UG (CBCS) EVEN SEMESTER EXAMINATION, 2023

EDUCATION (B.Sc. B.Ed.)

PHYSICS (PASS)

6th Semester

Course No. : BSPP - 603

(Quantum Mechanics, Atomic & Nuclear Physics, Crystallography & Electronics)

Full Marks : 50

Pass Marks : 20

Time : 2 hours

The figures in the margin indicate full marks for the questions

1. (a) What is compton effect? Show that the compton shift is 1+7=8

$$\Delta\lambda = \lambda' - \lambda = \frac{h}{m_e C}\,(1 - cos\theta\,)$$

The symbols have their usual meanings.

(b) Estimate the value of compton wavelength of the proton. 2

Or

2. (a) Show that the wave group associated with a particle travels with the same velocity as the particle itself. 7

(b) Determine the binding energy (B.E) of an electron of an atom of atomic number Z using Heisenberg

uncertainty principle. Also evaluate the B.E of the electron of He and H atoms. 3

3. (a) Define excitation and ionization potentials. 2

(b) Discuss the working of Frank-Hertz experiment to determine the excitation potential of Hg atom. 8

Or

4. (a) Write the Sommerfeld's modifications in Bohr's theory of atom. And discuss how Bohr-Sommerfeld theory explain the fine structure of atomic line. 5

(b) Describe the formation of fine structure of H_α-Balmer line. 5

5. (a) Show that the mean life of a radioactive sample is the reciprocal of the decay constant. 5

(b) Discuss (i) secular and (ii) transient equilibrium 5

Or

6. (a) For a radioactive series

A $\rightarrow$ B $\rightarrow$ C ..... X (stable)

Show that $N_2 = \frac{\lambda_1 N_0}{\lambda_2 - \lambda_1} [e^{-\lambda_1 t} - e^{-\lambda_2 t}]$ 6

The symbols have their usual meanings.

(b) Explain how radioactive dating estimates the age of earth. 4

7. (a) Describe Bragg's law of X-ray diffraction. 4

(b) Show that the pracking fraction for a simple cubic (SC) structure is 52% for body centred cubic (bcc) structure is 68% and for a face centred cubic (fcc) structure is 74%. 6

Or

8. (a) Derive the experession for the interplanar spacing d(hkl) between two parallel planes with Miller indices (hkl) and show that for a simple cubic lattice is 6

$$d(h\,k\,l) = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$

(b) The spacing between principle planes of NaCl crystal is 2.8Å. It is found that first order Bragg's reflection occurs at an angle of 10^0. What is the wavelength of X-rays? 4

9. (a) Show that $I_{rms} = I_0/\sqrt{2}$ 2

(b) What is rectifier? Describe the working of a full wave rectifier using two pn junction diodes. 1+7=8

Or

10. (a) Explain the three transitor configurations. Draw the circuit diagram using p-n-p transistor. 3

(b) Describe the working of CE amplifier using n-p-n transistor. 5

(c) What is d.c load line? 2

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