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Code No: V0424/R07

SET - 1

II B.Tech II Semester, Regular Examinations, Apr – 2011

ELECTRO MAGNETIC WAVES AND TRANSMISSION LINES
(Electronics and Communications Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

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1. a) Define and distinguish between the terms electric fields, electric displacement and electric flux density.
   b) A line charge ρ_L = 400pC/m lies along the X- axis. The surface of zero potential passes through the point P (0,5,12)m. Find the potential at point (2,3,-4)m. (8M+8M)

2. a) Define Ampere's force law with associated relations.
   b) A filamentary current of 10A is directed in from infinity to the origin on the positive x-axis, and then back out to infinity along the positive y-axis. Find $\vec{H}$ at P (0, 0, 1). (8M+8M)

3. a) State the boundary conditions satisfied by electromagnetic fields E and H at the interface of air perfect dielectric.
   b) In a nonmagnetic medium E= 50 cos $(10^9 t-8x)a_y$+ 40 Sin$(10^9 t-8x)$ a_z V/m. Find the dielectric constant ε_r and the corresponding H. (8M+8M)

4. a) Define uniform plane wave. Prove that uniform plane wave does not have field components in the direction of propagation. (8M+8M)
   b) If $\in_r$ =9, $\mu = \mu_0$, for the medium in which a wave with a frequency of f=0.3GHz is propagating, determine the propagation constant and intrinsic impedance of the medium when $\sigma = 0$.

5. a) For good dielectrics derive the expression for α, β, V and η. (8M+8M)
   b) Find α,β,V and η for ferrite at 10 GHz, ε_r =9, μ_r =4, σ=10 mho/m

6. a) Derive the field components for TE wave between parallel plates. (8M+8M)
   b) If a wave of 6 GHz is propagation between two parallel conducting plates separated by 30mm, find the cut off wave length, guide wave length for TE_1 mode.

7. a) Using the general line equations, obtain an expression for the input impedance of a line.
   b) A lossless transmission line has capacitance if 50 Pf/m and an inductance of 200 nH/m. Find the characteristic impedance for section of a line 10m long and 500m long. (8M+8M)

8. a) Explain clearly why the short circuited stubs are preferred over to a open circuited stubs?
   b) Derive the expression for the input impedance of a loss-less line. Hence evaluate Z_{sc} and Z_{oc} and sketch their variation with line length. (8M+8M)

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SET - 2

II B.Tech II Semester, Regular Examinations, Apr – 2011

ELECTRO MAGNETIC WAVES AND TRANSMISSION LINES

(Electronics and Communications Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

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1. a) State and expression Coulomb's law. Obtain an expression in vector form. (6M+10M)
   b) Two uniform line charges of density 8nC/m are located in a plane with y=0 at x = ±4m. Find the E- field at a point P(0m,4m,10m).

2. a) State and explain Biot-Savart's law relating the magnetic field produced at a point due to the current in a small elemental wire. (8M+8M)
   b) A thin ring of radius 5 cm is placed on plane z=1 cm so that its center is at (0, 0, 1) cm. If the ring carries 50 mA along $\bar{a}$ a $_{\emptyset}$, find $\bar{H}$ at i) (0, 0,-1) cm ii) (0, 0, 10) cm.

3. a) State Maxwell's equations in differential form and write down their word statements.
   b) In a three dimensional space, divided into region 1(X<0) and region 2(X>0), $\sigma_1 = \sigma_2 = 0$ $\bar{E}_1 = 1\bar{a}_x + 2\bar{a}_y + 3\bar{a}_z$. *Find* $\bar{E}_2$ *and* $\bar{D}_2$ $\varepsilon_{r1}=1, \varepsilon_{r2}=2$ (8M+8M)

4. a) Discuss about uniform plane wave in lossless dielectrics, and establish the relationship between electric and magnetic field in the medium. (8M+8M)
   b) The electric field in free space is given by E= 50 cos (10^8 t + βx) a_y V/m.
   i) Find the direction of wave propagation. ii) Calculate β and the time it takes to travel a distance of half-wavelength. iii) Sketch the uniform plane wave at t=0, T/4, and T/2.

5. a) Show that in a good conductor, the skin depth 'δ' is always much shorter than the wave length. (8M+8M)
   b) A polarized wave is incident from air to polystyrene with $\mu = \mu_0$, $\varepsilon = 2.6\ \varepsilon_0$ at Brewster angle. Determine the transmission angle.

6. a) Derive the field components for TM waves between parallel plates. (8M+8M)
   b) When a wave of 6 GHz is to be propagated between parallel conducting plates separated by 60 mm, find the modes that will propagate through the guide.

7. a) List out the application of transmission lines. (4M+4M+8M)
   b) Draw an equivalent circuit of a two wire transmission line
   c) A lossy cable which has R=2.25Ω/m, L=1.0μH/m, C=1pF/m and G=0 operates at f= 0.5GHz. Find out the attenuation constant of the line.

