TDC (CBCS) Even Semester Exam., 2022

PHYSICS

(Honours)

(2nd Semester)

Course No. : PHSHCC-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 *ten* questions : 2×10=20

1. Two point charges are placed at a certain distance apart. The electric field intensity is zero at a point between them. What can you conclude about the charges?

2. What can you say about the electric field intensity E—
   (a) in a region where potential V is constant;
   (b) at a point where V is zero?

3. Write Laplace's and Poisson's equations.

4. Find the capacitance of the earth taking its radius to be 6400 km.

5. Write the significance of electric displacement vector.

6. What is dielectric polarization?

7. Define magnetic field induction $\vec{B}$. Give its SI unit.

8. What is magnetic dipole moment? For a circular coil carrying current, how does the magnetic moment change on doubling its radius?

9. What is meant by vector potential?

10. What are magnetization vector and magnetic intensity?

11. Explain whether Lenz's law is in accordance with the law of conservation of energy.

12. Write the Maxwell's equation which expresses non-existance of magnetic monopoles.

13. State Kirchhoff's laws.

14. What is current sensitivity? On what factors does it depend?

15. State maximum power transfer theorem.

SECTION—B

Answer any *five* questions : 6×5=30

16. State and prove Gauss' law in electrostatics. Express Gauss' law in differential form. 3+3=6

17. Find the expression for electric field intensity and electric potential due to an electric dipole. 3+3=6

18. *(a)* Find an expression for force acting on the surface of a conductor.
    (b) Define electrical susceptibility. Show how it is related to dielectric constant. 3+3=6

19. *(a)* Find an expression for capacitance of a spherical capacitor.
    (b) Obtain a relation connecting electric field ($\vec{E}$), polarization vector ($\vec{P}$) and electric displacement vector ($\vec{D}$). 3+3=6

20. What is Biot-Savart law? Use it to find the magnetic field at the centre of a circular coil-carrying current.

21. *(a)* State and prove Ampere's circuital law.

(b) Obtain an expression for magnetic field due to a solenoid using Ampere's circuital law. 3+3=6

22. What is hysteresis? Explain the terms 'coercivity' and 'retentivity'. Show that the area enclosed by a hysteresis loop gives the measure of energy loss per cycle. 1+2+3=6

23. What is mutual induction? Find the expression for mutual inductance between two current-carrying coils. State the reciprocity theorem. 1+4+1=6

24. What is electrical resonance? What is the phase relation between current and voltage at resonance in a series LCR circuit? State and prove Thevenin's theorem. 1+1+4=6

25. Describe how the correction for damping is done in a ballistic galvanometer. State and prove Norton's theorem. 2+4=6

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