AC-3075
B. Sc. (Sem. IV) Examination
April / May – 2015
Physics (For Electronics) : Paper - IV
(Quantum Mechanics & Laser)

Time : Hours
[Total Marks :
Instructions :
(1)

(2) Figures to the right indicate the total marks carried by the question.
(3) Symbols used in the question paper have their usual meanings.
(4) Students can use non-programmable scientific calculator, if required.
(5) \[ m_e = 9.1 \times 10^{-31} \text{ kg}, \quad e = 1.6 \times 10^{-19} \text{ C}, \]
\[ h = 6.62 \times 10^{-34} \text{ Js}, \quad \varepsilon_0 = 8.85 \times 10^{12} \frac{C^2}{Nm^2} \]

Q:1  Answer the following in brief. (Any eight). (8)
(1) State the features of Rutherford’s atomic model.
(2) Define excitation.
(3) Give full form of LASER.
(4) What is transverse velocity of electron?
(5) What is an angular quantum number?
(6) What is a gain constant?
(7) Which was the first successful laser?
(8) State any two properties of laser.
(9) What do you mean by population inversion?
(10) State Bohr’s second hypothesis.

Q:2  (A) State Bohr’s first hypothesis. Using it, derive an equation for the radius of electron orbit in hydrogen atom. (10)

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(B) Calculate the orbital angular momentum of electron in hydrogen atom in its first excited state.

OR

Q:2  (A) Add correction for the finite mass of the nucleus of hydrogen atom to the Bohr’s theory and derive an equation for total kinetic energy of electron.

(B) The fine structure constant appearing in Sommerfeld’s theory is given by \( \frac{e^2}{2\varepsilon_0 hc} \). Show that it is a unitless and dimensionless quantity.

Q:3  (A) Explain spontaneous and stimulated emission and derive equations among the Einstein’s coefficients.

(B) Explain the principle of laser.

OR

Q:3  (A) Explain the construction and working of He-Ne laser.

(B) Write a short note on applications of laser.

Q:4  Write short note on any two of the following.

(i) Cavity resonance
(ii) Ruby laser
(iii) Matter waves
(iv) Spectral series observed for hydrogen atom