PVP 20

Code: 20BS1402

II B.Tech - II Semester – Regular Examinations – JULY 2022

ELECTROMAGNETIC FIELDS & WAVES
(ELECTRONICS & COMMUNICATION ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. a) Two uniform line charges of density 8 nC/m are located in a plane with y = 0 at x = ±8m. Determine the ***E*** field at a point P (5, 4, 8) m. 7 M
   b) Develop the electric field intensity at a point 'P' due to infinite line charge distribution. 7 M

OR

2. a) Establish Gauss law in point form and integral form, and hence deduce Laplace's and Poisson's equations. 7 M
   b) Three parallel line charges 5 nC/m, 4 nC/m and -6 nC/m respectively are located at (0,0), (3,0) and (0,4) m respectively. Determine electric flux density (***D***) and electric filed intensity (***E***) at (3, 4). 7 M

UNIT – II

3. a) Explain the concept of Magnetic vector potential. 7 M
   b) An infinitely long straight conducting rod of radius 'a' carries a current of ***I*** in positive Z-direction. Using Ampere's circuital law, Determine ***H*** in all regions and

sketch the variation of $\boldsymbol{H}$ as a function of radial distance. If I=3 mA and a=2 cm, determine $\boldsymbol{H}$ and $\boldsymbol{B}$ at (0, 1, 0) and (0, 4, 0). 7 M

OR

4. a) Explain Biot-savart's law with necessary mathematical expressions. 7 M

   b) Make use of Ampere's circuital law and Biot-savart's law to determine the magnetic field intensity due to an infinite line current. 7 M

UNIT-III

5. a) Write Maxwell's equations in integral form and in word statements. 7 M

   b) X-Z plane is a boundary between two dielectrics. Region y<0 contains dielectric material with ε_{r1}=2.5 while region y>0 has dielectric with ε_{r2}=4.
   If $\boldsymbol{E}$ = -30a_x+5a_y+70a_z V/m, determine normal and tangential components of the $\boldsymbol{E}$ field on both sides of the boundary. 7 M

OR

6. a) Derive the electric field boundary conditions between dielectric and conductor. 7 M

   b) Show that the displacement current in a capacitor is equal to the conduction current. 7 M

UNIT – IV

7. a) What is poynting theorem? Derive the expression for poynting vector. 7 M

   b) A manufacturer produces a ferrite material with 7 M

$\mu = 750\mu_0$, $\varepsilon = 5\varepsilon_0$,and $\sigma = 10^{-6}$ S/m at 10 MHz
i) Would you classify the material as lossless, lossy, or conducting? ii) Calculate β and λ.

OR

8. a) Given that $\boldsymbol{E} = 40 \cos (10^8 \text{ t} - 3\text{x})a_y$ V/m.
(i) Determine the direction of wave propagation.
(ii) The velocity of the wave and the wavelength. 7 M

b) Explain skin depth and derive an expression for depth of penetration for good conductor. 7 M

UNIT – V

9. Define and distinguish between the terms perpendicular polarization, parallel polarization, for the case of reflection by a perfect conductor under oblique incidence. 14 M

OR

10. a) Obtain an expression for the power loss in a plane conductor in terms of the surface impedance. 7 M

b) Consider two dielectric media, where medium 1 is free space and medium 2 has $\varepsilon_2 = 3\varepsilon_0$ and $\mu_2 = \mu_0$,Analyse the reflection coefficient for a wave obliquely incident at $\theta_1 = 30^o$ for
i) Perpendicular Polarization
ii) Parallel Polarization 7 M