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

**II B.Tech II Semester Examinations,April/May 2012**
**ELECTROMAGNETIC 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**

⋆ ⋆ ⋆ ⋆ ⋆

1. Derive the expression for Curl of a Vector in Cartesian, Cylindrical and Spherical Co-Ordinate system. [15]

2. (a) State and explain boundary conditions between two dielectric media.
   (b) A circular loop conductor having radius of 0.2 m is placed in XY plane. The loop consists of a resistance of 10 ohms. If the Magnetic field is B = $\text{Sin}10^4$t Tesla, find the current flowing in the loop. [7+8]

3. (a) Explain the concepts of conduction, convection and displacement current in materials.
   (b) What are "isotropic" and "homogeneous" dielectric materials?
   (c) What is "Relaxation time" and discuss its effect on conductors? [5+5+5]

4. (a) Explain the terms "work" and Energy density in electrostatic fields.
   (b) Esablish the relationship between potential energy and the work done on charges. Four point charges of 0.8 nC are located in free space at the corners of a square 4 cms side. Find the total potential energy stored. [7+8]

5. (a) Explain the importance of the parameter "$\frac{\sigma}{\omega\varepsilon}$" of a medium and evaluate the values of $\alpha, \beta, \eta$ and propagation constant of the medium if $\frac{\sigma}{\omega\varepsilon} << 1$.
   (b) Earth is considered to be a good conductor where $\frac{\sigma}{\omega\varepsilon} << 1$. Determine the highest frequency for which earth can be considered as good conductor if $\frac{\sigma}{\omega\varepsilon} << 0.1$. Assume the following constant for earth: $\sigma = 5 \times 10^{-3}$; $\varepsilon = 10\varepsilon_0$. [7+8]

6. (a) Define Polyting's theorem and Polyting Vector.
   (b) A sinusoidally varying EM wave in a medium of $\varepsilon_r = 1$; $\mu_r$ is transmitting power at a density 1.2 watts/sqm. Find the maximum values of 'E' and 'H' fields. [7+8]

7. (a) Using transmission lines how to obtain various impedances. Explain.
   (b) What is the input impedance of a short circuited loss less line whose lengths are
      i. $\lambda/8$
      ii. $\lambda/4$
      iii. $3\lambda/8$ [8+7]

8. (a) What is a quarter wave transformer and how is it used for matching? Explain.

   (b) Explain the method of measuring an unknown load impedance $Z_L$ using a slotted transmission line and VSWR with the help of Smith's chart.
   . [7+8]

⋆ ⋆ ⋆ ⋆ ⋆

**II B.Tech II Semester Examinations,April/May 2012**
**ELECTROMAGNETIC 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**

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Define and explain Biot - Savart's law. Hence obtain the magnetic field due to a straight current carrying filamentary conductor of finite length.
   (b) A current element (ax+2ay-az)mA, located at P(-1, 2,-2) produces a Magnetic field "dH" at Q(2,2,2). Find a unit vector in the direction of "dH", at the point Q. [7+8]
2. (a) What are Primary and Secondary Parameters of a Transmission line?
   (b) Obtain an expression for the propagation constant of a line at W in terms of line parameters.
   (c) Given R = 10.4 Ω/mt
   L = 0.00367 H/mt
   G = $0.8 \times 10^{-4}$ mhos/mt
   C = 0.00835 $\mu$F/mt.
   Calculate $Z_0$ and $\gamma$ at 1.0 KHz. [5+5+5]
3. (a) Evalaute the equivalent lumped element parameters of a lossless short circuited line of different lengths such as $l = \frac{\lambda}{8}$; $l = \frac{\lambda}{4}$; $l = \frac{5\lambda}{16}$; $l = \frac{3\lambda}{8}$ and $l = \frac{\lambda}{2}$.
   (b) An antenna with Radiation resistance of $Z_L$ = 73 Ω is to be matched to a lossless line of $Z_0$ = 50 ohms. Evaluate a simple matching mechanism to match the antenna to the line. Give the values. [8+7]
4. (a) Explain the terms charges, electric forces, Electric fields and Potentials.
   (b) Derive the expression for the energy stored in an electrostatic field. [7+8]
5. (a) Write Maxwells equaitons for time varying fileds in Defferential and Integral form.
   (b) Derive the expression for Displacement current density in a medium.
   (c) Given the conduction current density in Silicon as $J_c$ = 1 mA, evaluate the displacement current density in Silicon at 1 MHz. (use $\sigma_{Si} = 10^2$ mhos/m; $\varepsilon r_{(Si)} = 9$) [5+5+5]
6. (a) Explain $\nabla.J = -\frac{\partial \rho}{dt}$ and what is its importance in Maxwell's equation and prove the equation.
   (b) $\nabla \times H = \sigma E + \varepsilon \frac{\partial E}{\partial t}$ is a Maxwells equation called Ampere's law. Explain the equation in respect of conduction and Displacement current. [7+8]

