**D 41960** (Pages : 2) 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 $\nabla . B = 0$ .

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 $2.4 \times 10^6$ 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 + 1.5$q$ + 1.5$q$ and – 3$q$ 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 $3 \times 104$ $Vm^{-1}$

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)