Hall Ticket No | | | | | | | | | | | Question Paper Code:AECC11

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Dundigal-500043, Hyderabad)

B.Tech IV SEMESTER END EXAMINATIONS (REGULAR) - JULY 2022

Regulation:UG20

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

(NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

MODULE – I

1. (a) Show that the electric field at any point due to an infinite sheet of charge is independent of the distance to the point from the sheet. [BL: Apply| CO: 1|Marks: 7]

   (b) A pair of 200mm long concentric cylindrical conductors of radii 50mm and 100 mm,is filled with a dielectric with $\epsilon = 10\epsilon_0$. A voltage is applied between the conductors which establishes $\overrightarrow{E} = \frac{10^6}{r}\widehat{a_r}$ Calculate capacitance, voltage applied and energy stored. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Determine Maxwell's equations in integral form. Based on this obtain the corresponding differential equation by applying Stroke's theorem. [BL: Apply| CO: 2|Marks: 7]

   (b) If a coil of 800μH is magnetically coupled to another coil of 200 μH and the coefficient of coupling between two coils is 0.05. Calculate inductance if two coils are connected in
   i) Series aiding
   ii) Series opposing
   iii)Parallel aiding
   iv) Parallel opposing. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Discuss about reflection and refraction of plane waves for normal incidence at the interface between two dielectrics. [BL: Understand| CO: 3|Marks: 7]

   (b) Find the amplitudes of reflected and transmitted fields (electric and magnetic both) at the interface of two regions,if $E_i = 1.5\ mV/m$ in region 1 for which $\epsilon_{r1} = 8.5$, $\mu_r = 1$ and σ=0 and region 2 is a free space. [BL: Apply| CO: 3|Marks: 7]

4. (a) What are the properties of uniform plane wave? Show that for a uniform plane wave, the field components are zero in the direction of propagation of it. [BL: Understand| CO: 4|Marks: 7]

   (b) Wet marshy soil is characterized by $\sigma = 10^{-2} s/m$, $\epsilon_r = 15$ and $\mu_r = 1$. At frequencies 60Hz,1MHz, 100MHz and 10GHz, indicate whether soil be considered a conductor or a dielectric.
   [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Explain the concept of infinite line and hence obtain the general expression for the line characteristic impedance using the lossy line equivalent circuit. [BL: Understand| CO: 5|Marks: 7]

   (b) An open wire line having $R = 10.15\Omega/km$, $L = 3.93mH/km$, $C = 0.00797F/km$ and $G = 0.29\mu\mho/km$ is 100 km long and terminated in Z_0.Find $Z_0, \alpha, \beta, \gamma, V_p, \lambda$ for 796Hz.
   [BL: Apply| CO: 5|Marks: 7]

6. (a) Classify various types of distortions that occur when waves propagate through the transmission line. Explain in detail. [BL: Understand| CO: 5|Marks: 7]

   (b) When a certain dissipationless line of 100 km length is terminated in an unknown load impedance Z_R, the input impedance is measured to be $536\angle 20^0\Omega$ and the phase constant $\beta = 0.1rads/Km$. Determine the primary constants of the line and the load impedance Z_R, if the characteristic impedance of the line is 625Ω and the operating frequency $\omega = 5000\ rad/sec$.
   [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Outline the principle of impedance matching using a single stub tuner and list out its limitations.
   [BL: Understand| CO: 6|Marks: 7]

   (b) A 50 Ω air filled co-axial line is terminated with a complex load impedance of $(80 - j60)\Omega$. Design a double stub matching system using short circuited co-axial lines of characteristic impedance 50Ω each. Assume spacing between stubs equal to $(3\lambda/8)$ at a frequency of 500MHz.
   [BL: Apply| CO: 6|Marks: 7]

8. (a) Derive the expressions of input impedance of SC and OC lines and explain how a UHF line can be used as inductance or a capacitance. [BL: Apply| CO: 6|Marks: 7]

   (b) A 50Ω RF line is connected to a load of $(75 + j40)\Omega$. Estimate the reflection coefficient, VSWR, Z_{min}, Z_{max}. Also find its impedance if the line length is 0.5 λ [BL: Apply| CO: 6|Marks: 7]

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