R13

Code No: 114CU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2016
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
(Common to ECE, ETM)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A **(25 Marks)**

1.a) How can materials be classified in terms of their conductivity? [2]
b) Give an expression for convection current density. Also state the point form of Ohm's Law. [3]
c) State Maxwell's equations for a lossless or non conducting medium. [2]
d) State the Amphere's Force Law. Give magnetic force for arbitary geometrics. [3]
e) Give an expression for intrinsic impedance in phasor form. What are its magnitude and phase components? [2]
f) Explain in brief significance of loss tangent. [3]
g) List any four types of transmission lines. [2]
h) How does group velocity vary when compared to phase velocity? [3]
i) What are the two families of circles that constitute the Smith Chart? [2]
j) What are the advantages and disadvantages of a Single Stub? [3]

PART - B **(50 Marks)**

2.a) State Coulomb's Law. Find the force on charge Q_1, 30 μc due to a change Q_2, -200 μc, where Q_1 is at (0,0,2) m and Q_2 is at (2,1,0) m.
b) Derive the relation between electric field, E and Scalar potential, V. Find the electric field at (2,3,1) if the potential distribution is of the form $3x^2y+y^2x+3z$. [5+5]

OR

3.a) Discuss the Maxwell's equations for electrostatic fields.
b) Obtain the expression of Gauss's Law for infinite surface charge. Also state any two limitations of Gauss's Law. [5+5]

4.a) State the important properties of magnetic lines of forces.
b) Show that the magnetic field due to a finite current element along z-axis at a point P "r" distance away from y-axis is given by $\overline{H} = \frac{1}{4\pi r}\left(\text{Sin}\,\alpha_1 - \text{Sin}\,\alpha_2\right)a\phi$, where "I" is the current through the conductor, α_1, α_2 are the angles made by the tips of the conductor element at P. [5+5]

OR

5.a) What are boundary conditions? State the boundary conditions at the interface of dielectric and perfect conductor.

b) A certain material has σ =0 and $\in_r = 1$, if $\overline{H} = 4\sin(10^6 t - 0.01z)\overline{a_y} A/m$. Use Maxwell's equations to find μ_r. [5+5]

6.a) Derive the relation between E and H in a Uniform plane wave.

b) What are the wave equations for a lossless medium and a conducting medium for sinusoidal variations? [5+5]

OR

7.a) Write short notes on normal incidence of a plane wave on a perfect dielectric.

b) A plane wave travelling in air is normally incident on a material with $\in_r = 4$ and $\mu_r = 1$. Find the reflection and transmission coefficients. [5+5]

8.a) Derive the expression for voltage and current at any point on the transmission line in terms of characteristics impedance.

b) Discuss the parameters that characterize a lossless and lowloss transmission line. [5+5]

OR

9.a) What is distortion? State the conditions that characterize a distortion less line.

b) The propagation constant of a lossy transmission line is $(1+j2)m^{-1}$ and its characteristic impedance is 20 Ω at w = 1M rad/s. Find L ,C, R and G for the line. [5+5]

10.a) What are the applications of transmission lines?

b) How can ultra high frequency transmission lines be used as circuit Elements? [5+5]

OR

11.a) What are the applications of Smit Chart.

b) One end of a lossless transmission line having the characteristic impedance of 75 Ω and length of 1 cm is short circuited. At 3 GHz, What is the input impedance at the other end of the transmission line? [5+5]

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Code No: 124CU **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, December - 2017

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

(Common to ECE, ETM)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Find Electric field intensity due to the charge distribution ρ_v. [2]
b) Write poisson's and Laplace equations. [3]
c) State Biot-Savart's law. [2]
d) Calculate the self inductance per unit length of an infinitely long solenoid. [3]
e) Write a wave equation in a lossy, charge free medium based on Maxwell's Equation. [2]
f) What is Brewster angle? Write its equation. [3]
g) What is condition for distortion less transmission line? [2]
h) Explain how Quarter wave transformer is used for matching? [3]
i) What is the value of characteristic impedance and reflection coefficient for an open circuited line? [2]
j) What are the characteristics of smith chart? [3]

PART-B

(50 Marks)

2.a) Point charges 5nC and -2nC are located at (2,0,4) and (=3,0,5), respectively. Find the electric field at (1,-3,7).
b) Given that $E=(3x^2+y_0a_x+xa_y)$ kV/m, find the work done in moving a –2μC charge from (0,5,0) to (2,-1,0) by taking the path. [5+5]

OR

3.a) An electric dipole of $100a_z$pC.m is located at the origin. Find V and E at point (1,π/3,π/2).
b) Three point charges -1nC, 4nC, and 3nC are located at (0,0,0),(0,0,1) and (1,0,0) respectively. Find the energy in the system. [5+5]

