QUESTION BANK

Subject: **EMWTL**

Year: **II / IV, II-Semester** Branch: **ECE**

Regulation: **R16** Academic Year: **2018-2019**

UNIT – I: Electrostatics

1. a. Point charges 4 mc and -3 mc are located at (2, 1, -3) and (-1, -2, 4) respectively. Calculate the electric force on a 12nc charge located at (0, 3, 1) and the electric field intensity at that point. **5M**

   b. State the applications of Gauss Law with respect to a) Point charge b) Infinite line charge **5M**

2. a. Derive an expression for the electric field intensity due to a finite length line charge along the Z- axis at an arbitrary point Q(x,y,z). **5M**

b. The finite sheet $0 \leq x \leq 1$ and $0 \leq y \leq 1$ on the z =0 plane has a charge density $\rho_s = xy(x^2 + y^2 + 25)^{3/2}$ nC/m^2 Find **5M**

i. The total charge on the sheet

ii. The electric field at (0,0,5)

iii. The force experienced by a -1nC charge located at (0, 0, 5).

3 a. Briefly explain Dielectric constant and its strength. **5M**

b. Explain about continuity equation and relaxation time. **5M**

4. a. Explain about the parallel plate capacitor and coaxial capacitor with necessary equations. **5M**

b. With necessary equations explain poisson's and Laplace's equation. **5M**

5. a. If $D = 2x^2a_x + a_y + 2z^2$ pC/m^2. Derive volume charge density. **5M**

b. Give the Maxwell's equations for electrostatic fields. **5M**

6. a. Explain about Electric flux density. Determine **D** at (4, 0, 3) if there is a point charge -5Π mC at (4,0,0) and a line charge at 3Π mC/m along the y-axis. **5M**

b. Write about convection current and conduction current. **5M**

UNIT – II: Magnetostatics & Maxwell's Equations for Time Varying Fields.

1. a. Derive expression for magnetic field at any point on the axis at a distance 'h' from the centre of a circular loop of radius 'a' and carrying current 'I'. **5M**

b. State and explain Biot – Savart's law. Give the expressions of Biot – Savart's law for line, surface and volume currents. **5M**

2. a. State Ampere's circuit law and explain. Give its applications. **6M**

b. Explain about inconsistency in Ampere's Law. **4M**

3. a. A circular loop located on $x^2 + y^2 = 9$ and $z = 0$ carries a direct current of 10A along a_ϕ. Determine H at (0, 0, 4) and (0, 0, -4). **5M**
b. With necessary equations explain about Magnetic scalar and Vector potential. **5M**

4. Explain about the following
i. Force on a charged particle. **5M**
ii. Force on a current element. **5M**

5. a. Write about the following Dielectric – Dielectric Boundary Condition and Conductor dielectric boundary condition. **5M**
b. State the Faraday's Law and explain briefly. **5M**

6. a. State all Maxwell's equations in differential and integral form for time varying fields. **5M**
b. Explain the concept displacement current and derive its necessary equations. **5M**

UNIT – III: EM Wave Characteristics - I

1. Define and explain the terms
i. Skin Depth **4M**
ii. Intrinsic Impedance of free space **3M**
iii. Phase Constant. **3M**

2. a. Derive the expression for attenuation and phase constants of uniform plane wave. **5M**
b. Prove that **E** and **H** are perpendicular to each other in uniform plane waves. **5M**

3. Derive the expression for wave equation in
i. Lossless Dielectric **4M**
ii. Good Conductors **3M**
iii. Free Space **3M**

4. A plane wave with E = 2 V/m and has a frequency of 300MHz is moving in free space impinging on thick copper sheet located perpendicular to the direction of the propagation. Find
i. **E** and **H** at the plane surface **4M**
ii. Depth of penetration **3M**
iii. Surface Impedance **3M**

5. a. In a lossless medium for which $\eta = 60\Pi$, $\mu_r = 1$ and **H** $= - 0.1\cos(\omega t - z)\, a_x + 0.5 \sin(\omega t - z) a_y$ A/m. Calculate ε_r, ω and **E**. **5M**
b. An elliptical polarized wave has an electric field of **E** $= \sin(\omega t - \beta z)\, a_x + 2\sin(\omega t - \beta z + 75^0) a_y$ V/m. Find the power per unit area conveyed by the wave in free space. **5M**

