Seat No. : 1481

KJ-144

December-2012

CC-201 : PHYSICS

Time : 3 Hours] **[Max. Marks : 70**

Instructions : (1) Attempt **all** questions.
(2) Symbols used have their usual meanings.

1. (a) Discuss the Laue method to obtain and study the diffraction of X-rays by crystals. Give its uses. 7

OR

What are symmetry operations ? Discuss the different types of symmetry operations and corresponding symmetry elements.

(b) (i) Discuss the Covalent bond in detail. 4

(ii) Solve : The interplanar spacing between consecutive (3, 2, 1) planes is 0.8×10^{-10} m. What is its atomic radius. 3

OR

(i) Discuss the Ionic bond in detail.

(ii) Solve : The molecular weight of NaCl is 58.44 and the density is 2.167 gm/cm^3. Find the lattice constant.

2. (a) What is an amplifier ? Draw and discuss the CE amplifier circuit of a NPN transistor. Draw the Input-Output characteristic curves and explain how a dc load-line is drawn and the position of the Q point is determined. 7

OR

Discuss the Common Base (CB) amplifier configuration of an NPN transistor and discuss its input and output characteristics. Hence establish the relation between α and β.

(b) Draw the reverse bias characteristics of Zener diode and explain the zener breakdown. Explain with necessary circuit diagram how it can be used as a voltage regulator. 7

OR

Give the construction and describe the working of Uni Junction Transistor. Draw the characteristics.

3. (a) Explain Compton effect and derive the expression for the wavelength of scattered radiation in this effect. 7

OR

Give the features of the Sommerfield Atomic model. Derive the quantum condition $k/n = b/a$ for elliptical orbits of electron.

P.T.O.

(b) Establish Schrodinger one dimensional wave equation for a free particle. 7

OR

Define non-normalizable wavefunction and give the method of Box Normalization for a wavefunction $\psi = e^{i(\vec{k} \cdot \vec{r})}$.

4. (a) What are Fresnel's half period zones ? Discuss the theory and show that the amplitude at an axial point on the screen is half, the amplitude due to first half period zone. 8

OR

Derive the equation for intensity in Fraunhoffer diffraction by N parallel slits. State the conditions for maxima and minima.

(b) What is resolving power ? Discuss the resolving power of Telescope. 6

OR

Give the construction of a zone plate. Derive the equation for focal length of a zone plate.

5. Answers the following short questions : 14

(1) Define a lattice ?

(2) Calculate packing fraction for bcc structure.

(3) Calculate the distance between consecutive planes of a crystal if X-rays of wavelength 1.23 Å are incident at an angle of 60° in the Bragg's experiment.

(4) Draw the (2, 1, 1) plane.

(5) For a given transistor if $\beta = 100$, what is α ?

(6) For a given transistor $\alpha = 0.99$ and $I_{CO} = 10\ \mu A$, than what is I_{CEO} ?

(7) Calculate the De-broglie wavelength of a bullet of mass 40 gm moving with speed of 360 km/hr.

(8) Determine the orbit of the electron in hydrogen for n = 2 from the Sommerfield model.

(9) 0.5 MeV photon is Compton scattered through an angle of 60°. What is the energy of scattered photon ?

(10) What is a normalized wave function and what is normalization ?

(11) Give Rayleigh's criterion for limit of resolution.

(12) What will be the radius of the first zone of a zone plate with a focal length of 50 cm for light of wavelength 4000 Å ?

(13) A light of wavelength 5400 Å falls on a plane diffraction grating and a first order spectral line is obtained at 30°. How many lines per cm are there in the grating ?

(14) Find the number of lines in a plane grating capable of resolving the sodium doublet (5890 Å and 5896 Å) in the second order.