Hall Ticket No | | | | | | | | | | |

Question Paper Code: AECC11

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech IV SEMESTER END EXAMINATIONS (REGULAR/SUPPLEMENTARY) - AUGUST 2023
Regulation: UG-20

ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

Time: 3 Hours (ELECTRONICS AND COMMUNICATION ENGINEERING) **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Obtain the expression for the electric field intensity of an infinite long straight line carrying uniform line charge density. [BL: Understand| CO: 1|Marks: 7]

   (b) Point charges 1mC and -2mC are located at (3, 2,-1) and (-1,-1, 4) respectively. Calculate the electric force on a 10 nC charge located at (0, 3, 1) and the electric field intensity at that point. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Illustrate the integral and point form of Maxwell's equations for static fields. Deduce an expression for boundary conditions between two dielectrics. [BL: Understand| CO: 2|Marks: 7]

   (b) From the Biot-Savart's law, determine the expression for magnetic field intensity at a point P and distance R from the infinitely long straight current carrying conductor. [BL: Understand| CO: 2|Marks: 7]

MODULE – III

3. (a) Write a short note on Poynting vector. Determine an expression for Poynting theorem. [BL: Understand| CO: 3|Marks: 7]

   (b) A plane wave travelling in free space has an average Poynting vector of 5 watts/m^2. Find magnitude of electric field intensity. [BL: Apply| CO: 3|Marks: 7]

4. (a) Classify different types of polarization. Write about skin depth and determine the expression for depth of penetration for good conductors. [BL: Understand| CO: 4|Marks: 7]

   (b) Deduce an expression for reflection and transmission cefficients of a plane wave which is incident obliquely with perpendicular polarization. [BL: Understand| CO: 4|Marks: 7]

MODULE – IV

5. (a) Explain in detail about different types of distortions and also derive the condition for distortionless line. [BL: Understand| CO: 5|Marks: 7]

(b) A transmission line has the R, L, G, C parameters, R = 100 ohm/m, L = 80 n H/m, G=0.2 mho/m and C=200pF/m. Consider a traveling wave at 2 G Hz on the line. Find the following

i) Attenuation constant

ii) Phase constant

iii) Phase velocity

iv) Characteristic impedance of the line [BL: Apply| CO: 5|Marks: 7]

6. (a) Mention different types of loading techniques. Derive the transmission line equation and obtain the solution of it. [BL: Understand| CO: 5|Marks: 7]

(b) A transmission line with a characteristic impedance of 75 ohm supports a forward-traveling wave with a power of 1 µW. The line is terminated in a resistance of 100Ω. Draw the lumped-element equivalent circuit at the interface between the transmission line and the load. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Elaborate the concept of single stub matching on a transmission line and derive the expression for the length of the stub used for matching on a line. [BL: Understand| CO: 6|Marks: 7]

(b) Lossless transmission line of characteristic impedance Z_0 =50Ω is terminated in a load of impedance Z_L=100 + j50 Ω. Determine the smallest length and the distance 'd' from the load of a single capacitive stub having characteristic impedance Z_{oc} = 75 Ω shorted at its ends, which when connected, will serve the purpose of a perfect match of load with the transmission line. [BL: Apply| CO: 6|Marks: 7]

8. (a) How the input impedance of a lossless line varies with frequency? Describe in detail about quarter wave transformer. [BL: Understand| CO: 6|Marks: 7]

(b) A transmission line has Z_0 = 50Ω, Z_L= 30- j50Ω.

i) What is reflection coefficient of the line?

ii) What is the VSWR on the line?

iii) What is the input impedance of the line at length 'l' =λ/4? [BL: Apply| CO: 6|Marks: 7]