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

Advanced Physics

P. Pages : 2 **NJR/KS/18/4343/4997**

Time : Two Hours * 0 7 6 2 * 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:

i) Velocity of light $c = 3 \times 10^8$ m/sec.
ii) Charge of electron $e = 1.602 \times 10^{-19}$C
iii) Mass of electron $m = 9.11 \times 10^{-31}$ kg
iv) 1 amu $= 1.67 \times 10^{-27}$kg
v) Mass of proton $= 1.67 \times 10^{-27}$kg
vi) Planck's constant $= 6.634 \times 10^{-34}$J.sec

1. a) Differentiate between spontaneous emission and stimulated emission. **3**

b) Explain the working of He-Ne laser with the help of suitable energy level diagram. **4**

c) Calculate number of photons emitted per second by a 3mW laser emitting radiation of wavelength $6943 \overset{o}{A}$. **3**

OR

2. a) In Newton's Rings experiment, explain why **4**
i) Plano-convex lens should have larger radius.
ii) Rings get closer away from the center.
iii) Central fringe is dark in reflected light.
iv) Fringes are circular.

b) What is thin film? Derive the expression for wedge angle in case of wedge shaped thin film. **3**

c) A thin film of cryolite ($\mu = 1.35$) is applied to a common lens. The coating is designed to reflect at blue end of the visible spectrum and transmit wavelength at the near IR. What should be the minimum thickness of the film to be given to the lens to transmit light at $8000 \overset{o}{A}$? **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) Explain the working of velocity selector. **3**

c) An electron enters the region having $\vec{B} = 0.3\,\vec{i}$ (Tesla). The initial velocity is $\left(6\,\vec{i} + 4\,\vec{k}\right) \times 10^5 \,\text{m/sec}$. Find the pitch and radius of electron trajectory. **4**

OR

4. a) Prove that the path travelled by an electron in an uniform transverse electric field is a parabolic. **4**

b) How can a charged particle be made to travel a helical path in uniform magnetic field? Obtain an expression for pitch of this helix. **3**

c) An electron is projected with an initial velocity of $10^6 \,\text{m/s}$ & at an angle 40º to the horizontal into a uniform electric field of 3500 N/C. Find the maximum height to which electron rises vertically. Also calculate range of electron trajectory. **3**

5. a) What is Bethe's law? Discuss the refraction of electron beam across the boundary seperating two equipotential regions. **4**

b) Draw block diagram of CRO. **3**

c) In a Bainbridge mass spectrograph, singly ionised atom of Ne^{20} passes into deflection chamber with velocity of $10^3 \,\text{m/sec}$. If they are deflected by a magnetic field of flux density of $0.07 \,\text{wb/m}^2$. Calculate the radius of the path of singly ionised Ne^{20} atom. **3**

OR

6. a) Explain construction & working of a Bainbridge mass spectrograph. **4**

b) What is cyclotron? State resonance condition. Obtain the expression for maximum kinetic energy gained by the charged particle in cyclotron. **4**

c) A cyclotron with does of radius 3m has a magnetic field of $0.8 \,\text{wb/m}^2$. Calculate the maximum energy to which proton can be accelerated. **2**

7. a) Derive an expression for angle of acceptance and numerical aperture of optical fibre. **4**

b) Discuss any one application of an optical fibre as sensor. **3**

c) An optical fibre has a NA of 0.3 and a cladding of refractive index of 1.5. Determine the acceptance angle for the fibre in water which has a refractive index of 1.33. **3**

OR

8. a) Describe any one method of synthesis of Nanomaterials. **3**

b) Write short notes on **4**
i) Zeolite ii) Graphene.

c) State the applications of Nano materials in engineering. **3**

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