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PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENIGINEERING

SUMMER TERM END TERM EXAMINATION – AUGUST 2024

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| **Semester : Summer Term** | **Date :05-08-2024** |
| **Course Code : ECE3004** | **Time :1:00PM-4:00PM** |
| **Course Name : ELECTROMAGNETIC THEORY**  | **Max Marks : 100** |
| **Program : B.TECH**  |  |
| **PART A** |
|  **ANSWER ANY 3 QUESTIONS 3Q X 5M=15M** |
| 1 | If $\vec{A}=3\hat{a\_{x}}+4\hat{a\_{y}}+\hat{a\_{z}}$ and $\vec{B}=2\hat{a\_{y}}-\hat{5a\_{z}}$, Find the angle between them by using dot and cross product? | (CO 1) | [Knowledge] |
| 2 | State Green’s Theorem. | (CO 2) | [Knowledge] |
| 3 | Define a conservative vector field and state the condition for a vector field to be conservative in terms of its curl. | (CO 2) | [Knowledge] |
| 4 | A +10uC point charge is 25cm away from a -20uC point charge. Calculate the magnitude of the electric force between them.  | (CO 3) | [Knowledge] |
| 5 | If a current of 5A is flowing through the wire. Determine the magnetic field at a distance 0.5m perpendicular from the wire.  | (CO 4) | [Knowledge] |
| **PART B** |
|  **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** |
| 6 | Given the field quantities $\vec{P}=2\hat{a\_{x}}+\hat{a\_{z}}$, $\vec{Q}=2\hat{a\_{x}}-\hat{a\_{y}}+2\hat{a\_{z}}$, $\vec{R}=2\hat{a\_{x}}-3\hat{a\_{y}}+\hat{a\_{z}}$, Calculate the following (a) ($\vec{P}$+$\vec{Q}$) x ($\vec{P}$-$\vec{Q}$), (b) $\vec{Q}.\vec{R}x\vec{P}$ (c) $\vec{P}.\vec{Q}x\vec{R}$ (d) $\sin(θ\_{QR})$ (e) $\vec{P}x(\vec{Q}x\vec{R}$) (f) A unit vector perpendicular to both $\vec{Q}x\vec{R}$ (g) Component of $\vec{P }$along $\vec{Q}$ | (CO 1) |  [Comprehension] |
| 7 | Prove the boundary conditions for the electric field at the interface between two different media. Derive the mathematical expressions, explain the underlying physical principles, and illustrate with examples how these conditions are applied in practical engineering scenarios. | (CO 3) |  [Comprehension] |
| 8 | Prove the boundary conditions for the magnetic field at the interface between two different media. Derive the mathematical expressions, explain the underlying physical principles, and illustrate with examples how these conditions are applied in practical engineering scenarios. | (CO 4) |  [Comprehension] |
| **PART C** |
|  **ANSWER ANY 3 QUESTIONS 3Q X 15M=45M** |
| 9 | State and verify Gauss Divergence Theorem $\vec{F}=4xz\hat{ i}-y^{2} \hat{j}+ yz \hat{k}$ over the cube bounded by $x=0 to 1$, y = 0 to 1, and z = 0 to 1. | (CO 2) | [Application] |
| 10 | State and verify Stoke’s theorem for $\vec{F}=\left(x^{2}+y^{2}\right)\hat{ i}-2xy \hat{j}$ taken around the rectangle bounded by $x=\pm a$ and y = 0 to b. | (CO 2) | [Application] |
| 11 | (i) Explain Biot-Savart's Law and its significance in electromagnetism.(ii) Derive the expression for the magnetic field $\vec{H}$ produced by the small current element $Idl.$(iii) Using Biot-Savart's Law, derive the expression for the magnetic field at the center of a circular loop of radius R carrying a steady current I.(iv) A wire carrying a current I and other carrying a current of 2I in the same direction produce a magnetic field H at the mid-point between two wires. What will be the magnetic field when 2I wire is switched off? | (CO 4) | [Application] |
| 12 | State and prove Ampere's Circuital Law. Using Ampere's Circuital Law, derive the expression for (i) The magnetic field due to a long cylindrical conductor carrying a steady current. (ii) The magnetic field due to solenoid.(iii) The magnetic field due to toroid. | (CO 4) | [Application] |