Code No: R09220404 **R09** **Set No. 2**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRO MAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the "poisson's" and "Laplace's" equation.
   (b) Obtain expression for the capacitance of
      i. a parallel plate capacitor and
      ii. a coaxial capacitor. [7+8]

2. (a) In a transmission line, name the types of distortions that occur and explain.
   (b) To avoid distortion, what is the condition for a "Distortionless line" and derive an expression for the same in terms of line parameters. [8+7]

3. (a) Derive the wave equation for a medium with μ, ε and σ and solve the same for the propagation constant γ.
   (b) Derive the expression for α and β for a general medium with μ, ε & σ [7+8]

4. (a) State and prove Boundary Conditions for electric field between a conductor and a dielectric.
   (b) Copper wire carries a conduction current of 1.0 Amp at 60 Hz. Determine the displacement current in the wire? Assume $\varepsilon_{cu} = \varepsilon_0$; $\mu_{cu} = \mu_0$; $\sigma = 5.8 \times 10^7$ mhos/m. [7+8]

5. (a) Explain the constructional features of "Smith's" chart and its importance.
   (b) A load Impedance of 90-j25 Ω is to be matched to a 50 Ω line using single stub mathcing. Find the length and position of the stub. [7+8]

6. (a) Determine the "Electric field" 'E'due to
      i. Point charge Q
      ii. Line charge ρ_l
      iii. "Surface charge" ρ_s at a point distance 'r' from the source.
   (b) Evaluate the Coulomb's force, Electric field intensity and potential due to a line charge 'ρ_l'. [7+8]

7. (a) Show that the magnetic field due to straight current carrying conductor of finite length AB is given by $H = \frac{I}{4\pi R}(\cos\alpha_2 - \cos\alpha_1)\hat{a}_Q$.(figure 1)
   (b) Find the vector magnetic field intensity at P(1,2,3) in Cartesian coordinates caused by a current filament carrying a current of 10Amp along Z-axis, if the filament extends from

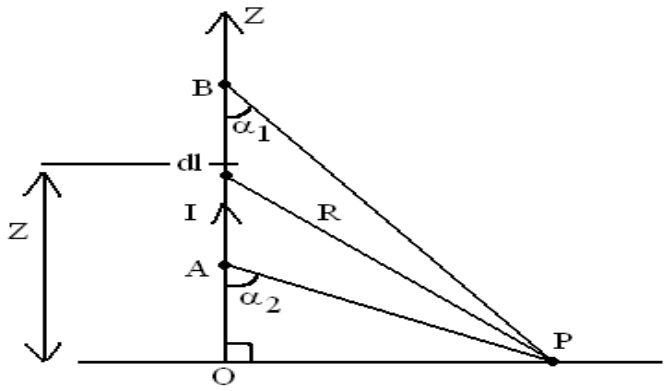

Figure 1:

i. z=0 to z=3

ii. z= -∞ to ∞ [8+7]

8. (a) Derive the Reflection coefficient for a parallel polarised wave at an angle of incidence θ_i between two media (loss less and $\mu_1 = \mu_2 = \mu_0$)

   (b) Define Brewster's angle and obtain an expression for the same in terms of medium parameters. [7+8]

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Code No: R09220404 **R09** **Set No. 4**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRO MAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define "Electric field", "Electric Flux density" and "Electric Potential" from charges and explain.
   (b) Explain about equipotential surfaces. [8+7]
2. (a) What is an isotropic and homogeneous medium?
   (b) What is a lossy and lossless medium?
   (c) Explain the term "Conduction Current Density". [5+5+5]
3. (a) State and explain Maxwell's equations obtained from Faraday's and Ampere's laws and their Magnetic field concepts & relationship.
   (b) The plane Y = 2 carries current density K = 30az Amp/mt. Find the Magnetic field intensity at A(0,0,1) and B(1,3,2). [8+7]
4. (a) Compare the impedance matching techniques such as
      i. $\lambda/4$
      ii. Single Stub
      iii. Double Stub on transmission lines.
   (b) A transmission line is terminated in a load Impedance Z_L = 73+j42.5 Ω, the frequency = 10^7 Hz line length l = 10 m. The inductance L = 10^{-6} H/m C= $\frac{1}{9} \times 10^{-10}$ F/m. Find Z_L? [7+8]
5. (a) A wave is incident from Air on to a perfect conductor normally. Evaluate the reflection coefficient.
   (b) What is surface impedance and explain the power loss between Air & a conductor surface at normal Incidence. [7+8]
6. (a) Evaluate the values of α, β, η and propagation constant, the velocity of propagation of EM waves in good conductors at a frequency W.
   (b) Define "Depth of propagation" and calculate the value of the same in copper at 10 MHz and 10 KHz.($\sigma_{cu} = 5.8 \times 10^7$ mhos/m; $\mu = \mu_0$). [7+8]
7. (a) State and explain Boundary conditions for electric field at a boudary surface between a conductor and dielectric boundary.
   (b) Evalaute the units of
      i. $\frac{\varepsilon}{\sigma}$

ii. $\frac{\sigma}{\omega\varepsilon}$

iii. $\sqrt{\frac{2}{\omega\mu\sigma}}$ [6+9]

8. (a) What is distortion on a line and derive a condition for Distortionless transmission.

