B.E. All Branches Second Semester (C.B.S.) / B.E. (Fire Engineering) Second Semester

Advanced Physics

P. Pages : 2 **NIR/KW/18/3288/3940**

Time : Two Hours * 1 1 6 9 * Max. Marks : 40

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Assume suitable data whenever necessary.
7. Illustrate your answers whenever necessary with the help of neat sketches.
8. Use of non programmable calculator is permitted.

List of constants :

Velocity of light $C = 3 \times 10^8$, Charge of electron $e = 1.602 \times 10^{-19} C$

Mass of electron $m = 9.11 \times 10^{-31} kg$

Mass of proton $m_p = 1.67 \times 10^{-27} kg$

Atomic mass unit = $1.67 \times 10^{-27} kg$

1. a) Explain construction and working of Ruby Laser with energy level diagram. **4**

b) Define the terms : **4**
i) Temporal coherence ii) Population Inversion
iii) Pumping iv) Stimulated emission

c) Compute coherence length of light with $6328 A^o$ in 10^{-9} sec . pulse duration. **2**

2. a) Derive an expression for fringe width (β) in wedge shaped thin film. **4**

b) How can Newton's rings experiment be used to determine refractive index of a liquid ? **3**

c) A material having an index of refraction 1.32 is used to coat a piece of glass. What should be minimum thickness of this film in order to minimize reflected light at a wavelength of 700 nm ? **3**

3. a) Show that the velocity acquired by an electron in longitudinal uniform electrostatic field varies as the square root of potential difference through which it is accelerated. **3**

b) Show that an electron moving with uniform velocity follows a parabolic path in a transverse uniform electric field. **4**

c) An electron with a velocity of $5.6 \times 10^6 m/s$ enters a uniform magnetic field of induction 0.084T perpendicular to the field lines. Determine the Lorentz force acting on the electron and radius of the circular path in which it moves. **3**

4. a) Explain the working of velocity selector. **3**

b) Explain how charged particle describes helical path in a uniform magnetic field. **4**

c) An electron moving with velocity 10^7 m/s enters at an angle 39º to the direction of uniform magnetic field. Calculate : **3**
i) Magnetic induction so that radius of helical path will be 3m
ii) Pitch of helix

5. a) Explain the law that governs the refraction of electrons. In what way it differs from the Snell's law ? **4**

b) Draw a neat block diagram of C.R.O. **3**

c) Protons are accelerated in a cyclotron. Magnetic field strength is 14×10^3 Gauss in the dees and radius of semicircle is 0.3 m. What is final energy acquired by proton. **3**

6. a) Explain construction and working of a cyclotron with neat labelled diagrams. Also state the resonance condition. **4**

b) Explain : **3**
i) Role of Aquadag coating
ii) Synchronization in C.R.O.

c) In a Bainbridge mass spectrograph, the electric field used is 25 kV/m and magnetic field is 0.2 wb/m^2. The element Tin is being analysed having isotopes of masses 116 and 120. Find linear separation between the lines produced on the photographic plate by singly charged ions of Tin 116 and 120. **3**

7. a) Deduce an expression for acceptance angle of an optical fibre. **4**

b) Differentiate between step index and graded index optical fibre. **3**

c) Find the fractional refractive index and numerical aperture for an optical fibre with refractive indices of core and cladding as 1.5 and 1.49 respectively. Determine numerical aperture of fibre. **3**

8. a) What are nanomaterials ? What is difference between Top-Down and Bottom-Up approach of synthesis of nanomaterial. **3**

b) Explain why following properties change in nanomaterials : **3**
i) Mechanical properties
ii) Physical properties
iii) Magnetic properties

c) Explain Sol-gel method of synthesis of nanomaterials. **4**

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