[Total No. of Questions: 09]   MORNING

Uni. Roll No. ....   17 JUN 2023   [Total No. of Pages: 02]

Program: B.Tech. (Batch 2018 onward)
Semester: 3rd
Name of Subject: Electromagnetic Fields
Subject Code: PCEE-104.
Paper ID: 16067
Scientific calculator is Allowed

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

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Part – A

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[Marks: 02 each]

Q1.

   a) Define Coulomb's law and what is its limitation.

   b) What are an electric dipole and a dipole moment?.

   c) Explain Ampere's force law and circuit law.

   d) What is skin effect?

   e) Is it feasible for an electric potential in a charge-free region to be given by: $V = x^2 + y^2 + z^2$, if not find the charge density.

   f) If the vector, $B = 2xy^2 a_x + 2y^3 a_y + xyz a_z$, find the divergence of B

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Part – B

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[Marks: 04 each]

Q2. State and prove the Gauss divergence theorem.

Q3. Deduce an expression for potential at a point due to an electric dipole.

Q4. Derive an expression for the magnetic field at a point on the axis of circular coil carrying current.

Q5. Explain and deduce the magnetic field's boundary conditions.

Q6. Create a uniform plane wave equation for the medium that accounts for the magnetic and electric fields.

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Q7. A 3 Amp current is carried by a coil with a radius of 18 cm and 120 turns. What is the magnitude of the magnetic field at the coil's centre and at a point on its axis that is situated a distance equal to the coil's radius from the centre?

Part – C   [Marks: 12 each]

Q8. State and prove Gauss's law in electrostatics.

OR

Explain Poisson's and Laplace's Equations. Consider a concentric spherical shell in the free space in which V= 0 volts at r = 10 cm and V = 10 volts at r = 20 cm. Find E and D.

Q9. Justify that $\left|\frac{E}{H}\right| = 120\pi\ \Omega \simeq 377\Omega$. Also, prove that E and H for electromagnetic waves are perpendicular to each other.

OR

Explain the relevance of Maxwell's Field equations and how they were derived.

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