

Gujarat University

Sem - III

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. *69, 72* 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 . *105, 106, 107 - 108*

- (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 Sommerfeld Atomic model. Derive the quantum condition $k/n = b/a$ for elliptical orbits of electron.

- (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 Fraunhofer diffraction by N parallel slits. State the conditions for maxima and minima. 240

- (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 \AA 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 $I_{CO} = 10 \mu A$, then 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 \AA ?
- (13) A light of wavelength 5400 \AA 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 \AA and 5896 \AA) in the second order.

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Seat No. : _____

N25-103

December-2014

B.Sc., Sem.-III

201 : Physics

Time : 3 Hours]

[Max. Marks : 70

- Instructions :**
- (1) Attempt **all** questions.
 - (2) **All** questions carry equal marks.
 - (3) Symbols have their usual meanings.

1. (a) Explain symmetry operations in detail. *Refer to 2013* 7
OR
Calculate the packing fraction for BCC and FCC structure.
- (b) Write Bragg's law for X-ray diffraction. Explain Laue's method to study crystal diffraction. 7
OR
Explain Van der Waal's bond and obtain the expression $u(R) = \frac{4\alpha p_1^2}{R^6}$.
2. (a) Explain leakage current in : 7
(i) CB configuration and obtain the expression for I_C .
(ii) CE configuration and obtain the expression for I_{CEO} .
OR
Show that the maximum efficiency of a Class A amplifier is 25%.
- (b) Explain the construction and working of silicon controlled rectifier (SCR). 7
OR
Describe the working of zener diode as a voltage regulator.
3. (a) Explain Frank-Hertz experiment in detail. 7
OR
Obtain the energy equation in case of
(i) a particle in a box and
(ii) simple harmonic oscillator
- (b) Obtain the Schrödinger equation for a free particle in one dimension. 7
OR
Explain conservation of probability and show that Schrödinger equation satisfies conservation of probability.

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P.T.O.

4. (a) Obtain the expression for resolving power of a plane diffraction grating. 7

OR

- (i) How many lines on a grating should be used to resolve the lines of wavelengths 5890 \AA and 5896 \AA ?
- (ii) An objective of telescope has diameter of 3 m. What will be the minimum angle subtended by two stars, so that they can be seen as separate objects ? ($\lambda_{\text{av}}(\text{visible}) = 5500 \text{ \AA}$)

- (b) Explain :

- (i) Resolving power of telescope and
- (ii) Zone plate

OR

Discuss Fraunhofer diffraction by double slit and obtain an expression for the intensity.

5. Answer in brief :

- (1) Find the Miller indices of a plane whose intercepts on X, Y, Z axes are (2, 1, 2) respectively. 14
- (2) Find the Miller indices of a plane whose intercepts on X, Y, Z axes are (1, 1, ∞) respectively.
- (3) Define a primitive and non-primitive cell.
- (4) What is the co-ordination number in HCP structure ?
- (5) Write any one use of UJT.
- (6) Define Q-point.
- (7) What is a Transistor ?
- (8) What is Compton's effect ?
- (9) Define a rigid rotator.
- (10) Define normalized wave function.
- (11) Write Bohr's correspondence principle.
- (12) The area of Fresnel-half period zones is $A_n = \underline{\hspace{2cm}}$.
- (13) Write Rayleigh's criterion.
- (14) There are 12700 lines per inch in a plane grating. Find the angular position for 1st order maxima for the wavelength of 6000 \AA .