8. a) Explain the significance and utility of λ/8, λ/4 and λ/2 lines. (8M+8M)
   b) A low transmission line of 100Ω characteristic impedance is connected to a load of 400Ω. Calculate the reflection coefficient and standing wave ratio.

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SET - 3

II B.Tech II Semester, Regular Examinations, Apr – 2011

ELECTRO MAGNETIC WAVES AND TRANSMISSION LINES

(Electronics and Communications Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

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1. a) State Coulomb's law of force between any two point charges, and indicate the units of the quantities in the force equation.
   b) A point charge,Q_1 =10μC is located at P_1 (1,2,3) in free space ,while Q_2 = 5μC is at P_2 (1,2,3,4,-5,10). i) Find the vector forces exerted on Q_2 by Q_1. ii) Find the coordinates of P_3 at which a point charge Q_3 experiences no force. (8M+8M)

2. a) Obtain an expression for differential magnetic field strength dH due to differential current element I dl at the origin in the positive Z- direction.
   b) Find the magnetic field strength, H at the centre of a square conducting loop of side '2a' in Z=0 plane if the loop is carrying a current, I in anti clock wise direction. (6M+10M)

3. a) i) State Faraday's law and transformer emf ii) Discuss about inconsistency of Ampere's law and displacement current density.
   b) In the space, the magnetic field of an EM wave is given by $\overline{H}$ =0.4ω ε_0 cos (ωt-50x) $\overline{az}$ A/m. Find the electric field and displacement current density. (8M+8M)

4. a) Derive the expression for the phase shift constant and attenuation constant of a plane wave propagation in a lossy dielectric medium.
   b) A plane wave propagation through a medium with ε_r =8, μ_r =2 has E=0.5 exp(-0.33z) sin (10^8 t –βz)a_x v/m.Determine wave velocity, wave impedance and the magnetic field intensity. (8M+8M)

5. a) Explain the significances of Pointing theorem and pointing vector.
   b) A plane wave travelling in a medium of ε_r =1,μ_r =1 has an electric field intensity of 100 X$\sqrt{\pi}$ Determine the energy density in the magnetic field and also the total energy density. (8M+8M)

6. For a parallel plane wave guide of 3cm separation, determine all the propagation characteristics, for a signal at 10 GHz, for (8M+8M)
   a) TE_{10} waves b) TEM waves Explain the terms used.

7. a) Show that a line will be distortion free if CR=LG. (8M+8M)
   b) A high frequency line has the following primary constants L=1.2 mH/Km, C=0.05μF/Km. R=G=negligible. Determine the characteristic impedance and propagation constant of the line.

8. a) What is Stub? Why are short- circuited stubs preferred to open circuited ones? Explain.
   b) With aid of Smith chart, Calculate the position and length of short circuited stub matching a (180+j120) ohm load to a 300 ohm transmission line. Assuming that the load impedance remains constant, find the VSWR on the main line when the frequency is i) Increased by 10% and ii) Doubled? (8M+8M)

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SET - 4

II B.Tech II Semester, Regular Examinations, Apr – 2011

ELECTRO MAGNETIC WAVES AND TRANSMISSION LINES

(Electronics and Communications Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Derive an expression for the electric field intensity due to a finite length line charge along the z-axis at an arbitrary point Q (x,y,z).
   b) Find the force on a 100μC charge at (0,0,3)m if four like charges of 40μC are located on x and y axes at ± 4m. (8M+8M)

2. a) Derive an expression for magnetic vector potential **A** for surface currents.
   b) What is magnetic dipole? Determine magnetic field at any point P in afree space due to a magnetic dipole. (8M+8M)

3. a) Derive Maxwell's equations from their basics.
   b) Explain the concept of displacement current introduced by Maxwell to account for the production of magnetic fields in the empty space. (8M+8M)

4. a) What is polarization of an EM wave? Explain different types of polarizations. (8M+8M)
   b) Discuss about the propagation characteristics of EM waves in conducting medium.

5. a) Derive the expression for the resultant Electric field and resultant magnetic field when a wave incidents normally on a perfect conductors.
   b) Discuss about Brewster angle, critical angle, total internal reflection and surface impedance. (8M+8M)

6. a) Explain the factors on which cutoff of a parallel plate wave guide depend. (8M+8M)
   b) Obtain the frequency in terms of cutoff frequency f_c at which the attenuation constant due to conductor losses for the TM_n mode is minimum for parallel plate wave guide.

7. a) Using expressions of wave amplitudes in a transmission line, deduce the relation for characteristic impedance of the line.
   b) A transmission line operating at 500MHz has Z_0 =80 ohms, α=0.04Np/m, β=1.5rad/m. Find the line parameters R, L, G and C. (8M+8M)

8. a) Discuss about single and double stub matching. (8M+8M)
   b) A load of (50-j100) Ω is connected across a 50Ω line. Design a short circuited stub in order to provide impedance matching between the two at a signal frequency of 30 MHz

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