2019/TDC/EVEN/PHYDSC/
PHYGEC-201T/043

TDC (CBCS) Even Semester Exam., 2019

PHYSICS

(2nd Semester)

Course No. : PHYDSC-201T/PHYGEC-201T

(Electricity and Magnetism)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* of the following questions : 1×2=2

(a) What is scalar product of two vectors?

(b) What is gradient of a scalar function?

(c) State Gauss' divergence theorem.

2. Answer *either (a)* and *(b) or (c)* and *(d)* :

(a) If a vector field is given by

$$\vec{F} = (x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j},$$

show that the field is irrotational. 4

(b) Prove Gauss' divergence theorem. 4

Or

(c) If $\vec{r} = \hat{i}x + \hat{j}y + \hat{k}z$, prove that $\nabla(r^n) = nr^{n-2}\vec{r}$. 4

(d) (i) If $\phi = x^2 + xy + z^2$, calculate grad ϕ. 2

(ii) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, calculate $\vec{\nabla} \cdot \vec{r}$. 2

UNIT—II

3. Answer any *two* of the following questions : 1×2=2

(a) Draw the electric field lines due to a positive point charge.

(b) Define capacitance of a capacitor.

(c) Define electric flux.

4. Answer *either (a)* and *(b) or (c)* and *(d)* :

(a) State and prove Gauss' theorem of electrostatics. 4

(b) Express electric potential as an integral of electric field. 4

Or

(c) State and deduce the Gauss' theorem in dielectrics. 4

(d) Obtain the expression of capacitance of a parallel-plate capacitor. 4

UNIT—III

5. Answer any *two* of the following questions : 1×2=2

(a) State Biot-Savart law of magnetostatics.

(b) Divergence of magnetic field is zero $(\vec{\nabla} . \vec{B} = 0)$—what does it imply?

(c) Define magnetic susceptibility.

6. Answer *either (a)* and *(b) or (c)* and *(d)* :

(a) Distinguish between diamagnetic and ferromagnetic materials. Give some examples of these materials. 4

(b) Define magnetic intensity and magnetic induction. Obtain the relation between magnetic susceptibility and magnetic permeability. 2+2=4

Or

(c) Obtain the expression for magnetic field intensity at a point due to a straight wire-carrying current I. 4

(d) State Ampere's circuital law. Use it to find the magnetic field inside a solenoid-carrying current *I*. 4

UNIT—IV

7. Answer any *two* of the following questions : 1×2=2

(a) Define mutual inductance.

(b) How does self-inductance of a coil vary with length of the coil?

(c) What is the significance of Lenz's law?

8. Answer *either (a)* and *(b) or (c)* and *(d)* :

(a) Derive the expression for energy stored in an inductor-carrying current *I*. 4

(b) Obtain the expression for mutual inductance of two long solenoids each of length *l* and area of cross-section *A*. 4

Or

(c) Explain the working principle of a transformer with necessary diagram. 4

(d) State and explain Faraday's laws of electromagnetic induction. 4

UNIT—V

9. Answer any *two* of the following questions : 1×2=2

(a) What is displacement current?

(b) Write the relation between magnetic field ($\vec{B}$), electric field ($\vec{E}$) and velocity of light.

(c) What is the significance of Poynting vector?

10. Answer *either (a)* and *(b) or (c)* and *(d)* :

(a) Write Maxwell's equations of electromagnetism in integral and differential forms. 4

(b) Deduce the equation of continuity. 4

Or

(c) Derive the expression for Poynting vector $\vec{P}$. 4

(d) Obtain the expression for total energy stored in an electromagnetic field. 4

★★★