Code No: R05220404 **R05** **Set No. 2**

II B.Tech II Semester Examinations,April/May 2012
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the significance of $V_{max} and V_{min}$ positions along the transmission line, for a complex load Z_R Hence calculate the impedances at these positions.
   (b) An aerial of (200-j300) Ω is to be matched with 500 Ω lines. The matching is to be done by means of low loss 600Ω stub line. Find the position and length of the stub line used if the operating wavelength is 20 meters. [8+8]

2. (a) Derive an expression for the field strength due to a volume of uniform charge density at an arbitrary point P(r, θ, ϕ).
   (b) A point charge Q is located at the center of a neutral spherical conducting shell. Find the surface charge density at the inner surface and also at the outer surface. Assume the inner and outer diameters of the spherical shell to be '2a' and '2b' respectively. [8+8]

3. (a) Develop Maxwell's equation involving $\nabla \times E$ from fundamental considerations of closed circuit.
   (b) A square loop of side 20 Cm is located in free space adjacent to a straight conductor that carries a sinusoidal current of 0.5 A (rms) at 5KHz. If a small gap of 5cm is introduced in to the loop what is the induced voltage across the gap. [8+8]

4. (a) List out types of transmission lines and draw their schematic diagrams.
   (b) Draw the directions of electric and magnetic fields in parallel plate and coaxial lines.
   (c) A transmission line in which no distortion is present has the following parameters $Z_o = 60\Omega, \alpha = 20mNP/m, V = 0.7V_0$. Determine R, L, G, C and wavelength at 0.1GHz. [5+5+6]

5. (a) Derive the relation $\lambda = \frac{\lambda_c \quad \lambda_g}{\sqrt{\lambda_g^2 \ + \lambda_c^2}}$ where λ is free space wave length, λ_g is the wave length measured in the guide, and λ_c is the cut off wave length.
   (b) Explain the impossibility of TEM wave propagation in wave guides. [10+6]

6. (a) State Ampere's circuital law. Specify the conditions to be met for determining magnetic field strength, H, based on Ampere's circuital law.
   (b) A long straight conductor with radius 'a' has a magnetic field strength $H = (Ir/2\pi a^2)\,\hat{a}_\phi$ within the conductor $(r < a)$ and $H = (I/2\pi r)\,\hat{a}_\phi$ outside the conductor $(r > a)$ Find the current density J in both the regions $(r < a \ and \ r > a)$

(c) Define Magnetic flux density and vector magnetic potential. [4+8+4]

7. (a) A plane sinusoidal electromagnetic wave travelling in space has $E_{max} = 1500\mu v/m$
   i. Find the accompanying H_{max}
   ii. The average power transmitted

   (b) The electric field intersity associated with a plane wave travelling in a perfect dielectric medium is given by $E_x(z, t) = 10 \cos (2\pi \text{ x } 10^7 \text{ t - } 0.1 \, \pi z)$v/m [4+4+8]
   i. What is the velocity of propagation
   ii. Write down an expression for the magnetic field intesity associated with the wave if $\mu = \mu_0$

8. (a) Determine the condition under which the magnitude of the reflection coefficient equals to that of the transmission coefficient for a uniform plane wave at normal incidence on an interface between two loss less dielectric media. What is the standing wave ratio in dB under this condition.

   (b) The reflected magnetic field $H_r = -\sqrt{2}$ mA/m. and the incident electric field in medium 1(free space) is 1 mV/m. The medium 2 has $\varepsilon_{r2} = 18 \, and \, \sigma_2 = 0$. Determine the permeability of medium2.
   Assume normal incidence of EM wave from medium1 to medium2. [8+8]

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Code No: R05220404 **R05** **Set No. 4**

II B.Tech II Semester Examinations,April/May 2012
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) A plane sinusoidal electromagnetic wave travelling in space has $E_{max} = 1500\mu v/m$
    i. Find the accompanying H_{max}
    ii. The average power transmitted

   (b) The electric field intersity associated with a plane wave travelling in a perfect dielectric medium is given by $E_x(z, t) = 10 \cos (2\pi \text{ x } 10^7 \text{ t - } 0.1 \pi z)$v/m [4+4+8]
    i. What is the velocity of propagation
    ii. Write down an expression for the magnetic field intesity associated with the wave if $\mu = \mu_0$

2. (a) Derive an expression for the field strength due to a volume of uniform charge density at an arbitrary point P(r, θ, ϕ).

