Code No: NR220403 **NR** **Set No. 2**

II B.Tech II Semester Examinations,December 2010
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) For an unloaded cable with R > > wL and wC > > G, derive expressions for the attenuation constant α and phase constant, phase velocity and compose them with those of distortion less Loss Lines. [8+8]
   (b) A transmission line having negligible losses and a characteristic impedance of 300Ω is one quarter wave length long. What will be the voltage at the open circuited receiving end when the other end is connected to a generator of emf 1V and 5Ω resistive internal impedance?

2. (a) Establish Poisson's and Laplace's equations from Gauss's law.
   (b) Obtain the expressions for the far field and the potential due to a small electric dipole oriented along z-axis. [8+8]

3. (a) Compare the modes, merits and demerits of Rectangular wave guides and Circular wave guides. [8]
   (b) An air filled $5cm \rightarrow 2cm$ wave guide has $E_z = 20sin(40\pi x)\ sin\ (50\pi y)e^{j\beta z}V/mat15GHz$.
      i. What mode is being propagated [2+3+3]
      ii. Find β
      iii. Determine $E_y/H_x and E_x/H_y$.

4. (a) For a parallel plane wave guide having z-propogation, explain the nature of variation and sketch the variation of E and H for TM_{10} waves.
   (b) Starting from the characteristic equation for propogation constant, establish the mathematical relations for the characteristics of TE and TM waves in a parallel plane guide. [8+8]

5. (a) Show that for any uniform transmission line the following relations are valid.
   $Z_0 = \sqrt{Z_{OC},\ Z_{SC}}\ Tan\,h\,P1 = \sqrt{\frac{Z_{SC}}{Z_{OC}}}$
   What will be their modifications for loss less lines? [8]
   (b) Short-circuited and open-circuited measurements at frequency of 5000 Hz on a line length 100 km yields the following results:
   $Z_{OC} = 570\ \underline{|-48^0}$
   $Z_{SC} = 720\ \underline{|34^0}$

   Find the characteristic impedance and propagation constant of the line. [8]

6. (a) Define uniform plane waves. Solve the wave equations for uniform plane waves in a medium of conductivity σ and hence establish the relations for propogation constant, attenuation and phase constants in terms of σ.

   (b) Explain the characteristics of the propogating waves in a good conducting medium. [10+6]

7. An infinitely long straight conducting rod of radius 'a' carries a current of I in $+\hat{Z}$ direction. Using Ampere's Circuital Law, find $\overline{H}$ in all regions and sketch the variation of H as a function of radial distance. If I = 3 mA. and a = 2 cm., find $\overline{H}$ and $\overline{B}$ at (0, 1cm., 0) and (0, 4cm., 0). [4+6+6]

8. A y-polarized uniform plane wave with fields (E_i, H_i) and a frequency of 100 MHz propogates in air in the + x direction and impinges normally on a perfectly conducting plane at x = 0, assuming the amplitude of E_i to be 6 mV/m, write the phasor and instantaneous expressions for.

   (a) E_i *and* H_i of the incident wave.

   (b) E_r *and* H_r of the reflected wave

   (c) E_T *and* H_T of the total wave in air

   (d) Determine the location nearest to the conducting plane where E_T *and* H_T are zero. [4+4+4+4]

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Code No: NR220403 **NR** **Set No. 4**

II B.Tech II Semester Examinations,December 2010
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. An infinitely long straight conducting rod of radius 'a' carries a current of I in $+\hat{Z}$ direction. Using Ampere's Circuital Law, find $\overline{H}$ in all regions and sketch the variation of H as a function of radial distance. If I = 3 mA. and a = 2 cm., find $\overline{H}$ and $\overline{B}$ at (0, 1cm., 0) and (0, 4cm., 0). [4+6+6]

2. (a) Compare the modes, merits and demerits of Rectangular wave guides and Circular wave guides. [8]

   (b) An air filled $5cm \rightarrow 2cm$ wave guide has $E_z = 20sin(40\pi x)\ sin\ (50\pi y)e^{j\beta z}V/mat15GHz$.

   i. What mode is being propagated [2+3+3]

   ii. Find β

   iii. Determine $E_y/H_x and E_x/H_y$.

3. (a) Define uniform plane waves. Solve the wave equations for uniform plane waves in a medium of conductivity σ and hence establish the relations for propogation constant, attenuation and phase constants in terms of σ.

