U.G. 2nd Semester Examination - 2021

PHYSICS

[HONOURS]

Course Code : PHY-H-CC-T-03

Full Marks : 20　　　　　　　　　　Time : 1 Hour

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP–A

1.　Answer any **five** questions:　　　　　$1 \times 5 = 5$

　a)　Find the dimension of $\frac{R}{L}$ where R is resistance, L is inductance.　　　　　　　　　　1

　b)　Write down the Maxwell equation (in S.I) which says that the number of $\vec{B}$ lines penetrating into a closed surface is equal to the number coming out of it.　　　1

　c)　Write down the 4th Maxwell equation in S.I and Gaussian unit.　　　　　　　　1

　d)　A charge q moves in a region where there is an electric field $\vec{E}$ and a magnetic field $\vec{B}$. Write

down the force on the charge. Is the field conservative?　　　　　　　　　　1

　e)　If　$\vec{A} = e^{-x} \sin y \hat{i} + (1 + \cos y)\hat{j}$　calculate the magnetic induction.　　　　　　　1

　f)　An electron is circulating in a circular orbit of radius r with a speed $\vec{v}$. If we consider that it constitutes a steady current find its magnitude.

　　　　　　　　　　　　　　　　　　1

　g)　Establish that 1 tesla = 10^4 gauss.　　　1

　h)　What is the expression of the torque on a current loop in a uniform magnetic field?　1

GROUP-B

1.　Answer any **one** question:　　　　$5 \times 1 = 5$

　a)　i)　Define polarization $\vec{P}$ in a dielectric.

　　　　　　　　　　　　　　　　　　1

　　　ii)　If $\vec{P} = ax^2\hat{x} + by\hat{y}$ find the volume charge density.　　　　　　　　　　　1

　　　iii)　Derive Gauss law in a dielectric .　　3

　b)　i)　Establish that $\vec{\nabla} \times \vec{E} = -\dfrac{\partial \vec{B}}{\partial t}$　　　3

　　　ii)　What is the relation between $\vec{B}, \vec{H}, \vec{M}$ vectors in electromagnetics?　　　1

[Turn over]　　　　　　　201/Phs.　　　　(2)

iii) What do you mean by the term 'power factor'? 1

c) i) A capacitor and inductor have equal reactances at 750Hz. What will be the ratio of their respective reactances of 50Hz? 1

ii) Oscillations can be generated in an LC circuit. Justify if the statement is correct or false. 2

iii) Mention the difference in the behavior of $\vec{B}$ lines in dia, para and ferro magent. 2

GROUP-C

3. Answer any **one** question: 10×1=10

a) i) State and prove Thevenin theorem. 4

ii) What is electromagnetic damping? 2

iii) Establish the relation $\vec{\nabla} \times \vec{M} = \vec{J}_M$. 4

b) i) Obtain the magnetic induction due to an ideal solenoid. 5

ii) Obtain the self inductance of an ideal solenoid. 5

c) i) If a point charge is placed in front of an infinite grounded conducting plane find the density of induced charge at a point on the plane. 5

ii) Mention when would you use the following equations to find the electrostatic potential:
Laplace equation, Poisson equation. 2

iii) Obtain maximum power transfer as per maximum power transfer theorem. 3

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