

## Second Semester B. E. Examination

## ADVANCED PHYSICS

Time : Two Hours ]

[ Max. Marks : 40

- N. B. : (1) All questions carry equal marks.  
 (2) Solve four questions as follows one or two, three or four, five or six, seven or eight.  
 (3) Assume suitable data wherever necessary.  
 (4) Illustrate your answers wherever necessary with the help of neat sketches.  
 (5) Use of non programmable electronic calculator is permitted.

## List of Constants :

- (1) Velocity of light =  $C = 3 \times 10^8$  m/s  
 (2) Charge on an electron =  $e = 1.602 \times 10^{-19}$  C  
 (3) Mass of an electron =  $m_0 = 9.11 \times 10^{-31}$  kg  
 (4) Mass of proton =  $m_p = 1.67 \times 10^{-27}$  kg  
 (5) Mass of  $\alpha$  - particle =  $m_\alpha = 6.64 \times 10^{-27}$  kg  
 (6) Charge of  $\alpha$  - particle =  $q_\alpha = 3.2 \times 10^{-19}$  C  
 (7)  $1 \text{ amu} = 1.67 \times 10^{-27}$  kg

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1. (a) Explain in brief construction and working of He:Ne laser with the help of suitable diagram. 4  
 (b) Explain the lasering action based on cavity resonator. 3  
 (c) A ruby laser emits light of wavelength 694.4 nm. If a laser pulse is emitted for  $1.2 \times 10^{-11}$  sec and the energy released per pulse is 0.15 J.

- (i) What is the length of the pulse ?  
 (ii) How many photons are there in each pulse ?

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OR

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2. (a) How can Newton's Rings experiment be used to determine refractive index of a liquid ? 4  
 (b) Fringes of equal thickness are observed in a thin glass wedge of RI 1.52. The fringe spacing is 0.1 mm, wavelength of light being  $5893 \text{ \AA}$ . Calculate wedge angle. 3  
 (c) A glass microscope lens ( $\mu = 1.5$ ) is coated with magnesium fluoride ( $\mu = 1.30$ ) film to increase the transmission of normally incident light ( $\lambda = 5800 \text{ \AA}$ ). What minimum film thickness would be deposited on the lens ? 3
3. (a) Show that the velocity acquired by an electron in uniform parallel Electrostatic field varies as the square root of potential difference through which it is accelerated. 3  
 (b) An electron passes undeviated through velocity selector having  $E = 10^4$  V/m and  $B = 0.02$  T. Determine the speed of electron. rtmnuonline.com 2  
 (c) Describe motion of electron when projected at an acute angle with the direction of uniform electric field and determine  
 (1) Maximum height  
 (2) Range of the charged particle  
 (3) Time taken to reach max. distance. 5

OR

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4. (a) How can a charged particle be made to travel a helical path in uniform magnetic field ? Obtain an expression for pitch of this helix. 218 4

- (b) A proton and  $\alpha$  particle with the same K. E. enter a region of uniform magnetic field moving at right angle to B. compare the radii of their circular paths. 3
- (c) A uniform magnetic field of 0.3 T exists along the X axis. A proton is shot into the field with speed of  $8 \times 10^6$  m/s at angle  $0^\circ$  with  $\alpha$ -axis. Describe the trajectory traced by the particle. 3
5. (a) Draw schematic diagram of CRO and explain the role of aquadag coating in CRT. 3
- (b) Describe construction and working of a cyclotron and state its limitation. 4
- (c) In a Bainbridge mass spectrograph, singly ionized atom of  $\text{Mg}^{26}$  passes into analysing chamber with velocity  $10^4$  m/sec having magnetic field of  $4 \times 10^{-2}$  wb/m<sup>2</sup>. Calculate the radius of path of singly ionized  $\text{Mg}^{26}$  atom. 3

OR

6. (a) Explain Beth's law with the help of necessary diagram and discuss the similarities with Snell's law. 4
- (b) Discuss the construction and working of velocity selector to produce the mono-velocity beam of charged particle. 3
- (c) A cyclotron with its disc of radius 150 cm has a magnetic field of 0.60 wb/m<sup>2</sup>. Calculate the maximum energy to which proton can be accelerated. 3
7. (a) Derive an expression for angle of acceptance in

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- numerical aperture of optical fibre. 4
- (b) Discuss any one application of an optical fiber as sensor. 3
- (c) A glass clad fibre is made with core glass of R.I. 1.5 and cladding is doped to give a fractional index difference of 0.0005, find.
- (1) cladding index, .
- (2) acceptance angle. 3

OR

8. (a) Discuss the classification of nano materials. 3
- (b) Discuss how nano materials have superior physical and chemical properties as compared to Bulk materials. 4
- (c) Discuss any two Engineering application of nano materials. 3

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