This question paper contains 3 printed pages.]

Your Roll No. .....

# 517

## Subsidiary for B.Sc. Honours/II A

### PHYSICS – Paper IV

### Electromagnetism and Atomic Physics

**Time : 3 Hours** **Maximum Marks : 50**

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

Attempt any **five** questions.
**All** questions carry equal marks.
Attempt parts of a question together.

1. (a) State and prove Gauss's theorem in electrostatics. 3

   (b) Derive an expression for the electric field of uniformly charged infinite linear conductor having a uniform charge density of $\lambda$. 3

   (c) Calculate electric field due to a uniformly charged solid sphere when the field point is (i) inside and (ii) outside the sphere. 4

2. (a) State and explain Biot Savart's law. Using this law, derive an expression for the field at any point lying on the axis of a circular loop. 5

   (b) Give the construction and theory of moving coil ballistic galvanometer. 5

3. (a) Explain the Kirchhoff's laws. Twelve identical wires each of resistance R are connected to form a cube. A battery is connected to two opposite corners of a face of the cube. Show that the equivalent resistance between these points is 3R/4. 5

(b) Define self and mutual inductance. Calculate the self inductance for a long solenoid. 5

4. (a) What is a triode valve ? Define $r_p$, $g_m$ and $\mu$ for it. Obtain the relation among these parameters of a Triode valve. 7

(b) Distinguish between peak value and root mean-square value of a sinusoidal e.m.f. How are these related to each other ? 3

5. What are positive rays ? How are these produced ? Discuss Thomson's parabola method for positive ray analysis. 1, 2, 7

6. (a) Deduce Bragg's law for the diffraction of X-rays. How will you use it to determine the wavelength of X-rays ? 6

(b) Give an account of the law of disintegration of a radioactive substance. Use this law to obtain expressions for mean life. 4

7. State Bohr's postulates for the hydrogen atom. Find the expression for the energy levels for this atom. Draw its energy-level diagram and show the transitions corresponding to Lyman series on this diagram. **10**

8. Write short notes on any **two** of the following :
   (a) Triode as an amplifier.
   (b) Einstein's explanation for the photo-electric effect.
   (c) Uncertainty principle.
   (d) Cathode ray oscillograph. **5, 5**

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