CENTRAL LIBRARY N.C.COLLEGE

2023/TDC(CBCS)/EVEN/SEM/
PHSDSC/GE-201T/003

TDC (CBCS) Even Semester Exam., 2023

PHYSICS

(2nd Semester)

Course No. : PHSDSC/GE-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. What is the condition for two vectors to be perpendicular?

2. What is meant by solenoidal vector?

3. State Stokes' theorem of vectors.

4. Define line integral.

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5. What is meant by electric flux?

6. State Gauss theorem of electrostatics.

7. What will happen to the capacitance of a parallel plate capacitor if we introduce a dielectric in the space between the parallel plates?

8. If electric potential V within certain region is constant, what is the nature of electric field inside the region?

9. Define magnetic susceptibility.

10. Define magnetic permeability.

11. Why can two magnetic lines of force never intersect each other?

12. What is paramagnetic material?

13. What is mutual induction?

14. Name the principle on which the working of a transformer based on.

15. What is electromagnetic induction?

16. What is the unit of magnetic flux in SI system?

17. Write down the equation of continuity of current.

18. What is the modified form of Ampere's circuital law?

19. Which law signifies the non-existence of magnetic monopole?

20. What is the basic source of electromagnetic waves?

SECTION—B

Answer any *five* questions : 2×5=10

21. Discuss the physical significance of divergence of vector field.

22. Evaluate 'grade r', where $\vec{r}$ is a position vector.

23. Find the expression for capacity of a spherical conductor.

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24. Express electric potential as line integral of electric field.

25. What is magnetic vector potential?

26. A closely wound solenoid of 1200 turns has an axial length of 80 cm and radius of 1·5 cm. A current of 1·2 A flows in the solenoid. Find the intensity of magnetic field at the middle of the axis.

27. State Faraday's laws of electromagnetic induction.

28. State different losses of transformer.

29. State Maxwell's equations.

30. What is displacement current?

SECTION—C

Answer any *five* questions : 5×5=25

31. Define gradient of a scalar function. Show that the gradient of a scalar function at any point is a vector representing the greatest rate of change of scalar function at that point. 5

32. *(a)* Show that vectors $\vec{A} = 3\hat{i} - 2\hat{j} + \hat{k}$, $\vec{B} = \hat{i} - 3\hat{j} + 5\hat{k}$ and $\vec{C} = 2\hat{i} + \hat{j} - 4\hat{k}$ form a right-angled triangle. 3

(b) Show that vectors $\vec{A} = 2\hat{i} - 3\hat{j} - \hat{k}$ and $\vec{B} = -6\hat{i} + 9\hat{j} + 3\hat{k}$ are parallel. 2

33. What is an electric dipole? Find the potential due to a short electric dipole at any arbitrary point. 1+4=5

34. Find the electric field intensity due to a uniformly charged spherical shell at different points. 5

35. Using Biot-Savart law, find the magnetic field at a point due to a long straight conductor. 5

36. Find the expressions for divergence and curl of magnetic field. 2+3=5

37. State Lenz's law. Show that it is in accordance with law of conservation of energy. 1+4=5

38. What is the coefficient of self-induction? What is its unit? Calculate the coefficient of self-induction of a coil of 1000 turns when current of 2·5 A produces a magnetic flux of 0·5 μ weber. 2+1+2=5

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39. Obtain the wave equation of electromagnetic wave in free space. Show that the speed of waves is equal to the speed of light. 5

40. What is Poynting vector? Find the expression for energy density in electromagnetic wave. 1+4=5

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