   (b) A lossless T_X line has 75 ohms characteristic impedance. The line is terminated in a load impedance of (50-J100) ohms. The maximum voltage measured on the line is 100volts. Find the maximum and minimum current and minimum voltage on the line. At what distance from the load, the voltage and current are maximum. [7+8]

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Code No: R09220404 **R09** **Set No. 1**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRO MAGNETIC THEORY AND TRANSMISSION LINES
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Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
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1. (a) Derive the wave equation for a general medium with μ, ε and σ solve the same for 'γ' the propagation constant.
   (b) If the medium is assumed to be a good conductor, evaulate the values of α, β, η and υ at a frequency ω. [7+8]

2. (a) State and explain boundary conditions between two dielectric media.
   (b) A circular loop conductor having radius of o.2mt.is placed in XY plane. The loop consists of a resistance of 10 ohms. If the Magnetic field is B = Sin10^4t Tesla, find the current flowing in the loop. [7+8]

3. (a) Name the types of distortions on the transmission lines and explain.
   (b) Derive an expression for a distortionless line. [8+7]

4. (a) Explain "Reflection and Refraction" of plane waves.
   (b) Obtain an expression for the Reflection and Transmission coefficients of uniform waves between two media for normal incidence. [5+10]

5. (a) State and prove Ampere's circiutal law.
   (b) Explain the action of transformer and capacitor in terms of static and time varying fields. Give examples. [7+8]

6. (a) Obtain an expression for the Input Impedance of lossless line of length 'l' with Z_0 as characteristic Impedance and terminated by a load Z_L.
   (b) A line with $z_0 = 100\ \Omega$ is connected to an impedance (load) $Z_L = 300 + j200$. Find
      i. the line length 'd_1' required to transform this load to a pure resistance
      ii. the impedance of a $\lambda/4$ line required for a match
      iii. VSWR on the 'd_1' line and VSWR on $\lambda/4$ line. Use Smith chart. [7+8]

7. (a) Derive Poisson's and Laplace's equations and mention their applications.
   (b) Obtain an expression for the capacitance of a coaxial line in terms of outer conductor dia 'b' and inner conductor dia 'a'. [7+8]

8. (a) State and explain Gauss's law and prove that $\nabla.D = \rho_v$.

(b) A volume charge density inside a hollow sphere is $\rho = 10e^{-20r}c/m^3$. Find the total charge enclosed with in the sphere also find the electric flux density on the surface of the sphere. [7+8]

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Code No: R09220404 **R09** **Set No. 3**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRO MAGNETIC THEORY AND TRANSMISSION LINES
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Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the conditions to be satisfied for
   i. Brewster's angle
   ii. Critical angle.

   Explain in detail.

   (b) Derive an expression for Reflection Coefficient and Transmission Coefficient for a uniform plane wave incident normally between two Dielectric media. ($\mu_1\varepsilon_1$ *and* $\mu_2\varepsilon_2$) [7+8]

2. (a) A material has a dielectric constant 30 and conductivity of 3×10^5 mhos/mt. What is the frequency above which the materials can not behave as a good conductor. If a plane wave of 15MHz isincident on the material, upto what depth can the wave penetrate the material, and what will be the wave length of the wave in the material.

   (b) A uniform plane wave in free space is having $\vec{E} = 200.\exp[-J(0.1)z]\,.a_x V/mt.$ Find the instantaneous value of poyinting vector at t = 0, z = 1mt. [7+8]

3. Derive the Boundary conditions for Magnetic field at the boundary of two Media. [15]

4. (a) Name the different applications of "Short Circuited" loss lines of various lengths in transmission line problems.

   (b) Explain the terms
   i. quarter wavelength mathcing
   ii. Single stub matching in detail.

   (c) An antenna of 76 Ω is to be matched to a loss less line of 50(=Z_0)Ω. Explain the procedure. [5+5+5]

5. (a) Define "Electric field Intensity" and 'potential V' due to "point charges" and "line charges" & explain.

   (b) Find the 'E' field intensity on the axis of a circular ring carrying a charge density 'Q' C/m. [7+8]

6. (a) Write Maxwells equations for Time Varying fields in integral and differential form. Discuss the difference between static fields and Time Varying fields.

(b) A parallel plate capacitor with plate area of 5.0 cm^2 and plate separation of 3.0 mm has a voltage 50 sin 10^3 t volts applied to its plate. Calculate the displacement current assuming $\varepsilon = 2\varepsilon_0$ [7+8]

7. (a) What are Linear, Homogeneous and isotropic media?

   (b) Explain "Point charge", "Line charge" and "Surface charge" distributions and the 'E' & 'V' expressions also to the above, given examples of their applications. [7+8]

8. (a) What are frequency distortion and phase (delay) distortions in Transmission lines? What is the condition for a Distortionless line? Derive an expression for the same.

   (b) A T_X line has primary constants R = 0.1Ω/mt, G = 0.01 mhos/mt, L = 0.01μH/mt; C = 100PF/mt. If the line is connected to a load impedance of (10+J20) ohms, find reflection coefficient at the

      i. load end

      ii. 20 cm from load. [7+8]

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