Code No: 07A31001 **Set No. 1**

II B.Tech I Semester Regular Examinations, November 2008
ELECTROMAGNETIC WAVES AND TRANSMISSION LINES
(Electronics & Instrumentation Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define potential gradient and list out salient features of potential difference.
   (b) An electric dipole, 1.0ay nC-m is located at (0, 0, 0). Find out the potential at $\left(1, \frac{\pi}{4}, \frac{\pi}{2}\right)$. [8+8]
2. (a) Obtain an expression for the energy density in the field of a solenoid.
   (b) Find the energy stored per unit length in the internal magnetic field of an infinite long straight wire of radii 2 mm carrying uniform current 10 A. [8+8]
3. (a) Write Maxwell's equations for free space in both point and integral form.
   (b) Find **D**, and **B** if $E = 10 \sin(\omega t - \beta z)\, a_y$. [8+8]
4. (a) Define direction cosine of a vector field.
   (b) What are the characteristics of waves when incident normally on perfect conductor. [8+8]
5. (a) Calculate the intrinsic impedance, propagation constant r and the wave veocity μ for a conducting medium in which $\sigma = 58$ Ms/m, $\mu_r = 1$ at a frequency f = 100 mHz.
   (b) State the fresnel's equations for parallel polarization and perpendicular polarization of a plane wave at OBLIQUE Incidence. [8+8]
6. (a) When a wave of 6GHz propagates in parallel conducting plates separated by 3cm, find the phase velocity, group velocity of the wave for the dominant wave.
   (b) Write the characteristics of TEM waves. [12+4]
7. (a) Explain the various primary constants for parallel wires?
   (b) Calculate the characteristic impedance, the attenuation constant and phase constant of a transmission line if the following measurements have been made on the line $Z_{OC} = 550\Omega$ and $Z_{SC} = 560\Omega$. [8+8]
8. For a typical open wire telephone cable the primary constants R = 10Ω/km, G = 0.4 $\times 10^{-6}$mho/km, L = 0.0037H/km, C = 0.0083μF/km. Determine Zo and the propagation constant at a frequency of 1KHz. [16]

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Code No: 07A31001 **Set No. 2**

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ELECTROMAGNETIC WAVES AND TRANSMISSION LINES
(Electronics & Instrumentation Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define potential gradient and list out salient features of potential difference.
   (b) An electric dipole, 1.0ay nC-m is located at (0, 0, 0). Find out the potential at $\left(1, \frac{\pi}{4}, \frac{\pi}{2}\right)$. [8+8]

2. (a) State and explain Ampere's force law.
   (b) If the vector magnetic potential, $A = 2.0\ a_v + 5.0\, a_\phi$ in spherical coordinates, find B at (2.0, $\pi/6$, 0). [8+8]

3. (a) Write Maxwell's equations for static fields and explain.
   (b) In free space, $\mathbf{D} = 5.0 \sin(\omega t + \beta z)\, a_x$. Find $\mathbf{B}$ using Maxwell's equations. [8+8]

4. The phasor magnetic field intensity for a 400 MHz uniform plane wave propagating in a certain lossless material is $(a_y - j\,5\, a_z)\ e^{-j25x},\ A/m$, if $E_m = 1000$ V/m, find:
   (a) β
   (b) η
   (c) λ. [16]

5. What is Transmission Coefficient? Derive the expression for transmission coefficient of a uniform plane wave at normal incidence. [16]

6. What are the field components for TE waves? Derive them and draw the sketches for JE_{10} mode.? [16]

7. (a) What are primary constants? Explain the features of primary constants?
   (b) Find the characteristic impedance of a line at 1600Hz if the following measurements have been made on the line at 1600Hz, $Z_{OC} = 650\Omega$ and $Z_{SC} = 550\Omega$. [8+8]

8. Write a detailed note on a double stub matching on a line using smith chart? [16]

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Code No: 07A31001 **Set No. 3**

