

**2024/TDC (CBCS)/EVEN/SEM/
PHSDSC/GEC-201T/089**

TDC (CBCS) Even Semester Exam., 2024

PHYSICS

(2nd Semester)

Course No. : PHSDSC/GEC-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 *three* of the following questions :

1×3=3

- (a) What is vector product of two vectors?
- (b) What is curl of a vector function?
- (c) What is the physical significance of $\vec{\nabla} \cdot \vec{F}$?
- (d) Define surface integral.

2. Answer any one of the following questions : 2

- (a) If $\phi = x^2 + xy + z^2$, then calculate $\text{grad } \phi$.
 (b) State Gauss' divergence theorem.

3. Answer any one of the following questions : 5

- (a) If $\vec{r} = \hat{i}x + \hat{j}y + \hat{k}z$, prove that

$$\vec{\nabla}(r^n) = nr^{n-2}\vec{r}$$

- (b) Evaluate $\iiint_V (2x+y) dV$, where V is the region bounded by the cylinder $z = 4 - x^2$ and the planes $x=0$, $y=0$, $y=2$ and $z=0$.

UNIT—II

4. Answer any three of the following questions :

1×3=3

- (a) Define electric potential.
 (b) Draw the electric field lines due to a positive point charge.
 (c) Define capacitance of a capacitor.
 (d) What is electric dipole?

5. Answer any one of the following questions : 2

- (a) Find an expression for electric field due to a point charge.

- (b) Show that the potential difference between any two points in an electric field is given by the line integral of the electric field taken over any path joining them.

6. Answer any one of the following questions : 5

- (a) State and prove Gauss' theorem of electrostatics.
 (b) Obtain the expression of capacitance of a parallel-plate capacitor. What will happen to the capacitance of a parallel-plate capacitor if we introduce a dielectric in the space between the parallel plates?

UNIT—III

7. Answer any three of the following questions :

1×3=3

- (a) Define magnetic vector potential.
 (b) State Ampere's circuital law.
 (c) Define magnetic intensity.
 (d) What is paramagnetic material?

8. Answer any one of the following questions : 2

- (a) State Biot-Savart law of magnetostatics.

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(b) Explain the divergence of magnetic field is zero.

9. Answer any *one* of the following questions : 5

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

(b) Define magnetic permeability and magnetic susceptibility. Establish the relation $\mu = \mu_0(1 + X)$, where the symbols have their usual meanings.

UNIT—IV

10. Answer any *three* of the following questions :

1×3=3

(a) What is electromagnetic induction?

(b) Define self-inductance of a coil.

(c) State Lenz's law.

(d) Name the principle on which the working of a transformer based on.

11. Answer any *one* of the following questions : 2

(a) Find an expression for energy stored in magnetic field.

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

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12. Answer any *one* of the following questions : 5

(a) State and explain Faraday's law of electromagnetic induction. Also explain the significance of Lenz's law.

(b) Explain the working principle of a transformer with necessary diagram. What are the different losses of transformer?

UNIT—V

13. Answer any *three* of the following questions :

1×3=3

(a) What is displacement current?

(b) Define Poynting vector.

(c) What is the basic source of electromagnetic waves?

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

14. Answer any *one* of the following questions : 2

(a) State Maxwell's equations.

(b) What is the significance of Poynting vector?

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(Turn Over)

15. Answer any one of the following questions : 5

(a) State and prove the equation of continuity.

(b) Obtain the wave equation of electromagnetic wave in free space. Show that the speed of waves is equal to the speed of light.

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