4.a) A circular loop located on $x^2+y^2=9$, z=0 carries a direct current of 10A along a_ϕ. Determine H at (0,0,4) and (0,0,-4).
b) In a certain conducting region, $H=yz(x^2+y^2)a_x-y^2xza_y+4x^2y^2a_z$mA/m. Determine J at (5,2,-3). [5+5]

OR

5.a) State Maxwell's equations in an integral and word form.
b) A unit normal vector from region 2 ($\mu=2\mu_0$) to region 1 ($\mu=\mu_0$) is $a_{n21}=(6a_x+2a_y-3az)/7$. If $H_1=10a_x+a_y+12a_z$ A/m and $H_2=H_{2x}a_x-5a_y+4a_z$ A/m. Determine H_{2x}. [5+5]

6.a) A lossy material has $\mu=5\mu0$, $\varepsilon=\varepsilon_0$. If at 5 MHz, the phase constant is 10 rad/m, calculate the loss tangent, conductivity of the material, complex permittivity attenuation constant and intrinsic impedance.

b) Derive the equation for intrinsic impedance in lossless dielectrics. [5+5]

OR

7.a) Determine the Fresnel coefficients for oblique incidence from lossless medium 1 to lossless medium 2 for parallel polarization.

b) Region 1 is a lossless medium for which $y \geq 0$, $\mu=\mu_0$, $\varepsilon=4\varepsilon_0$, whereas region 2 is free space, $y \leq 0$. If a plane wave $E=5\cos(108t+\beta t)a_z$ V/m exists in region1, find the time average pointing vector. [5+5]

8.a) A transmission line operating at 500MHz has $Z_0=80\Omega$, Propagation constant = 0.04 Np/m, $\beta=1.5$ rad/m. Find the line parameters R, L, G and C?

b) Find the Z_{in} at any point on the line in terms load impedance starting from voltage and current wave equations on line. [5+5]

OR

9.a) For a lossless two wire transmission line show that the Characteristic impedance $Z_0 = \frac{120}{\sqrt{\epsilon_r}} cosh^{-1} \frac{d}{2a}$.

b) A lossless transmission line operating at 4.5GHz has $L=2.4\mu H/m$ and $Z_0=85\Omega$. Calculate the phase constant and the phase velocity. [5+5]

10.a) A 500Ω lossless line has $V_L = 10e^{j25^0}$V and $Z_L = 50e^{j30^0}\Omega$. Find the current at $\lambda/4$ from the load?

b) A 60 Ω air line operating at 20MHz is 10m long. If the input impedance is $90 + j150\Omega$. Calculate Z_L, Γ and S. [5+5]

OR

11. Explain how double stub is used for matching with suitable diagram? Derive equations for its length and location. [10]

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Code No: 114CU **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, October/November - 2016

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

(Common to ECE, ETM)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART - A **(25 Marks)**

1.a) State Divergence theorem and Stokes theorem. [2]
b) Mention the differences between scalar and vector magnetic potentials. [3]
c) If the flux flowing through closed surface is 3nc. What is the total charge enclosed by that surface? [2]
d) Find the input impedance of a section of a $50\,\Omega$ lossless transmission line that of length $0.1\,\lambda$ long and is terminated in a short circuit. [3]
e) Define reflection coefficient and VSWR. [2]
f) Derive expression for electrostatic energy of a capacitor. [3]
g) State Maxwell's four laws in derivative form. [2]
h) Find skin depth at 1GHz for copper having conductivity 5.7×10^{7} mho/m. [3]
i) What is stub matching? Draw typical stub matching transmission line. [2]
j) List the applications of smith chart. [3]

PART - B **(50 Marks)**

2.a) Derive Poisson's and Laplace's equations from fundamentals. List few of its applications concerned to electrostatic fields.
b) An infinitely long uniform line charge is located at $y = 3,\ z = 5$. If $\rho_l = 30nc/m$, find field $\vec{E}$ intensity at (i) origin (ii) P(5,6,1) [5+5]

OR

3.a) Develop an expression for potential due to dipoles.
b) Evaluate the electric field intensity at a point P (-5, 7, -4) in free space due to a charge of 0.2 mille coulombs placed at point R (2,-1,-2). [5+5]

4.a) Distinguish between conduction and convection currents.
b) Find the polarization 'P' in a dielectric material with $\varepsilon_r = 2.8$ if $D=3.0\times10^{-7}\,\hat{a}_n$ c/m^2
c) Derive the boundary conditions at the interface between
(i) Dielectric-Dielectric (ii) Dielectric-conductor [3+3+4]

OR

5.a) Derive Maxwell's equations in integral form. Based on this obtain the corresponding differential equation by applying Stroke's theorem.
b) Compare boundary conditions in Electrostatics and Magnetostatics. [5+5]

6.a) Evaluate the reflection and transmission coefficients for the case of an electromagnetic wave in air incident normally upon the copper sheet at frequency of 1 MHz. Given $\mu_1 = \mu = \mu$, $\varepsilon_1 = \varepsilon_2 = \varepsilon_0$, $\sigma_1 = 0$, $\sigma_2 = 5.8 \times 10^7$ v/m.

