Code: 15A04403 **R15**

B.Tech II Year II Semester (R15) Supplementary Examinations December 2017

ELECTROMAGNETIC THEORY & TRANSMISSION LINES

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) State and explain the Coulomb's law.
(b) Derive the Passion's and Laplace equations for electrostatic field.
(c) State and express the Biot-Savart's law.
(d) Write down the Maxwell's equations in word statement.
(e) Define the uniform plane wave.
(f) Define polarization. Explain different types of polarization.
(g) Define the propagation constant in terms of primary constants.
(h) Define the group velocity.
(i) Define the stub.
(j) Write down the applications of smith chart.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Given the field $D = 6\rho \sin\frac{1}{2}\phi \hat{a}_\rho + 1.5\cos\phi\, \hat{a}_\phi c/m^2$, evaluate both sides of the divergence theorem for the region bounded by $\rho = 2, \phi = 0\ to\ \phi = \pi\ and\ \ z = 0\ to\ z = 5$.

(b) At given points A(5,70^0,-3) and B(2,-30^0,1), find :
(i) A unit vector in Cartesian co-ordinates at A directed towards B.
(ii) A unit vector in cylindrical co-ordinates at A directed toward B.
(iii) A unit vector in cylindrical co-ordinates at B directed towards A.

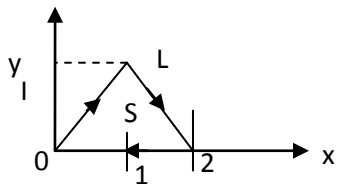
OR

3 Express the vector field $\vec{D} = (x^2 + y^2)^{-1}\left(x\hat{a}_x + y\hat{b}_y\right)$ in cylindrical components and cylindrical variables. Determine the vector normal to $S(x, y, z) = x^2 + y^2 - z\ at\ point\ (1,3,0)$.

UNIT – II

4 Given that $\vec{F} = \left(x^2 y\hat{a}_x - y\hat{a}_y\right)$, find:

(a) $\oint_L \overrightarrow{F} \bullet dL$, where L is shown in the figure below.



(b) $\int_S \left(\nabla X\vec{F}\right) \bullet ds$, where S is the area bounded by L.

OR

5 A uniform line charge of 16 nC/m is located along the line defined by y = -2, z = 5. If $\varepsilon = \varepsilon_0$, find $\vec{E}$, at point P(1,2,3). Plane x + 2y = 5 carries charge $\rho_s = 6nC/m^2$. Determine $\vec{E}$ at (-1,0,1).

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UNIT – III

6 A dielectric material contains 2 X 10^{19} polar molecules/m^3, each of dipole moment 1.8 X 10^{-27} cm. Assuming that all dipoles are aligned in the direction of electric field $\vec{E} = 10^5 a_x$ V/m, find polarization $\vec{P}$ and relative permittivityε_r.

OR

7 Region 1 (z<0) contains a dielectric for which ε_{rl} = 2.5, while region 2 (z>0) is characterized by ε_{r2} = 4. Let $\overrightarrow{E_1} = -30a_x + 50a_y + 70a_z \frac{V}{m}, find\ \overrightarrow{D_2}\ \&\ \overrightarrow{P_2}$.

UNIT – IV

8 (a) Derive the equation for uniform plane wave in terms of H.

(b) A 100 MHz uniform plane wave propagates in a lossless medium for which ε_r = 5 and μ_r = 1 find V_p, β, λ, E_s, H_s.

OR

9 (a) State and prove the Pointing vector theorem.

(b) Write short notes on: (i) Surface impedance. (ii) Brewster angle.

UNIT – V

10 A lossless transmission line of electrical length = 0.4 λ is terminated with a complex load impedance as shown in the accompanying figure below. Find the following using smith chart.

(a) Reflection coefficient at the load.

(b) The SWR on the line.

(c) The reflection coefficient at the input of the line.

(d) The input impedance to the line

OR

11 Derive the transmission line equation for lossless line and obtain the expressions for propagation constant (γ) and Z_0.

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