



# MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi &amp; Affiliated to JNTUH, Hyderabad)

Accredited by NBA and NAAC with 'A' Grade &amp; Recognized Under Section 2(f) &amp; 12(B) of the UGC act, 1956

## II B.Tech II Sem Regular End Examination, July 2022 Electro Magnetic Theory and Transmission Lines (ECE)

**Time: 3 Hours.****Max. Marks: 70**

Note: 1. Question paper consists: Part-A and Part-B.

2. In Part - A, answer all questions which carries 20 marks.

3. In Part - B, answer any one question from each unit.

Each question carries 10 marks and may have a, b as sub questions.

**PART- A****(10\*2 Marks = 20 Marks)**

- |       |  |    |     |     |
|-------|--|----|-----|-----|
| 1. a) | Define electric field intensity in terms of point charge.                              | 2M | CO1 | BL1 |
| b)    | Describe the properties of conductors.   | 2M | CO1 | BL2 |
| c)    | State Biot-Savart's law.   | 2M | CO2 | BL1 |
| d)    | Explain the Boundary conditions for Dielectric to Dielectric medium.                   | 2M | CO2 | BL4 |
| e)    | Write the wave equation for free space and conducting media.                           | 2M | CO3 | BL1 |
| f)    | Write the expression for Brewster angle, critical angle and total internal reflection. | 2M | CO3 | BL1 |
| g)    | Explain the types of transmission lines.   | 2M | CO4 | BL4 |
| h)    | How does group velocity vary when compared to phase velocity?                          | 2M | CO4 | BL1 |
| i)    | What are the advantages of Smith chart?  | 2M | CO5 | BL1 |
| j)    | Explain the brief about $\lambda/4$ , $\lambda/2$ and $\lambda/8$ lines.               | 2M | CO5 | BL4 |

**PART- B****(10\*5 Marks = 50 Marks)**

- |      |  |    |     |     |
|------|--|----|-----|-----|
| 2 a) | State and Prove Gauss's law. List the limitation of Gauss's law          | 5M | CO1 | BL3 |
| b)   | Derive the Poisson's and Laplace equation for starting from Gauss's law? | 5M | CO1 | BL6 |

**OR**

- |      |  |     |     |     |
|------|--|-----|-----|-----|
| 3    | Two point charges $Q_1=5C$ and $Q_2=1nC$ are located at $(-1,1,3)$ m and $(3,1,0)$ m respectively .Determine the electric field at $Q_1$ and $Q_2$ . | 10M | CO1 | BL3 |
| 4 a) | Write down Maxwell's equation in their general integral form. Derive the corresponding equations for fields varying harmonically with time.          | 5M  | CO2 | BL6 |
| b)   | State Ampere's circuits law. Specify the conditions to be met for determining magnetic field strength, H, based on Ampere's circuits                 | 5M  | CO2 | BL3 |

**OR**

- 5 A rectangular loop of wire in free space joins points A(1,0,1) to B(3,0,1) to C(3,0,4) to D(1,0,4) to A. The wire carries a current of 6 mA, flowing in the direction from B to C. A filamentary current of 15 A flows along the entire z-axis in the direction. Find the total force on the loop
- 10M C02 BL3
- 6 a) Derive the relation between E and H in a Uniform plane wave 5M C03 BL6  
b) What are the wave equations for a lossless medium and a conducting medium for sinusoidal variations? 5M C03 BL1
- OR**
- 7 The conductivity of silver is  $\sigma = 3 \times 10^7$  u/m at microwave frequencies. Find the skin depth at 10 GHz
- 10M C03 BL3
- 8 Derive all the relations of primary constants transmission lines.
- 10M C04 BL6
- OR**
- 9 The attenuation constant on a 50 ohm distortion less transmission line is 0.01 dB/m. The line has a capacitance of 0.1nF/m. Determine the resistance, inductance and conductance per meter of the line.
- 10M C04 BL4
- 10 a) Design the equivalent circuits of a transmission lines when  
1) length of the transmission line,  $L < \lambda/4$ , with shorted load  
2) when  $L < \lambda/4$ , with open end  
3) When  $L = \lambda/4$  with open end 5M C05 BL6  
b) One end of a lossless transmission line having the characteristic impedance of  $75 \Omega$  and length of 1 cm is short circuited. At 3 GHz, What is the input impedance at the other end of the transmission line? 5M C05 BL3
- OR**
- 11 What is the purpose of loading and explain various types of loading of a transmission line? 10M C05 BL3