



AC-3059

B. Sc. (Sem. - IV) Examination

April / May - 2015

Applied Physics : Paper - IV

(Quantum Mechanics & Laser)

Time : Hours]

[Total Marks : 50

Instructions :

(1)

नीचे दृष्टावेक निशानीवाणी विगतो उत्तरवही पर अवश्य कपवी.  
Fillup strictly the details of signs on your answer book.

Name of the Examination :  
B. SC. (SEM. - IV)

Name of the Subject :  
APPLIED PHYSICS : PAPER - IV

Subject Code No. : 3 0 5 9 Section No. (1, 2,.....): Nil

Seat No. :  
[ ] [ ] [ ] [ ] [ ] [ ]

Student's Signature

- (2) Figures to the right indicate the total marks carried by the question.  
(3) Symbols used in the paper have their usual meaning.  
(4) Students can use non-programmable scientific calculator, if required.

(5)  $m_e = 9.1 \times 10^{-31}$  kg,  $e = 1.6 \times 10^{-19}$  C ,

$$h = 6.62 \times 10^{-34} \text{ Js. , } \epsilon_0 = 8.85 \times 10^{-12} \frac{\text{C}^2}{\text{Nm}^2}$$

**Q:1 Answer the following in brief. (Any eight). (8)**

- (1) State the features of Rutherford's atomic model.
- (2) Define excitation.
- (3) What is transverse velocity of electron?
- (4) What is an angular quantum number?
- (5) Give full form of LASER.
- (6) Which was the first successful laser?
- (7) What is a gain constant?
- (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)**

(B) Calculate the orbital angular momentum of electron in hydrogen atom in its first excited state. (4)

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. (10)

(B) The fine structure constant appearing in Sommerfeld's theory is given by  $\alpha = \frac{e^2}{2\epsilon_0 hc}$ . Show that it is a unitless and dimensionless quantity. (4)

Q:3 (A) Explain spontaneous and stimulated emission and derive equations among the Einstein's coefficients. (10)

(B) Explain the principle of laser. (4)

OR

Q:3 (A) Explain the construction and working of He-Ne laser. (10)

(B) Write a short note on applications of laser. (4)

Q:4 Write short note on any two of the following. (14)

(i) Matter waves

(ii) Spectral series observed for hydrogen atom

(iii) Cavity resonance

(iv) Ruby laser

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