

Please check that this question paper contains _____ questions and _____ printed pages within first ten minutes.

[Total No. of Questions: 09]

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Uni. Roll No.

Program: B.Tech. (Batch 2018 onward)

Semester: 3rd

MORNING

Name of Subject: Electromagnetic Fields

13 MAY 2023

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

Part – A

[Marks: 02 each]

Q1.

- a) What is the physical significance of the divergence of a vector field?
- b) State Biot Savart law.
- c) Write magnetic boundary conditions.
- d) Give two differences between an electric field and a magnetic field.
- e) Given two-coplanar vectors $A = 3a_x + 4a_y - 5a_z$; $B = -6a_x + 2a_y + 4a_z$.
Obtain the unit vector normal to the plane of vectors A and B.
- f) The relative magnetic permeability of the medium is 2.5 and the relative electrical permittivity of the medium is 2.25. Compute the refractive index of the medium.

Part – B

[Marks: 04 each]

- Q2. State and prove the Gauss Divergence theorem.
- Q3. Starting from Gauss's law as applied to a differential volume element, explain the concept of divergence.
- Q4. State and prove Ampere's circuital law.

- Q5. Obtain an expression for total electric field intensity at a point due to an infinite number of point charges.
- Q6. Derive an expression for the wave equation in free space and homogeneous medium.
- Q7. A charge of one coulomb is at (2,0,0). What charge must be placed at (-2,0,0) which will make y component of total \vec{E} zero at point (1,2,2).

Part – C

[Marks: 12 each]

- Q8. State and explain Gauss's law. Derive an expression for the potential at a point outside a hollow sphere having a uniform charge density.

OR

- a) How we can represent a differential element in spherical coordinates and also give the relationship between cartesian and spherical coordinate systems.
- b) Give the cartesian coordinate vector field $\vec{H} = 20a_{\vec{r}} - 10a_{\vec{\theta}} + 3a_{\vec{z}}$, at point $P(x = 5, y = 2, z = -1)$.

- Q9. State and explain the Maxwell equation for the static field. Explain how they are modified for time-varying electric and magnetic fields.

OR

How is magnetic flux density related to magnetic vector potential? Find out the magnetic vector potential in the vicinity of a very long straight wire carrying a current I . Hence find the magnetic field strength.
