in first order by certain planes of cubic of lattice constant 3\AA . Determine Miller indices of the possible reflecting planes.
4. (a) Define Ligancy. Find the value of critical radius ratio for ligancy 4. 5
(b) An impurity of 0.01 ppm is added to Si. The semiconductor has a resistivity of $0.25 \Omega\text{m}$ at 300K. Calculate the hole concentration and its mobility. Atomic weight of Si is 28.1, density of Si = $2.4 \times 10^3 \text{ kg/m}^3$ 5
(c) Explain the origin of electronic, ionic and orientational polarization and temperature dependence of respective polarizability. 5

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5. (a) The density of copper is 8980kg/m^3 and unit cell dimension is 3.61 \AA . Atomic weight of copper is 63.54. Determine type of crystal structure. Calculate atomic radius and interplanar spacing of (1 1 0) plane. 5
- (b) What is Hall effect? Derive expression for Hall voltage with neat labelled diagram. 5
- (c) Explain how the reverberation time is affected by (i) size (ii) nature of wall surface (iii) audience in an auditorium. 5
6. (a) Estimate the ratio of vacancies at (i) -119°C (ii) 80°C where average energy required to create vacancy is 1.8eV . 5
- (b) How a p-n junction diode is used to generate a potential difference in a photovoltaic solar cell? 5
- (c) Explain with neat labelled diagram the construction and working of a piezoelectric oscillator. 5

Q.P. Code : 530101

(2 Hours)

[Total Marks : 60

- N.B. :** (1) Question No. 1 is **Compulsory**.
 (2) Attempt any **three** questions from remaining **five** questions.
 (3) **All** questions carry **equal** marks.
 (4) **Figures** to the **right** indicate **full** marks.
 (5) Atomic weights : H = 1, C = 12, N = 14, O = 16, S = 32, Cl = 35.5, Ba = 137.3

1. Answer any **five** of the following :-

15

- (a) What are plain carbon steels? Mention any four drawbacks of plain carbon steels.
 (b) Define Octane number and Cetane number.
 (c) Define 'Corrosion'? Explain how rate of corrosion of the following metals is influenced by atmospheric oxygen.
 (i) Molybdenum (ii) Tin
 (d) Give classification of composite materials.
 (e) Mention any three constituents of Paint and give their functions.
 (f) What is supercritical CO₂? Why is it considered a green solvent? Give one application of supercritical CO₂.
 (g) A sample of coal has the following composition by mass :
 C = 70% H = 9% O = 4%
 S = 2% N = 1% and Ash = 14%
 Calculate gross calorific value of the fuel using Dulong's formula.

2. (a) How do the following factors affect the rate of corrosion ?

6

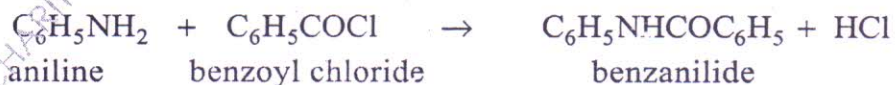
- (i) Purity of metal
 (ii) Nature of corrosion products
 (iii) Overvoltage

(b) What are propellants? Give their classification with an example of each type. Mention any four characteristics of a good propellant.

5

(c) Calculate percentage atom economy for the following reaction with respect to benzanilide

4



3. (a) A gaseous fuel has the following composition by volume.

6

- CO = 40% H₂ = 42% C₃H₈ = 4%
 CH₄ = 4% N₂ = 4% and O₂ = 6%

Calculate volume and weight of air required for complete combustion of 1m³ of fuel (Molecular wt. of air = 28.949)

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- (b) Explain conventional & green synthesis of Indigo dye. Mention the green chemistry principle involved. 5
- (c) Explain Intergranular corrosion with a suitable diagram and example. 4
4. (a) List composition, properties and uses of the following alloys : 6
(i) Duralumin (ii) Gun metal
- (b) What are metallic coatings ? Explain the following methods of coating. 5
(i) Metal cladding
(ii) Cementation coating (Sherardizing)
- (c) What are glass fibre reinforced composites ? Outline their properties, application and limitations. 4
5. (a) With neat diagram, explain any one method of catalytic cracking. Mention any four advantages of catalytic cracking over thermal cracking. 6
- (b) What is 'compaction' in powder metallurgy ? Explain Powder Injection moulding method of compaction with a suitable diagram. 5
- (c) Define matrix phase of composite material. State functions of matrix phase. 4
6. (a) What is Electrochemical corrosion ? With suitable diagram and electrode reactions explain electrochemical mechanism of rusting of iron in neutral, aqueous medium. 5
- (b) 1.5 g of a coal sample was analysed for nitrogen content by Kjeldahl's method. The liberated ammonia required 14ml of 0.1N H_2SO_4 solution for neutralization. In a separate experiment using Bomb Calorimeter, 1.5g of the same sample gave 0.3 g of $BaSO_4$. Calculate percentage nitrogen and sulphur in the sample. 5
- (c) (i) Explain any two purposes of alloying with suitable examples. 2
(ii) Explain manufacture of high purity alumina ceramic powder. 3
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