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SECOND YEAR (B.Sc. (Blended))
PHY401: Electricity, Magnetism, Special Relativity and Optics
(Semester IV)

Program: B.Sc. Blended
Program Specific: B.Sc. Blended (Chemistry)
Course Type: DSC
Paper: I

Credits: 2
Time: 2 Hours
Max. Marks: 30
SET: A

Instructions to the candidate:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Draw a well labelled diagram wherever necessary.
- 4) Use of scientific calculator and log table is allowed.

Q1) Answer the following

[5 X 1= 5]

- a) Define polar molecule.
- b) Define magnetic flux.
- c) State Biot Savart's law.
- d) What are the two conditions for diffraction?
- e) What will be the length of object which is moving with speed of light?

Q2) Answer the following (Attempt any 5/7)

[5 X 2 =10]

- a) Two parallel plates have equal and opposite charges. When the space between two plates is vacuum, the electric intensity is 3×10^6 V/m. When the space is filled with dielectric, the electric intensity becomes 1.5×10^6 V/m. Find dielectric constant.
- b) What do you mean by dielectric material?
- c) Two long straight wires are carrying electric currents 10A in opposite directions. The separation between the wires is 4 cm. Find magnetic field at point midway between the wire.
- d) What do you understand by twin paradox?
- e) What is the increase in relativistic mass of a particle of rest mass 1 gm when it is moving with velocity $0.8 c$?
- f) Why the centre of Newton's rings is dark?
- g) State Lorentz transformation equations.

Q3) Answer the following/Write short notes on following (Attempt any 2/4)

[2 X 5 = 10]

- Write a short note on electric polarization of dielectric.
- The parallel-plate capacitor of plate area 0.01m^2 is filled with dielectric of dielectric constant 5. Its capacitance is 2×10^{-10} F and it has been charged to 50 v. Find electric field intensity in dielectric. (Given- $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$)
- A proton is projected with speed of 3×10^6 m/s horizontally from east to west. A uniform magnetic field of strength 4×10^{-3} T exists in vertically upward direction. Find the force on proton just after its projection. Also calculate the acceleration produced. (Given- mass of proton = 1.67×10^{-27} kg and charge = 1.6×10^{-19} C)
- Prove the relation

$$\lambda = \frac{Dm^2 - Dn^2}{4(m-n)R}$$

Q4) Answer the following (Attempt any 1/2)

[5 X 1 = 5]

- Obtain an expression for time dilation.
- Diameter of 10^{th} dark ring in Newton's ring experiment is 0.5 cm. Calculate the radius of curvature of the lens and air thickness at the position of ring. The wavelength of light used is 5000 \AA .
