

P15

Code No: 1240U

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, May - 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) Derive the expression for continuity current equation. [2]
- b) Write Maxwell's equations for electrostatic fields. [3]
- c) Explain gauss law for magnetic fields [2]
- d) State Ampere's law and discuss its significance. [3]
- e) Define Uniform plane wave. [2]
- f) Describe instantaneous, time averaged and reactive power. [3]
- g) Differentiate group and phase velocities. [2]
- h) A lossless transmission line of length 50cm with $L=10\mu\text{H/m}$ and $C=40\text{pF/m}$ is operating at 30MHz. Find its electrical length. [3]
- i) List the properties of smith chart [2]
- j) In an air line, adjacent maxima are found at 12.5cm and 37.5cm. Calculate the operating frequency. [3]

PART-B**(50 Marks)**

- 2.a) What is Gauss Law. Explain any two applications of Gauss Law.
- b) Derive the expression of Electric field at a point due to an infinite sheet of charge. [5+5]

OR

- 3.a) Discuss energy density in electrostatic fields.
- b) Three point charge -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) State Faraday's Law. Explain the methods that cause variation of flux with time.
- b) Explain the concept of displacement current. [6+4]

OR

- 5.a) Express Maxwell's equation in differential form and integral form. Derive Boundary conditions at dielectric to dielectric boundary.
- b) Derive the Lorentz condition for potentials. [6+4]

- 6.a) Explain oblique incidence wave propagation with perpendicular polarization.
b) What is skin depth? Mention its importance citing some applications. Calculate skin depth of copper with following conditions $f=10^{10}$ Hz, $\mu=\mu_0$, $\sigma = 5.8 \times 10^7$ S/m. [5+5]
- OR**
- 7.a) What is Poynting theorem? Derive the expression for Poynting vector.
b) Explain wave propagation in conducting medium. [6+4]

- 8.a) Short circuited and open circuited measurements at a frequency of 5 KHz on a line length 100 km yields the following results. $Z_{oc}=570|-48^\circ$, $Z_{sc}=720|34^\circ$. Find characteristic impedance and propagation constant of the line.
b) Derive the transmission line equations in terms of receiving end voltages and currents. [5+5]

OR

- 9.a) An open wire unloaded line of 75 km is operating at frequency of 1000 KHz. $Z_{oc}=170|-48^\circ$, $Z_{sc}=20|34^\circ$. Calculate line parameters.
b) Derive the expression for attenuation and phase constants expressed in terms of primary constants. [5+5]
- 10.a) Derive the construction of Smith chart.
b) A lossless line is terminated in a resistance is found to have a VSWR of 4, characteristic impedance is calculated as 100Ω . A short circuited stub that matches the line to the load is placed at $< \lambda/8$ distance from the load using Smith chart. Find the value of load resistance and stub length in wavelength. [5+5]

OR

- 11.a) Explain how UHF lines can be used as circuit elements.
b) Mention the importance of $\lambda/2$, $\lambda/4$ and $\lambda/8$ lines. [5+5]

---ooOoo---