ELECTROMAGNETIC THEORY BRANCH : ELECTRICAL Max Marks : 100 Time : 3 Hours Q.CODE : HB821Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.210Part-1(2 × 10)(2 × 10)and frequencies in the right hand margin indicate marks.210Part-1(2 × 10)(2 × 10)and frequencies from the cross product are obtained from two vectors?(2 × 10) <th>210</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	210							
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 bisecting plane. Determine the potential and <i>E</i> field at P(3,4,12). b) Two points P(1,π,0) and Q(0, -π/2,2) are given in the cylindrical coordinate system. Find the distance vector from P to Q. What is the length? What the distance from Q to P? Express the distance vector from P to Q in terms of the distance vector from Q to P. c) If <i>F</i> = r<i>a</i>_r + r tan θ<i>a</i>_θ + r sin θ cos φ<i>a</i>_φ. Transform <i>F</i> to the rectangular coordinate system. 210 210 210 210 210 210 210 d) Derive the expression of electric field due to a volume charge using both Coulomb's Law and Gauss's law. e) State Poynting's theorem. What is Poynting vector? f) If the electric field intensity in a source-free, dielectric medium is given by <i>E</i> = E₀[sin(αx - ωt) + sin(αx + ωt)]<i>a</i>_y. V/m, determine the magnetic field intensity using Maxwell's equation from Faraday's law. What is the displacement current density in the medium? 	(6 X 8)	separated by a	n and a proton se	noment. An ele	ole and dipole m	State electric dip	a)	۲۲
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- h) State electric dipole and dipole moment.
- i) Evaluate $\oint \vec{\rho} dl$ along the closed circular path of radius b in the xy plane.
- Find the volume of a region bounded by the xy plane (z=0) and $z = 4 x^2 y^2$. j)
- What is Stoke's theorem? What are its advantages and limitations? Can Stoke's k) theorem be applied to closed surfaces?
 - I) The electric field intensity of a wave in a region is given by $\vec{E} = 3\cos(\omega t - \beta x - 45^{\circ})\vec{a}_{y} + 4\sin(\omega t - \beta x + 45^{\circ})]\vec{a}_{z}$ V/m. Determine the polarization of the wave.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) For electromagnetic fields to exist in a linear, homogeneous, isotropic, surfaces-free (16) 210 Q3 conduction region, show that the \vec{E} field must satisfy the following equation: $\nabla^2 \vec{E} - \mu \varepsilon \, \frac{\partial^2 \vec{E}}{\partial t^2} - \mu \sigma \, \frac{\partial \vec{E}}{\partial t} = 0 \, .$ Q4 Define the divergence of a vector. What do you mean by a positive divergence and (16) negative divergence of a vector? Formulate the divergence of electric flux leaving from a volume in Cartesian, Cylindrical and spherical coordinates. 210 Q5 Define the displacement current density. Differentiate between the displacement (16)current and conduction current. Derive the expression for displacement current density from Ampere's circuital law. Relate the Stoke's theorem to this Ampere's circuital law. Q6 Explain the polarization of a wave. What is the major difference between an elliptically (16)and circularly polarized wave? A uniform 2 plane wave with an $\vec{E} = 12\cos(\omega t - \beta z)\vec{a}_x - 5\sin(\omega t - \beta z)a_y$ V/m is propagating in a lossless medium $\mu_r = 1$, $\varepsilon_r = 2.5$ at 200 Mrad/sec. Determine the corresponding the phase constant β i) ii) the phase velocity iii) wave length iv) loss tangent V) H field Intrinsic impedance. vi) The polarization of the wave. vii)

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