II B.Tech I Semester Regular Examinations, November 2008
ELECTROMAGNETIC WAVES AND TRANSMISSION LINES
(Electronics & Instrumentation Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) An infinite line charge, $\rho_L = 10$ nC/m parallel to z-axis is at x = 3, y = 4 in free space. Find E at (a) (0, 0, 0), (b) (0, 1, 2), (c) (1, 1, 1).
   (b) A parallel plate capacitor with free space between the plates remains connected to a constant voltage source while the plates are moved closer together from separation d to ⊥d. Find the charge in ρ_s , **C, D, E**. [8+8]

2. (a) Derive Amperes circuit law in differential form.
   (b) What is the magnetic field, H in Cartesian coordinates due to z-directed current element and hence find out J if I = 2 A. [8+8]

3. (a) Prove that the field given by $E = x^2 a_x + x\, a_y$ can not arise from a static distribution of charge.
   (b) Show that the power density corresponding to the field $E = a_x \cos(\beta z - \omega t) + a_y \sin(\beta z - \omega t)$ is constant everywhere. [8+8]

4. (a) Identify frequency, phase constant when the electric field of an EM wave is given by E = 5.0 $\sin(10^8 t - 4.0x)a_z$. Also find λ.
   (b) Describe the propagation characteristics of EM waves in good dielectrics. [8+8]

5. (a) Explain the characteristics of Uniform plane wave in perfect dielectric?
   (b) A 300MHz uniform plane wave propagates through fresh water for which $\sigma = 0$, $\mu_r = 1$, $\varepsilon_r = 78$. Calculate:
      i. The attenuation constant
      ii. The phase constant
      iii. Wavelength
      iv. Intrinsic impedance. [8+8]

6. (a) Explain the different excitation methods for different TE and TM waves.
   (b) A rectangular waveguide with dimensions 3 × 2cm operates at 10GHz. Find f_c, λ_c, λ, λ_g, β_g, υ_p of TE_{10} mode. [8+8]

7. Derive the equation for input impedance of a transmission line. & deduce the expression for short & open circuited lines. [16]

8. (a) Explain applications of the smith chart?
   (b) A lossless transmission line of length 100m has an inductance of 28μH and a capacitance of 20nF. Find propagation velocity, phase constant at an operating frequency of 100kHz and characteristic impedance of the line. [8+8]

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Code No: 07A31001 **Set No. 4**

II B.Tech I Semester Regular Examinations, November 2008
ELECTROMAGNETIC WAVES AND TRANSMISSION LINES
(Electronics & Instrumentation Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define potential at a point and obtain its expression.
   (b) The potential at a point A is 10 volts and at B is 15 volts. If a charge, Q = 10 μC is moved from A to B, what is the work required to be done. [8+8]

2. (a) Explain the coefficient of coupling in an inductor coil.
   (b) Two coils of L_1 = 100 mH, L_2 = 50 mH have a coefficient of coupling equal to 0.3. Find mutual inductance. [8+8]

3. (a) Obtain Maxwell's equations in phasor form.
   (b) Verify whether the following fields $\mathbf{E} = 2 \sin x \sin t \, a_y$ and $\mathbf{H} = \frac{2}{\mu_0} \cos x \cos t \, a_z$ satisfy the Maxwell's equation in free space. [8+8]

4. (a) Derive an expression for reflection of a wave when incident on dielectric with oblique incidence with perpendicular polarization.
   (b) Explain the concept of total internal reflection. [8+8]

5. (a) Derive the expression for power flow in a concentric cable?
   (b) A parallel polarized wave propagates from air to a dielectric at Brewster angle of 75 degrees. Find ε_r. [8+8]

6. (a) Explain the field equations for TE waves in rectangular wave guide. Define dominant mode.
   (b) If a wave of 6GHz is propagating between two parallel conducting plates separated by 30mm, find the cut-off wavelength, guide wavelength for TE_{10} mode. [8+8]

7. Obtain the expression for current and voltage at any point along a line which is terminated in Zo. [16]

8. (a) Explain briefly properties of smith chart?
   (b) A lossless transmission line of length 100m has an inductance of 28μH and a capacitance of 20nF. Find propagation velocity, phase constant at an operating frequency of 100kHz and characteristic impedance of the line. [8+8]

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