   (b) Explain the characteristics of the propogating waves in a good conducting medium. [10+6]

4. A y-polarized uniform plane wave with fields (E_i, H_i) and a frequency of 100 MHz propogates in air in the + x direction and impinges normally on a perfectly conducting plane at x = 0, assuming the amplitude of E_i to be 6 mV/m, write the phasor and instantaneous expressions for.

   (a) E_i *and* H_i of the incident wave.

   (b) E_r *and* H_r of the reflected wave

   (c) E_T *and* H_T of the total wave in air

   (d) Determine the location nearest to the conducting plane where E_T *and* H_T are zero. [4+4+4+4]

5. (a) For a parallel plane wave guide having z-propogation, explain the nature of variation and sketch the variation of E and H for TM_{10} waves.

   (b) Starting from the characteristic equation for propogation constant, establish the mathematical relations for the characteristics of TE and TM waves in a parallel plane guide. [8+8]

6. (a) Establish Poisson's and Laplace's equations from Gauss's law.
   (b) Obtain the expressions for the far field and the potential due to a small electric dipole oriented along z-axis. [8+8]

7. (a) Show that for any uniform transmission line the following relations are valid.
   $Z_0 = \sqrt{Z_{OC},\ Z_{SC}}\ Tan\,h\,P1 = \sqrt{\frac{Z_{SC}}{Z_{OC}}}$
   What will be their modifications for loss less lines? [8]
   (b) Short-circuited and open-circuited measurements at frequency of 5000 Hz on a line length 100 km yields the following results:
   $Z_{OC} = 570\ \underline{|-48^0}$
   $Z_{SC} = 720\ \underline{|34^0}$

   Find the characteristic impedance and propagation constant of the line. [8]

8. (a) For an unloaded cable with R > > wL and wC > > G, derive expressions for the attenuation constant α and phase constant, phase velocity and compose them with those of distortion less Loss Lines. [8+8]
   (b) A transmission line having negligible losses and a characteristic impedance of 300Ω is one quarter wave length long. What will be the voltage at the open circuited receiving end when the other end is connected to a generator of emf 1V and 5Ω resistive internal impedance?

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Code No: NR220403 **NR** **Set No. 1**

II B.Tech II Semester Examinations,December 2010
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) Establish Poisson's and Laplace's equations from Gauss's law.
   (b) Obtain the expressions for the far field and the potential due to a small electric dipole oriented along z-axis. [8+8]

2. A y-polarized uniform plane wave with fields (E_i, H_i) and a frequency of 100 MHz propogates in air in the + x direction and impinges normally on a perfectly conducting plane at x = 0, assuming the amplitude of E_i to be 6 mV/m, write the phasor and instantaneous expressions for.
   (a) E_i *and* H_i of the incident wave.
   (b) E_r *and* H_r of the reflected wave
   (c) E_T *and* H_T of the total wave in air
   (d) Determine the location nearest to the conducting plane where E_T *and* H_T are zero. [4+4+4+4]

3. (a) For a parallel plane wave guide having z-propogation, explain the nature of variation and sketch the variation of E and H for TM_{10} waves.
   (b) Starting from the characteristic equation for propogation constant, establish the mathematical relations for the characteristics of TE and TM waves in a parallel plane guide. [8+8]

4. An infinitely long straight conducting rod of radius 'a' carries a current of I in $+\hat{Z}$ direction. Using Ampere's Circuital Law, find $\overline{H}$ in all regions and sketch the variation of H as a function of radial distance. If I = 3 mA. and a = 2 cm., find $\overline{H}$ and $\overline{B}$ at (0, 1cm., 0) and (0, 4cm., 0). [4+6+6]

5. (a) For an unloaded cable with R > > wL and wC > > G, derive expressions for the attenuation constant α and phase constant, phase velocity and compose them with those of distortion less Loss Lines. [8+8]
   (b) A transmission line having negligible losses and a characteristic impedance of 300Ω is one quarter wave length long. What will be the voltage at the open circuited receiving end when the other end is connected to a generator of emf 1V and 5Ω resistive internal impedance?

6. (a) Define uniform plane waves. Solve the wave equations for uniform plane waves in a medium of conductivity σ and hence establish the relations for propogation constant, attenuation and phase constants in terms of σ.