UNIT-IV: EM Wave Characteristics - II

1. a. What is Brewster angle? Derive the expression for the same. **5M**
b. Discuss about power loss in plane conductor. **5M**

2. a. State and prove the critical angle theorem. **5M**
b. Derive an expression for reflection when a wave is incident on a dielectric obliquely with parallel polarization. **5M**

3. a. State and prove Poynting theorem. **5M**

b. For good dielectric derive the expression for α, ß, v and η. **5M**

4. a. Find the depth of penetration δ of an EM wave in copper at f = 60Hz and f = 100MHz. For copper σ = 5.8 x 10^7 mho/m, $\varepsilon_r = 1$ and $\mu_r = 1$. **5M**
   b. Prove that $E_i = -E_r$ when the wave is normal incidence on a perfect conductor. **5M**
5. a. A plane wave travelling in air is normally incident on a material with $\mu_r = 1$ and $\varepsilon_r = 4$. Find the reflection and transmission coefficient. **5M**
   b. Define and derive the transmission coefficient of a wave incidence in normal on dielectric. **5M**

UNIT – V: Transmission Line – I

1. a. Derive the relationship between the primary constants and secondary constants in a transmission line. **5M**
   b. Derive the expression for the input impedance of a transmission line length L. **5M**
2. a. Show that a transmission line will be distortion less free if RC = LG **5M**
   b. A high frequency line has the following primary constants L=1.2 mH /Km, C=0.05μF/Km. R = G = negligible. Determine the characteristics impedance and propagation constant of the line. **5M**
3. a. List out applications of smith's chart. How to measure them? **5M**
   b. Give details about smith chart and write steps how to calculate impedance, reactance, and wavelength using this chart. **5M**
4. a. Define and explain both lossless and distortion less transmission lines in terms of transmission lines parameters. **5M**
   b. State the impedance relations, reflection coefficient and VSWR for **5M**
   i. Shorted line
   ii. Open circuited transmission line.
5. a. A lossy cable which has R = 2.25Ω/m , L = 0.1μH/m, C = 1 pF/m and G = 0 operates at f = 0.5 GHz. Find the attenuation constant of the line. **5M**
   b. Define the term characteristic impedance and derive the expression for it. **5M**
6. a. A transmission line in which no distortion is present has the following parameters: $Z_0 = 50\Omega$, $\alpha = 0.02\ m^{-1}$, $v = 0.6\ v_0$. Determine R, L, G, C and wavelength at 0.1GHz. **5M**
   b. List out types of transmission lines and draw their schematic diagrams **5M**
7. a. Define phase & group velocities in transmission line and derive the relation between them. **5M**
   b. A lossless transmission line used in a TV receiver has a capacitance of 50pF/m and an inductance of 200 nH/m. Find the characteristic impedance for section of a line 10m long. **5M**

UNIT – VI: Transmission Line - II

1. a. Write short notes on stub matching technique. **5M**
   b. For a uniform transmission line, the open and short circuit impedances are given by Z_{oc} = (50 + j25) Ω and Z_{sc} = (60 – j20) Ω. Find Z_0 of the line. **5M**
2. a. Define the reflection coefficient and derive the expression for the input impedance in terms of reflection coefficient. **5M**
   b. Explain with sketches how the input impedance varies with the frequency. **5M**
3. a. List out types of transmission lines and draw their schematic diagrams **5M**
   b. A low transmission line of 100Ω characteristic impedance is connected to a load of 400Ω. Calculate the reflection coefficient and standing wave ratio. **5M**
4. a. Discuss the configuration of the smith chart considering the two families of constant circles. **5M**

b. What are the advantages and disadvantages of stub matching? **5M**

5. a. A transmission line in which no distortion is present has the following Parameters Z_0 = 60Ohms, α = 20m Np/m, v = 0.7v_0. Determine R, L,G, C and wavelength at 0.1GHz. **5M**
   b. Discuss the applications of smith chart. **5M**
6. a. Write short notes on reflection coefficient and VSWR? Derive the relation between them. **5M**
   b. Write short notes on different lengths of transmission lines with open end load. **5M**