2022/TDC(CBCS)/EVEN/SEM/
PHSDSC/GEC-201T/112

**TDC (CBCS) Even Semester Exam., 2022**

# 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*

## SECTION—A

Answer any *fifteen* questions : 1×15=15

1. Define dot product of two vectors.
2. Write $\vec{A}\times\vec{B}$ in differential form.
3. What is gradient of a scalar function?
4. What is the physical interpretation of $\vec{\nabla}\cdot\vec{F}$?
5. Define electric potential.
6. Draw the electric field lines due to a positive point charge.

7. Define electric field intensity.

8. What is capacitance of a capacitor?

9. State Ampere's circuital law.

10. What is magnetic intensity?

11. Define magnetic induction.

12. What is the divergence of magnetic field $\vec{B}$?

13. Write the SI unit of self-inductance.

14. Define mutual inductance.

15. What is the physical significance of curl of a magnetic field?

16. How does self-inductance of a coil vary with length of the coil?

17. Which law does $\vec{\nabla} \times \vec{E} = \frac{-\partial \vec{B}}{\partial t}$ represent?

18. What is the integral form of first Maxwell's equation of electromagnetism?

19. Write the Maxwell's equation which gives Gauss' law in electrostatics.

20. Why are electromagnetic waves called so?





## SECTION—B

Answer any *five* questions : 2×5=10

21. If $\phi = x^2 + xy + z^2$, then calculate grad $\phi$.

22. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then calculate $\vec{\nabla} \cdot \vec{r}$.

23. Is electric flux a scalar quantity? Give the SI unit of electric flux.

24. Electric field intensity within a conductor is always zero. Why?

25. State Biot-Savart law.

26. Establish the relation $\mu = \mu_0(1 + x)$, where the symbols have their usual meanings.

27. What is the significance of Lenz's law?

28. State Faraday's law of electromagnetic induction.

29. What is displacement current?

30. Define Poynting vector.

## SECTION—C

Answer any *five* questions : 5×5=25

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

**32.** If $\vec{F} = 2x\hat{i} - x\hat{j} + y\hat{k}$, then evaluate

$$\iiint_V \vec{F}\, dV$$

where $V$ is the given region bounded by the surfaces $x = 0$, $y = 0$, $x = 2$, $y = 4$, $z = x^2$ and $z = 2$.

**33.** State and prove Gauss' theorem of electrostatics.

**34.** Obtain the expression of capacitance of a parallel-plate condenser.

**35.** Distinguish between diamagnetic and ferromagnetic materials. Give some examples of these materials.

**36.** Use Biot-Savart law to find the magnetic field intensity inside an infinitely long solenoid.

**37.** Explain the working principle of a transformer with necessary diagram.

**38.** Derive the expression for energy stored in an inductor carrying current $I$.

**39.** Deduce the equation of continuity.

**40.** Obtain the expression for total energy stored in an electromagnetic field.

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