7. (a) Derive the wave equation for 'E' field from Maxwell's equation and solve the same for uniform plane wave propagating in freespace.
   (b) Determine the relationship $\frac{E}{H}$ and show that it is equal to $\sqrt{\frac{\mu}{\varepsilon}}$ [7+8]

8. (a) Derive the Reflection coefficient for a parallel polarised wave at an angle of incidence $\theta_i$ 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]

⋆⋆⋆⋆⋆

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

**II B.Tech II Semester Examinations,April/May 2012**
**ELECTROMAGNETIC 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**
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Define "Poynting Vector" and "Power flow".
   (b) A medium is characterised by $\sigma = 0$; and $\mu = 2\mu_0$ and $\varepsilon = 5\varepsilon_0$. If $H = 2\cos\hat{z}(wt - 3y)A/m$, calculate W and E. [7+8]

2. (a) Distinguish between conduction current and displacement current with examples.
   (b) If the Magnetic flux density is B = Cos($10^4$t).Sin(0.1x).$a_z$ milli Tesla, find the magnetic flux passing through the surface Z = 0, $0 < x < 10$mt., $0 < y < 3$ mt. at t = 2Microsec. [7+8]

3. (a) State and explain Biot - Savart's Law.
   (b) Derive an expression for the magnetic force on a current element. mention its applications.
   (c) A surface current Density K = 20ax Amp/mt flows in Y = 1 plane. Find the Magnetic field intensity at (-1,3,2). [5+5+5]

4. (a) What are isotropic and homogeneous media? Give examples.
   (b) The z - axis carries a non - uniform charge density of ($Z^2$+1)nC/mt for $-2 < Z < 2$ in free space. Find the electric field intensity at P(1,0,0). [5+10]

5. (a) Show that a loss less quater wave length line behaves as impedance inverter and a half-wavelength line behaves as 1:1 transformer
   (b) Show that a lossless transsmission line of different lengths can be made to behave as
      i. inductance 'L'
      ii. capacitance 'C'
      iii. series impedance(figure 1) and

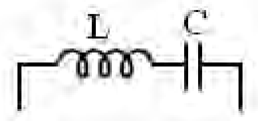


Figure 1:

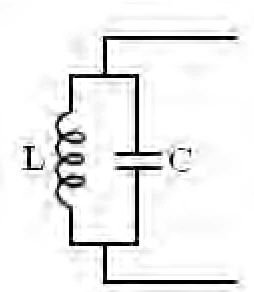


Figure 2:

iv. shunt impedance resonant circuits(figure 2) (either shorted or open). [5+5+5]

6. (a) Define 'E' field and 'H' fields.
   (b) Determine the Electric field intensity due to
      i. a point charge 'Q'
      ii. to a line charge $P_l$ in space at a point P.
   (c) Evaluate the potential at that point from 'E' fields. [5+5+5]

7. (a) Derive the wave equation for 'H' field from Maxwell's equation and solve the same for propagation constant in homogeneous, isotropic medium for uniform plane wave propagating in Z-direction. Get the value of 'E' field.
   (b) Determine the value of $\alpha, \beta, \eta$ and propagation constant for a good conductor and Depth of penetration. [7+8]

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]

⋆⋆⋆⋆⋆

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

**II B.Tech II Semester Examinations,April/May 2012**
**ELECTROMAGNETIC 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**

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) State and explain Coulomb's law & Faraday's law.
   (b) Evaluate the electrostatic force(F) field 'E' and potential 'V' due to
      i. point charge and
      ii. a line charge at a distance 'r' from the source. [7+8]

2. (a) Define Faradays's law and Lenz law.
   (b) State Ampere's law and explain. [8+7]

3. (a) Explain the principle of quarter wave matching and single stub matching on transmission lines at $\mu$HF.
   (b) A load has admittance $\frac{Y_L}{Y_0} = 1.25 + \mathrm{j}0.25$. Find the length and location of a single stub to match the line to the load use Smith chart. [7+8]

4. (a) What is Total Internal reflection and critical angle between two media?
   (b) Explain the term "Surface impedance" and "depth of penetration". [7+8]

5. (a) State and explain Biot-Savart's law.
   (b) Deduce Biot-Savart Law considering
      i. Surface Current
      ii. Volume Current. [8+7]

6. (a) Write the basic transmission equations in terms of R,L,C,G and V & I and explain.
   (b) Obtain the wave equation from the basic equation and solve the same for propagation constant and characteristic impedance of the transmission line at a frequency 'W' in terms of R,L,C,G. [8+7]

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) Derive the wave equation for a general medium and solve the same for a uniform plane wave propagating in a medium with $\mu, \varepsilon, \sigma$ at a frequency $\omega$. Obtain the values of $\gamma = \alpha + j\beta$.
   (b) Define loss Tangent and explain how materials are clasified based on loss Tangent. [7+8]

⋆⋆⋆⋆⋆