(b) Explain the characteristics of the propogating waves in a good conducting medium. [10+6]

7. (a) Compare the modes, merits and demerits of Rectangular wave guides and Circular wave guides. [8]

(b) An air filled $5cm \rightarrow 2cm$ wave guide has
$E_z = 20sin(40\pi x)\ sin\ (50\pi y)e^{j\beta z}V/mat15GHz.$

i. What mode is being propagated [2+3+3]

ii. Find β

iii. Determine $E_y/H_x and E_x/H_y$.

8. (a) Show that for any uniform transmission line the following relations are valid.
$Z_0 = \sqrt{Z_{OC},\ Z_{SC}}\ Tan\,h\,P1 = \sqrt{\frac{Z_{SC}}{Z_{OC}}}$
What will be their modifications for loss less lines? [8]

(b) Short-circuited and open-circuited measurements at frequency of 5000 Hz on a line length 100 km yields the following results:
$Z_{OC} = 570\ \underline{|-48^0}$
$Z_{SC} = 720\ \underline{|34^0}$

Find the characteristic impedance and propagation constant of the line. [8]

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Code No: NR220403 **NR** **Set No. 3**

II B.Tech II Semester Examinations,December 2010
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) For an unloaded cable with R > > wL and wC > > G, derive expressions for the attenuation constant α and phase constant, phase velocity and compose them with those of distortion less Loss Lines. [8+8]
   (b) A transmission line having negligible losses and a characteristic impedance of 300Ω is one quarter wave length long. What will be the voltage at the open circuited receiving end when the other end is connected to a generator of emf 1V and 5Ω resistive internal impedance?

2. (a) Define uniform plane waves. Solve the wave equations for uniform plane waves in a medium of conductivity σ and hence establish the relations for propogation constant, attenuation and phase constants in terms of σ.
   (b) Explain the characteristics of the propogating waves in a good conducting medium. [10+6]

3. (a) Show that for any uniform transmission line the following relations are valid.
   $Z_0 = \sqrt{Z_{OC}, Z_{SC}}\ Tan\,h\,P1 = \sqrt{\frac{Z_{SC}}{Z_{OC}}}$
   What will be their modifications for loss less lines? [8]
   (b) Short-circuited and open-circuited measurements at frequency of 5000 Hz on a line length 100 km yields the following results:
   $Z_{OC} = 570\ \underline{|-48^0}$
   $Z_{SC} = 720\ \underline{|34^0}$

   Find the characteristic impedance and propagation constant of the line. [8]

4. (a) Compare the modes, merits and demerits of Rectangular wave guides and Circular wave guides. [8]
   (b) An air filled $5cm \rightarrow 2cm$ wave guide has
   $E_z = 20sin(40\pi x)\ sin\ (50\pi y)e^{j\beta z}V/mat15GHz.$
      i. What mode is being propagated [2+3+3]
      ii. Find β
      iii. Determine $E_y/H_x and E_x/H_y$.

5. (a) For a parallel plane wave guide having z-propogation, explain the nature of variation and sketch the variation of E and H for TM_{10} waves.

(b) Starting from the characteristic equation for propogation constant, establish the mathematical relations for the characteristics of TE and TM waves in a parallel plane guide. [8+8]

6. (a) Establish Poisson's and Laplace's equations from Gauss's law.

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7. An infinitely long straight conducting rod of radius 'a' carries a current of I in $+\hat{Z}$ direction. Using Ampere's Circuital Law, find $\overline{H}$ in all regions and sketch the variation of H as a function of radial distance. If I = 3 mA. and a = 2 cm., find $\overline{H}$ and $\overline{B}$ at (0, 1cm., 0) and (0, 4cm., 0). [4+6+6]

8. A y-polarized uniform plane wave with fields (E_i, H_i) and a frequency of 100 MHz propogates in air in the + x direction and impinges normally on a perfectly conducting plane at x = 0, assuming the amplitude of E_i to be 6 mV/m, write the phasor and instantaneous expressions for.

   (a) E_i *and* H_i of the incident wave.

   (b) E_r *and* H_r of the reflected wave

   (c) E_T *and* H_T of the total wave in air

   (d) Determine the location nearest to the conducting plane where E_T *and* H_T are zero. [4+4+4+4]

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