b) Find the energy stored in a standing wave incident normally on a perfect conductor over a distance $-\lambda/4$ to 0 per unit in x, y coordinates. [5+5]

OR

7.a) State and prove Poynting theorem.

b) Derive the equation in conducting medium. Discuss skin effect and find the skin depth at 1 GHz for copper having conductivity 5.7×10^7 mho/m. [5+5]

8.a) Discuss in brief about inductance loading of telephone cables.

b) A lossless transmission line of length 0.434 lambda and characteristic impedance 100 Ω is terminated in an impedance 260 + j 180 Ω. Find

(i) Voltage reflection co-efficient

(ii) Standing wave ratio

(iii) Input Impedance [5+5]

OR

9.a) The attenuation constant on a 50 ohm distortionless transmission line is 0.01 dB/m. The line has a capacitance of 0.1 nF/m. Find the resistance, inductance and conductance per meter of the line.

b) A loss less of 100 ohms is terminated by a load which produces SWR = 3. The first maximum is found to be occurring at 320 cm. If f = 300 MHz determine the load matching. [5+5]

10.a) Write a short notes on reflection losses on unmatched transmission line.

b) The input impedance of as short-circuited lossy transmission line of length 2m and characteristic impedance 75 Ω is $45 + j\ 225\ \Omega$.

(i) Find α and β of the line.

(ii) Determine the input impedance if the short-circuit is replaced by a Z_L=67.5 - j4.5 Ω [5+5]

OR

11.a) Explain the basis for construction of Smith chart. Illustrate as to how it can be used of an Admittance chart.

b) A line having Z_0 of 100 ohms is terminated into a load of 50-j50 ohms. It is desired to provide matching between the time and the load by means of a short circuit street. Determine the length of the stun if signal frequency is 10 MHz..

[5+5]

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Code No: R09220404

R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B.Tech II Year II Semester Examinations, May-2013

Electromagnetic Theory and Transmission Lines

(Common to ECE, ETM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

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1.a) A cube of 2 cm. side is centered at the origin, with its sides parallel to the axes, and contains a field of $3x^2\ U_x$ V/m. Find the total charge contained in the cube, and the flux coming out of one face of the cube.

b) Find the potential and sketch its variation with radial distance, for a spherical shell of radius a = 3 cm, having a surface charge density of ρ_S C/m^2. [15]

2.a) Distinguish between the Conduction and Convection currents. Establish the current continuity equation, and hence, calculate the relaxation time for Brass material, having a conductivity of 1.1×10^7 mhos/m. at 10 MHz.

b) Find the capacitance of a 50 cm. long coaxial cable, having conductors of 4 cm and 2 cm diameters, separated by a medium of relative permittivity 2.56. Also find the stored energy and field at a radius of 1.5 cm in the dielectric when 10 V is applied. [15]

3.a) Define Ampere's Circuital Law in point and integral forms for static fields.

b) Establish the fields in the different regions of a coaxial cable carrying a current I, and sketch their variation with radial distance. Is this cable a shield cable ? [15]

4.a) Define and derive the Maxwell's curl equation involving Faraday's Law. Explain the concept of displacement current.

b) If $\bar{H} = 10\cos(10^8 t - z)\ \hat{Y}$ mA/m, find the corresponding electric field in air, and the displacement current density. [15]

5.a) Define a Uniform Plane Wave and establish the wave equations for a conducting medium.

b) A lossy dielectric has intrinsic impedance of $250\angle 30^\circ$ ohms, and $\bar{E} = 2\ e^{-\alpha x}\cos(\omega t - 0.5x)\ \hat{Z}$ V/m. Find the loss tangent, propagation constant, skin depth, polarization and direction of propagation. [15]

6.a) With neat sketches, define and distinguish between vertical and horizontal polarizations, when a uniform plane wave is obliquely incident on a perfect dielectric from air, with relevant schematics.

b) A Uniform plane wave is normally incident from free space onto a non-magnetic medium of $\epsilon_r = 2.56$, $\sigma = 0$. Determine the reflection and transmission coefficients for E and H fields, and find the VSWR. [15]

7.a) Draw the equivalent circuit of lossy and lossless transmission lines, and account for the different types of distortions present in such lines. How can these distortions be avoided?

b) A 50 ohm transmission line operates at 10 MHz, with a velocity of 2×10^8 m/sec. If the load impedance is 60 + j 10 ohms, determine its input impedance for a line length of 10 m and 5 m. [15]

8.a) Establish the relations for Z_{SC} and Z_{OC} of rf lines, and sketch their variation with $(\beta\ell)$.

b) A 60 ohm lossless line is 30 m long and is terminated with a load of 75 + j 50 ohms at 3 MHz. Find its reflection coefficient, VSWR, Z_{MAX} and Z_{MIN}, if the line velocity is 60% of the velocity of light. [15]

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