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QUESTION BANK (DESCRIPTIVE)

Subject with Code : EMTL(16EC409) **Course & Branch**: B.Tech – ECE

Year & Sem: II-B.Tech & II-Sem **Regulation:** R16

UNIT-I

ELECTROSTATICS-1

1.(a)State Coulomb's law and write the equation of **F** that exists between two unlike Charges? [6M]

(b) Three Point Charges Q_1=1 mc, Q_2=2 mc and Q_3=-3 mc are respectively located at (0,0,4), (-2,6,1) and (3,-4,-8). Calculate the Power on Q1. [6M]

2.(a)What are the types of Charge Distributions.Determine the Electric Field Intensity Due to infinite Surface Charge. [6M]

(b) A Point Charge of 20ηc is Located at the Origin .Determine the Magnitude and Direction of the electric Field Intensity $\overline{E}$ at the Point (1,3,-4) [6M]

3.(a)Define the Electric Flux Density. A Point Charge of 30ηc is located at the origin.While the Plane y=3 carries a charge 10ηc/m^2.Find Density at (0,4,3). [6M]

(b) Point Charges Q_1=4μc ,Q_2=-5μc and Q_3=2 μc are located at (0,0,1).(-6,8,0) and (0,4,-3) respectively.Find $\overline{D}$ at the Origin. [6M]

4.(a) State the Gauss's Law.Apply Gauss's law to evaluate Electric Flux Density $\overline{D}$ for a Uniformly charged Sphere. [6M]

(b) $\overline{D} = \left(2y^2 + z\right)\overline{a}_x + 4xy\overline{a}_y + x\overline{a}_z$,Find [6M]

(i) The Volume Charge Density at (-1,0,3)

(ii)The Flux through the Cube defined by $0 \le x \le 1, 0 \le y \le 1, 0 \le z \le 1$

(iii) The Total Charge Enclosed by the Cube

5.(a).Define Eclectic Potential.What is the Relationship Between $\overline{E}$ and V [6M]

(b) Spherical surfaces r=2,4 and 6 m carrying uniform charge density of 20 ηc/m^2, -4ηc/m^2 and ρ_{s0} Respectively [6M]

(i) Find the Flux Density $\overline{D}$ at r=1, 3 and 5 m

(ii) Determine ρ_{s0} such that $\overline{D}$=0 at r=7 m

6. (a).Define and Derive Energy Density for Electrostatic Fields. [6M]

(b)A Point Charge 100 pC is located at (4,1,-3) while the x-axis carries charge 2ηC/m .If the Plane z=3 is also carries charge 5ηC/m^2, find $\overline{E}$ at (1,1,1)

7.(a).Define and Derive Convection and Conduction Current. [6M]

(b) If $\overline{J} = \frac{1}{r^3}\left(2\cos\theta\,\overline{a_r} + \sin\theta\,\overline{a_\theta}\right)$ A/m^2 , Calculate the Current Passing through [6M]

(i) A Hemispherical shell of Radius 20 cm, $0 < \theta < \pi/2, 0 < \phi < 2\pi$

(ii) A Spherical Shell of Radius 10cm

8.(a)Explain the Concept of polarization in Dielectrics. [6M]

(b) Define the Following Terms [6M]

(i) Eclectic Susceptibility (ii) Dielectric Constant

(iii) Dielectric Strength (iv)Dielectric Breakdown

9.(a) Derive the Continuity Equation and Relaxation time for Electrostatic Fields. [6M]

(b) In a one-dimensional device,the Charge density is given by $\rho_v = \rho_0 x/a$ .If $\overline{E}$= 0 at x=0 and V=0 at x=a, find V and $\overline{E}$. [6M]

10. Define Capacitance. Write about Different types of Capacitors and give the expression for Capacitance. [12M]

UNIT-II

MAGNETOSTSICS

1.(a).State Biot-Savart's Law. [6M]

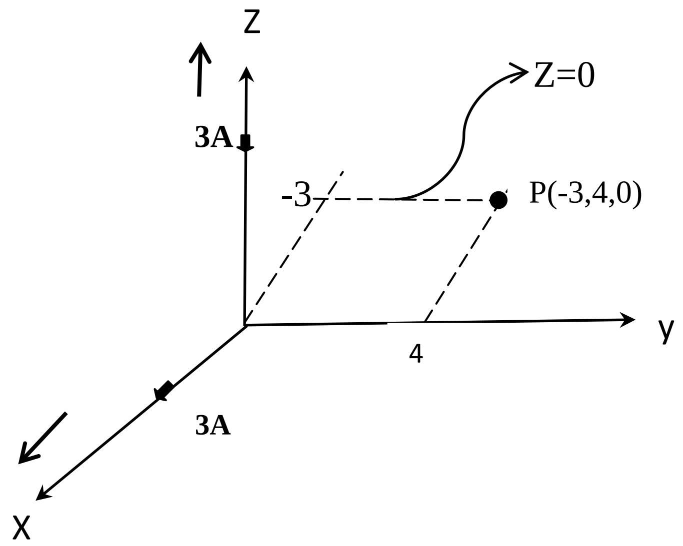
(b) A Positive Y-axis (Semi Infinite Line with respect to the Origin) Carries a Filamentary Current of 2 A in the $-\mathbf{a}_y$ Direction. Assume it is part of a large circuit.Find $\overline{H}$ at