   (b) A point charge Q is located at the center of a neutral spherical conducting shell. Find the surface charge density at the inner surface and also at the outer surface. Assume the inner and outer diameters of the spherical shell to be '2a' and '2b' respectively. [8+8]

3. (a) Determine the condition under which the magnitude of the reflection coefficient equals to that of the transmission coefficient for a uniform plane wave at normal incidence on an interface between two loss less dielectric media. What is the standing wave ratio in dB under this condition.

   (b) The reflected magnetic field $H_r = -\sqrt{2}$ mA/m. and the incident electric field in medium 1(free space) is 1 mV/m. The medium 2 has $\varepsilon_{r2} = 18 \, and \, \sigma_2 = 0$. Determine the permeability of medium2.
   Assume normal incidence of EM wave from medium1 to medium2. [8+8]

4. (a) Derive the relation $\lambda = \frac{\lambda_c \;\; \lambda_g}{\sqrt{\;\lambda_g^2 \; + \; \lambda_c^2}}$ where λ is free space wave length, λ_g is the wave length measured in the guide, and λ_c is the cut off wave length.

   (b) Explain the impossibility of TEM wave propagation in wave guides. [10+6]

5. (a) Develop Maxwell's equation involving $\nabla \times E$ from fundamental considerations of closed circuit.

   (b) A square loop of side 20 Cm is located in free space adjacent to a straight conductor that carries a sinusoidal current of 0.5 A (rms) at 5KHz. If a small gap of 5cm is introduced in to the loop what is the induced voltage across the gap. [8+8]

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   (c) Define Magnetic flux density and vector magnetic potential. [4+8+4]
7. (a) List out types of transmission lines and draw their schematic diagrams.
   (b) Draw the directions of electric and magnetic fields in parallel plate and coaxial lines.
   (c) A transmission line in which no distortion is present has the following parameters $Z_o = 60\Omega, \alpha = 20mNP/m, V = 0.7V_0$. Determine R, L, G, C and wavelength at 0.1GHz. [5+5+6]
8. (a) Explain the significance of $V_{max} and V_{min}$ positions along the transmission line, for a complex load Z_R Hence calculate the impedances at these positions.
   (b) An aerial of (200-j300) Ω is to be matched with 500 Ω lines. The matching is to be done by means of low loss 600Ω stub line. Find the position and length of the stub line used if the operating wavelength is 20 meters. [8+8]

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Code No: R05220404 **R05** **Set No. 1**

II B.Tech II Semester Examinations,April/May 2012
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

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   (c) A transmission line in which no distortion is present has the following parameters $Z_o = 60\Omega, \alpha = 20mNP/m, V = 0.7V_0$. Determine R, L, G, C and wavelength at 0.1GHz. [5+5+6]

3. (a) Explain the significance of $V_{max} and V_{min}$ positions along the transmission line, for a complex load Z_R Hence calculate the impedances at these positions.
   (b) An aerial of (200-j300) Ω is to be matched with 500 Ω lines. The matching is to be done by means of low loss 600Ω stub line. Find the position and length of the stub line used if the operating wavelength is 20 meters. [8+8]

4. (a) A plane sinusoidal electromagnetic wave travelling in space has $E_{max} = 1500\mu v/m$
      i. Find the accompanying H_{max}
      ii. The average power transmitted
   (b) The electric field intersity associated with a plane wave travelling in a perfect dielectric medium is given by $E_x(z, t) = 10 \cos(2\pi \times 10^7 t - 0.1\pi z)$v/m [4+4+8]
      i. What is the velocity of propagation
      ii. Write down an expression for the magnetic field intesity associated with the wave if $\mu = \mu_0$

5. (a) Determine the condition under which the magnitude of the reflection coefficient equals to that of the transmission coefficient for a uniform plane wave at normal incidence on an interface between two loss less dielectric media. What is the standing wave ratio in dB under this condition.

(b) The reflected magnetic field $H_r = -\sqrt{2}$ mA/m. and the incident electric field in medium 1(free space) is 1 mV/m. The medium 2 has $\varepsilon_{r2} = 18\, and\, \sigma_2 = 0$. Determine the permeability of medium2.
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Code No: R05220404 **R05** **Set No. 3**

II B.Tech II Semester Examinations,April/May 2012
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

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1. (a) Derive the relation $\lambda = \frac{\lambda_c \ \lambda_g}{\sqrt{\lambda_g^2 + \lambda_c^2}}$ where λ is free space wave length, λ_g is the wave length measured in the guide, and λ_c is the cut off wave length.
   (b) Explain the impossibility of TEM wave propagation in wave guides. [10+6]

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ii. Write down an expression for the magnetic field intesity associated with the wave if $\mu = \mu_0$

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