

**B.Sc. DEGREE EXAMINATION NOVEMBER 2016**  
**BRANCH III - PHYSICS**  
**FIFTH SEMESTER**

REG. No. \_\_\_\_\_

**COURSE : MAJOR – CORE**  
**PAPER : ELECTROMAGNETISM**  
**TIME : 30 MINS.**

**MAX. MARKS : 30**

**SECTION – A**

**TO BE ANSWERED IN THE QUESTION PAPER ITSELF**

**ANSWER ALL QUESTIONS:**

**(30 x 1 = 30)**

**I. CHOOSE THE CORRECT ANSWER:**

- According to coulomb's theorem, the electric field at any point near a charged conductor is  
a)  $\frac{1}{\epsilon_0}$                       b)  $\frac{\sigma}{\epsilon_0}$                       c)  $\frac{\epsilon_0}{\sigma}$                       d)  $\sigma \times \epsilon_0$
- The differential form of Gauss's law is  
a)  $\text{div } E = \frac{\rho}{\epsilon_0}$                       b)  $\text{div } E = \frac{\epsilon_0}{\rho}$                       c)  $\text{div } E = \epsilon_0 \times \rho$                       d)  $\text{div } E = \frac{\rho}{\epsilon_0}^2$
- The capacitance of a parallel plate capacitor is 400 picofarad and its plates are separated by 2 mm of air. The energy of the capacitor when it is charged to 1500 volts is  
a)  $45 \times 10^{-4} J$                       b)  $450 \times 10^{-4} J$                       c)  $4.5 \times 10^{-4} J$                       d)  $0.45 \times 10^{-4} J$
- (i) Water molecules possess permanent dipoles.  
(ii) Polar molecules when subjected to an electric field experience a torque tending to align their dipole moments parallel to the field direction.  
Which of the above statement is correct?  
a) only (ii)                      b) only (i)                      c) both (i) and (ii)                      d) none of the above
- The magnitude of the induced dipole moment is directly proportional to  
a) electric field                      b) dielectric constant                      c) thickness                      d) area
- Decrease in the value of electric field depends upon the degree of \_\_\_\_\_ of the dielectric material which further depends upon the \_\_\_\_\_ of the material.  
a) polarization, dielectric constant                      b) dielectric constant, polarization  
c) polarization, density                      d) polarization, thickness
- The equation of continuity of current flow is  
a)  $\nabla \cdot J + \frac{d\rho}{dt} = 0$                       b)  $\nabla \cdot J + \frac{d\rho}{dt} = 1$                       c)  $\nabla \cdot J + \frac{dt}{d\rho} = 0$                       d)  $\nabla \cdot J + 1 = \frac{dt}{d\rho}$
- The magnetic polarity of the current carrying solenoid is given by  
a) Biot – savart law                      b) Ampere's law                      c) Gauss's law                      d) end rule



**III. FILL IN THE BLANKS:**

21. The electrostatic force between two point charges kept at distance  $d$  apart, in a medium  $\epsilon_r = 6$  is 0.3 N. the force between them at the same separation in vacuum is \_\_\_\_\_.
22. The polarization of a dielectric means the displacement of charges in the atoms of the dielectric under the action of the applied field. The charges so displaced are called \_\_\_\_\_.
23. In the presence of an electric field  $E$  and magnetic field  $B$ , the total force on a moving charged particle is \_\_\_\_\_.
24. \_\_\_\_\_ is the ability of the material to allow the passage of magnetic lines of force through it.
25. \_\_\_\_\_ demonstrated the reverse effect of Oersted experiment.

**IV. ANSWER BRIEFLY:**

26. Define electric potential.
27. What is meant by induced dipoles?
28. Define current density.
29. Define magnetic permeability.
30. Define coefficient of mutual induction.

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STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.  
(For candidates admitted during the academic year 2011-12 & thereafter)

SUBJECT CODE : 11PH/MC/EM54

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**COURSE : MAJOR – CORE**  
**PAPER : ELECTROMAGNETISM**  
**TIME : 2 ½ HOURS** **MAX. MARKS : 70**

**SECTION – B** **( 5 x 5 = 25 )**  
**ANSWER ANY FIVE QUESTIONS**

1. Describe Poisson's and Laplace's equation and its importance in physics.
2. A cylinder of large length has a charge of  $2 \times 10^{-8}$  Coulomb/ meter. Find the field intensity at a distance of 0.2 m from it.
3. A sample of  $H_2O$  is placed in an electric field of  $2 \times 10^4$  NC<sup>-1</sup>. The displacement of each  $H_2O$  molecule is  $3.4 \times 10^{-30}$  Cm .
  - (i) Find the value of molecular polarizability.
  - (ii) Find the maximum torque that can act on a molecule.
4. Obtain an expression for the magnetic induction at a point due to an infinitely long straight conductor carrying current.
5. In an atom, an electron circulates in a path of radius  $5.1 \times 10^{-11}$  m at a frequency of  $6.8 \times 10^{15}$  rps . What is the value of the magnetic field at the centre of orbit?  
( $\mu_0 = 4\pi \times 10^{-7}$  Wb A<sup>-1</sup>m<sup>-1</sup>)
6. The magnetic susceptibility of a medium is  $948 \times 10^{-11}$  henry / m . Calculate its absolute permeability and relative permeability.
7. Calculate the mutual inductance between two coils when a current of 4 A changing to 8 A in 0.5 s in one coil, induces an emf of 50 mV in the other coil.

**SECTION C** **( 3 x 15 = 45 )**  
**ANSWER ANY THREE QUESTIONS**

8. (i) State the principle of a capacitor.  
(ii) Derive an expression for the capacity of parallel plate capacitor. What will be the capacity of the space between the plates is partially filled with a slab of thickness  $d$  and dielectric constant  $K$  ?

9. (i) Find an expression for the Gauss's law in a dielectric medium.  
(ii) Explain polar and non-polar molecules. Mention one example each.
10. Explain the principle, construction and working of cyclotron. Write its limitations.
11. (i) Explain clearly what do you understand by the dia, para and ferromagnetism.  
(ii) Derive an expression for the torque acting on the magnetic dipole when it is placed in a uniform field.
12. (i) State Faraday's law of electromagnetic induction.  
(ii) Derive Maxwell's equation

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