(i) A(2,3,0)

(ii)B(3,12,-4) [6M]

2. (a)What is the Magnetic field Intensity Due to a Straight current carrying filamentary conductor of finite length. [6M]

(b) Find $\overline{H}$ at (-3,4,0) due to the Current Filament Shown in the Figure [6M]



3. (a).State Ampere's Circuit Law. [6M]

(b)Determine the Magnetic Field Intensity due to a infinitely long coaxial Transmission line. [6M]

4.(a).Define and Derive Maxwell's Equations for Elctric and magnetic Fields. [6M]

(b).Determine the Magnetic Flux Density due to a Infinite Sheet of Current [6M]

5.(a).Write about Magnetic Vector and Scalar Potentials. [6M]

(b).Given Magnetic Vector potential $A = -\frac{\rho^2}{4}\overline{a}_z$ wb/m, Calculate the total magnetic flux crossing the $\phi = \frac{\pi}{2}, 1 \le \rho \le 2\ m, 0 \le z \le 5\ m$ [6M]

6.(a).A Current Distribution gives rise to the vector potential $A = x^2 y\overline{a}_x + y^2 x\overline{a}_y - 4xyz\overline{a_z}$ Wb/m. Calculate the following [6M]

(i) $\overline{B}$ at (-1,2,5)

(ii) The Flux through the surface defined by z=1, $0 \le x \le 1, -1 \le y \le 4$

(b)Explain about Non Existence of Magnetic Mono pole.

7.(a).Define Magnetic Force.Explain about the Magnetic force on a one Current Element. [6M]

(b) In a Conducting Medium, $\overline{H} = y^2 z\overline{a}_x + 2(x+1)yz\overline{a}_y - (x+1)z^2\overline{a}_z$ A/m ,Find [6M]

(i) $\overline{J}$ at (1,0,-3)

(ii) The Current Passing through y=1, $0 \le x \le 1, 0 \le z \le 1$

8.(a).Explain about Lorentz Force Equation. [6M]

(b) In a Certain Conducting Region, **H**$=yz(x^2+y^2)a_x - y^2xza_y + 4x^2y^2a_z$ A/m [6M]

(i) Determine **J** at (5,2,-3)

(ii) Find the Current passing through x=-1,0<y, z<2

(iii) Show that $\nabla . B = 0$

9. Explain about the Any two applications of Ampere's Circuit law.

[12M]

10.(a). Explain about Poission's Equation of Magneto-statics. [6M]

(b).An infinitely filamentary wire carries a current of 2A in the +z direction .Calculate [6M]

(i) **B** at (-3,4,7)

(ii) The flux through the square loop described by $2 \le \rho \le 6, 0 \le z \le 4, \phi = 90^0$

UNIT – III

MAXWELL'S EQUATIONS (TIME VARYING FIELDS)

1.(a).State and Explain the Faraday's laws in Electromagnetic induction. [6M]

(b) Show that the Displacement Current Density $J_D = \frac{\partial D}{\partial t}$ [6M]

2. Write down the Maxwell's Equations in their integral form. Derive the Corresponding Equations for fields varying harmonically with time. [6M]

4. (a).Explain Faraday's law of electromagnetic induction and derive the Expression for Induces e.m.f [6M]

(b)Obtain Lorentz's Force equation [6M]

5. (a).Derive the Expressions for Displacement Current. [6M]

(b)A Parallel-plate capacitor with plate area of 5cm^2 and Plate separation of 3 mm has a voltage 50sin10^3 t V applied to its plates.Calculate the Displacement Current assuming $\varepsilon = 2\varepsilon_0$ [6M]

6.(a).Derive the Boundary Conditions for time varying Fields. [6M]

(b).A Medium is characterized by σ=0, $\mu = 2\mu_0$ and $\varepsilon = 5\varepsilon_0$.if $H = 2\cos(\omega t - 3y)\overline{a}_z$ A/m, calculate ω and **E** **[6M]**

7.(a). Explain the Following [6M]

(i) Motional e.m.f (ii)Transformer e.m.f

(b)Give the reason why ampere's Law is In-consistence and drive displacement current [6M]

8..Derive the Expression for one of the Maxwell's equation $\nabla \times \overline{E} = -\frac{\partial B}{\partial t}$ [6M]

9. Show that $\nabla \times E_m = J + \frac{\partial D}{\partial t}$ [6M]

10.Define the Following Terms [6M]

(i)Inductance (ii) Mutual Inductance (iii)Generator e.m.f (iv)Magnetic Vector Potential

UNIT – IV
EM WAVE CHARACTERISTIC-I &II

1. (a).State Poynting theorem. What does poynting vector represents? [6M]

   (b).Given a Uniform Plane wave in air as $\bar{E} = 40\ \cos(wt - \beta z)\bar{a}_x + 30\sin(\omega t - \beta z)\bar{a}_y$ V/m. Find **H_i,** and if the wave encounters a perfectly conducting plate normal to the z-axis at z=0,find the reflected wave **E_r** and **H_r** [6M]

