This question paper contains 3 printed pages.]

Your Roll No. .....

1393 **A**

B.Sc. (Hons.)/I

ELECTRONIC SCIENCE—Paper 1.2 (II)

(Electricity and Magnetism)

Time : 3 *Hours* *Maximum Marks* : 38

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

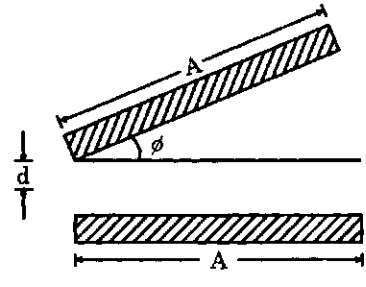
Attempt ***four*** *questions in all, including* Q. No. **1** *which is compulsory.*

1. Attempt any ***five*** of the following : 2 × 5

(a) If the electric field is given by $\vec{E} = 8\hat{i} + 4\hat{j} + 3\hat{k}$, calculate the electric flux through a surface of area 100 units lying in the X-Y plane.

(b) A capacitor has square plates, each of side 'A' making an angle ϕ with each other as shown in the figure below. Show that for small angle ϕ the capacitance is given by :

$$C = \frac{\epsilon_0 A^2}{d}\left[1 - \frac{2\phi}{2d}\right]$$



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(c) State and explain Kirchhoff's laws.

(d) Show that the mutual inductance between two coils of self inductances L_1 and L_2 can not exceed $\sqrt{L_1 L_2}$

(e) What do you understand by hysteresis, retentivity and coercivity? Explain.

(f) Explain how a parallel resonant LCR circuit acts as a rejector circuit.

2. State and prove Gauss's theorem in electrostatics. Using this theorem find an expression for the mechanical force per unit area on the surface of a charged conductor. 7

3. (a) Obtain an expression for the electrostatic energy of the system of N number of charges. 3

(b) Evaluate the electrostatic energy of a uniformly charged sphere and show that it is 6/5 times the energy of a conducting sphere having the same amount of charge and of same radius. 4

4. (a) Explain seebeck effect, Peltier effect and Thomson effect. 4

(b) Define π, σ and obtain a relation between them. The symbols have their usual meanings. 3

5. Differentiate between paramagnetic, diamagnetic and ferromagnetic substances. Discuss in detail the Langevin's theory of paramagnetism. 7

6. (a) Write down the Maxwell's equations. Obtain the wave equation and velocity of electromagnetic waves in free space. 3½

   (b) Derive an expression for Poynting vector and give physical significance. 3½

7. Write short notes on any ***two*** of the following : 3½ + 3½

   (a) Sensitivity of Wheatstone's Bridge.

   (b) Clausius and Mossotti relation.

   (c) Langevin's theory of Diamagnetism.