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Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2018

(CUCBCSS—UG)

Physics

PHY 4B 04/APY 4B04—ELECTRODYNAMICS—I

Time : Three Hours

Maximum : 80 Marks

I. Answer *all* questions, each question carries 1 mark (in a word or phrase) :

- 1 Give an example of a physical quantity to be quantized.
- 2 For a given potential difference does a capacitor store more or less charge with a dielectric than it does without a dielectric ?
- 3 What is force on surface charge ?
- 4 Can two different equipotential surface intersect ?
- 5 What is Laplace equation ?
- 6 What is bound charge ?
- 7 Is there any difference between dielectric constant and dielectric strength ?
- 8 Write down the expression for magnetic field of toroidal coil.
- 9 What is the use of magnetic vector potential ?
- 10 Why electrostatic potential is a scalar ?

(10 × 1 = 10 marks)

II. Answer *all* questions, each question carries 2 marks (Answer in two or three sentences) :

- 11 Electric charge is quantized. What does this statement mean ?
- 12 A dipole in a uniform electric field experiences no net force. Is this statement true or false ? Give the reason for your answer.
- 13 State two properties of electric field.
- 14 State mean value theorem.
- 15 State the properties of solutions of Laplace's equation.
- 16 What is bound currents ?
- 17 Discuss magnetic field inside matter.

(7 × 2 = 14 marks)

III. Answer any *five* questions, each question carries 4 marks (Answer in a paragraph) :

- 18 Derive the expression for capacitance of a parallel plate capacitor with partially filled dielectric.
- 19 Briefly discuss the method of images.

Turn over

- 20 Obtain Clausius-Mosotti formula.
- 21 Show that $\nabla \cdot \mathbf{B} = 0$.
- 22 Give a brief account of comparison of Magneto statics and electrostatics.
- 23 Use Biot-Savart law to find the magnetic field inside and outside an infinitely long current carrying solenoid.
- 24 Explain magneto static boundary condition.

(5 × 4 = 20 marks)

IV. Answer any *four* questions, each question carries 4 marks :

- 25 An electron with a velocity of 2.4×10^6 m/s flies into a uniform electric field of intensity 135 Vm^{-1} . It moves along a field line until it comes to a halt. Calculate the distance travelled by the electron within the field.
- 26 Three charges $+1.5q$, $+1.5q$ and $-3q$ are placed at the vertices of an equilateral triangle of side b . Find the dipole moment of the charge distribution.
- 27 Dielectric constant of a gas at NTP is 1.000074. Calculate dipole moment of each atom of the gas when it is held in an external field of $3 \times 10^4 \text{ Vm}^{-1}$
- 28 A wire shaped to regular hexagon of side 2 cm. carries a current of 2 amperes. Find the magnetic induction at the centre of the hexagon.
- 29 Derive an expression for the gyro magnetic ratio.
- 30 In the Rowland ring 2.0 amp current is passing through the winding of number of turns per unit length 10- turns /cm. Magnetic Induction measured is 1.0 weber/m^2 Calculate (a) H, (b) M.
- 31 A toroidal winding of N turns surrounding a ferromagnetic specimen in which a narrow gap of width d has been cut. Calculate the value of magnetic field both in the gap and in the material.

(4 × 4 = 16 marks)

V. Answer any *two* questions, each question carries 10 marks :

- 32 Derive an expression for the potential at a point due to a uniformly charged spherical shell.
- 33 Obtain Laplace's equation in two and three dimensions. Explain the properties of the solutions. State mean value and maximum value theorem.
- 34 Explain the terms polarization and displacement. Derive the relation connecting them. Derive an expression for potential of polarized objects.
- 35 Discuss in detail the Ampere's law in Magnetized materials. Derive an expression for the magnetic field at any point inside and outside of a long copper rod of radius R carries a uniformly distributed current I.

(2 × 10 = 20 marks)