R20

II B. TECH II SEMESTER REGULAR EXAMINATIONS, JUNE - 2022
ELECTROMAGNETIC FIELDS AND WAVES
(ELECTRONICS AND COMMUNICATION ENGINEERING)

Time: 3 hours   Max. Marks: 70

Note: Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**
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UNIT-I

1. a) The point Charges -1nc , 4nC, and 3nC are located at (0,0,0), [8M]
        (0,0,1) and (1,0,0), respectively . Find the electric field intensity
        at (1, 1, 1).

    b) Find the dot product of $\vec{A} = 2\hat{x} + 3\hat{y} - \hat{z}$ on $\vec{B} = 3\hat{x} - 3\hat{y} - 2\hat{z}$. [6M]

(OR)

2. a) What do mean by the Gauss's law of electrostatics? Explain the [8M]
        physical significance of divergence in explaining the Gauss's law
        of electrostatics.

    b) Transform the vector $\vec{A} = 3\hat{r} + 2\hat{\theta} - \hat{\phi}$ in to the Cartesian [6M]
        coordinate system.

UNIT-II

3. a) Define meaning of linear, isotropic and homogenous medium. [6M]

    b) What do you mean by the dipole moment? Calculate the electric [8M]
        field at any point in free space due to an electric dipole placed at
        the origin.

(OR)

4. a) Two dielectric rods with the relative permittivity ϵ_1 and ϵ_2 are [7M]
        forming the coaxial structure. Calculate the equivalent
        capacitance.

    b) Establish Gauss Law in point form and integral form hence [7M]
        deduce Laplace' s and Poisson's Equations.

UNIT-III

5. a) Define Biot-Savart law? How it will useful to derive H? Explain? [6M]

    b) Find magnetic field strength, H, on the Z-axis at a point P (0,0,h), [8M]
        due to a current carrying circular loop, $x^2+y^2= a^2$ in Z=0 plane.

(OR)

6. a) Why does the magnetic monopole not exit? Explain the physical [6M]
        significance of Gauss's law of magnetostatics.

    b) Derive and explain the magnetic boundary conditions. [8M]

UNIT-IV

7. a) What do you mean by the displacement current density? Explain the continuity equation and its physical significance. [7M]

    b) Write all the Maxwell's equations in point form and integral form with electrostatic and time varying field. [7M]

(OR)

8. a) How are the time varying potentials are utilized in establishment of a wave equation? [7M]

    b) Explain Faraday's law and its physical significance in establishment of Maxwell's equations. [7M]

UNIT-V

9. a) Define the properties of mediums (i) lossless dielectrics, (ii) lossy dielectrics, (iii) perfect electric conductor. What is the phase difference between the electric and magnetic field of any wave propagating in the different mediums? [6M]

    b) What do you mean by the plane of incidence? What will be the orientation of electric and magnetic field vectors if wave is incident at oblique incidence. [8M]

(OR)

10. a) Draw the wave being represented by the mathematical equation as $E_x = E_o e^{-2z} \sin(\omega t - kz)\, \hat{x}$. Also, find the attenuation and phase constant and magnetic field associated with this wave. [8M]

    b) Explain the Poynting theorem and derive its time average value. [6M]

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