2. (a).What is Polarization.What are the Different types of Polarization? [6M]

   (b)In a lossless Dielectric for which $\eta=60\pi,\mu_r=1$,and **H**=$-0.1\cos(\omega t - z)\bar{a}_x + 0.5\sin(\omega t - z)\bar{a}_y$ A/m, Calculate ε_r, ω *and* $\bar{E}$ [6M]

3. (a).Derive the Relation between **E** and **H** in free Space. [6M]

   (b)In a Non magnetic medium [6M]

   $$\bar{E} = 4\sin\left(2\pi \times 10^7 t - 0.8x\right)\bar{a}_z \text{ V/m} \quad \text{,Find}$$

   (i) ε_r, η
   (ii) Time Average Power carried by the wave
   (iii) The Total Power crossing 100 cm^2 of plane 2x+y=5

4. Determine the reflected wave **H_r** ,**E_r** and the transmitted wave **E_t**.Show that the Intrinsic Impedance of the Lossy medium is $\eta = \sqrt{\dfrac{j\omega\mu}{\sigma + j\omega\varepsilon}}$ [6M]

5. Calculate the reflection coefficient for vertical polarization with oblique incident on perfect dielectric. [6M]

6. Define the Following terms [6M]

   (i)Uniform plane wave (ii) Skin depth
   (iii)Critical Angle (iv)Total Internal Reflection

7. (a)A Plane wave through a medium with ε_r=8,μ_r =2 has $\bar{E} = 0.5 e^{z/3}\sin\left(10^8 t - \beta z\right)\bar{a}_x$. Determine the loss tangent, **H** field and Intrinsic Impedance. [6M]

(b)Derive the Expression for Transmission Coefficient for the Horizontal Polarization with Oblique incidence. [6M]

8.Define the following [6M]

(i)Reflection efficient (ii)Poynting Theorem (iii) Transmission Coefficient

(iv)Snell's Law (v) Surface Impedance

9.A Plane wave Propagating through a Non Magnetic medium has $\overline{E} = 50\sin\left(10^8 t + 2z\right)\overline{a}_y$ V/m ,Find λ, ε_r and $\overline{H}$. [6M]

10.(a)Define the Conducting Medium and Obtain the Expression for Intrinsic impedance. [6M]

(b) Ensure the Transmission for Perfect Conductor with Normal incidence. [6M]

UNIT – V

TRANSMISSION LINES-I &II

1.(a)Define Transmission line and Explain the Primary Constants. [6M]

(b)An air line has a Characteristic Impedance of 70Ω and phase Constant of 3 rad/m at 100MHz.Calculate R,C,and L. [6M]

2.(a)What is the Characteristic Impedance? Obtain the Relation between Characteristic Impedance and the Propagation Constant. [6M]

(b)A Transmission line operating at 500 MHz has Z_0=80 Ω, α =0.04 Np/m, β =1.5 rad/m.Find the Line Parameters R,L,G and C [6M]

3.(a).Define lossless and Distortion less transmission lines and write the Conditions for both. [6M]

(b)A Distortion line has Z_0=60Ω,α =0.04 Np/m,u=0.6c,Where c is the speed of the light in a vacuum.Find R,L, and G [6M]

4.(a).Obtain the input impedance of Transmission line of length ***l*** characterized by Z_0 and γ [6M]

(b).A telephone line has R=30Ω/km, L=100 mH/km, G=0 and C=20 µF/km, At f=1 KHz obtain Z0,γ and Phase Velocity (u) [6M]

5.Derive the Expression $Z_O = \sqrt{Z_{OC} Z_{SC}}$ [6M]

6.Explain the Construction of the Smith Chart . [12M]

7.Define the Following Terms [6M]

(i) Transmission Lines (ii)Relation between Group Velocity and Phase Velocity

(iii)Standing wave (iv)Stub Matching (v)Application of Smith Chart

8.A Loss less transmission line with $Z_0 = 50\Omega$ is 300m long Operates at 2 MHz.The Line is terminated with load $Z_L = 60 + j40\Omega$,if *u=0.6c* on the line .Find the Reflection Coefficient ,Standing Wave ration S and the Input Impedance Z_{in} [6M]

9. A Load of $100 + j150\Omega$ is connected to a 75 Ω lossless line.Find [12M]

(i) Γ

(ii)S

(iii)The Load Admittance Y_L

(iv)Z_{in} at 0.4λ from the load

(v)The locations of V_{max} and V_{min} with respect to the load if the lone is 0.6 λ long

(vi)Z_{in} at the Generator

10.A Certain transmission line operating at ω =10^6 rad/s has α =8 dB/m, β=1 rad /m , and $Z_0 = 60 + j40\Omega$ And is 2m long. If the line is connected to the source of $10\angle 0^0$ V,Z_g=40 Ω And terminated by the load $20 + j50\Omega$,Determine the

(i)Input impedance

(ii)The sending-end Current

(iii)The Current at the middle of the line [12M]

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