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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

May 2023 Semester End Make-Up Examinations

Programme: B.E. **Semester: V**

Branch: Electronics & Telecommunication Engineering **Duration: 3 hrs.**

Course Code: 19ET5PCTLA **Max Marks: 100**

Course: Transmission Lines and Antennas **Date: 17.05.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) Obtain the condition for the line to be distortion less. Prove that the characteristic impedance of the distortion less line is purely real. **10**

b) The open and short circuited impedance of a 100 km long uniform transmission line at ω=5000 rad/sec is $482\angle -32^{o}$ and $1612\angle 12.4^{o}$ respectively. Determine R, L, G and C of the line. **10**

OR

2 a) A cable 50km long having a R= 53.6 Ω/km, L=0.625mH/km, C= 0.04 μF/km and G=1μmho is supplied by a generator of 2 volts, 400 Ω internal impedance, 1200 cycles/sec and terminated in Zo. Find the insertion loss of the line in decibels. **10**

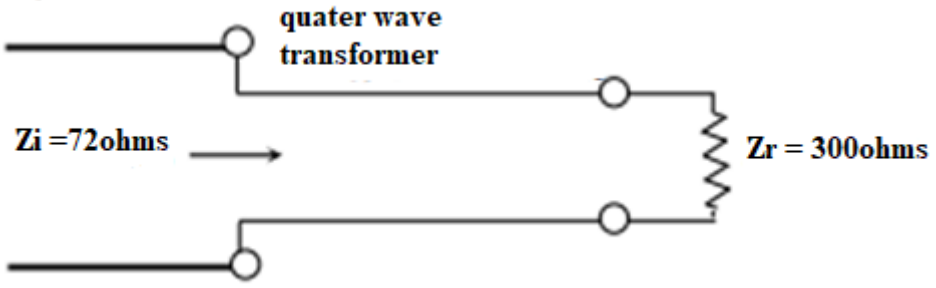
b) Design an equivalent T-section for a transmission line with line constants/km given as R=6Ω, L = 2.5mH, C=0.005μf, G= 20μmhos. The length of the line is 65km and is operated at 1000cycles/sec. **10**

UNIT - II

3 a) Show that the input impedance of the dissipation less RF transmission line with open or short circuited terminations are pure reactance. **06**

b) Derive an expression for the input impedance of a quarter wave line. Explain its applications. From the given figure, find the characteristic impedance and the length of the quarter wave section used. **10**

(10)



c) Find the reflection coefficient and the voltage standing wave ratio of a line having Ro = 100 Ω and Z_R = 100 – j100 Ω. **04**

UNIT - III

4 a) An open-wire line of 60MHz is to be built of copper wire of radius 1.632mm and have Ro=425ohms a) find the desired spacing between the two wires b) L c) C d) Z_0 and e) phase velocity if the line is dissipation less. **08**

b) Compare fiber optic cable over copper as a transmission medium. **04**

c) In a coaxial cable, the diameter of the inner copper conductor is 3.6 mm and the outer diameter of the outer copper conductor is 11.64 mm. The two coaxial conductors are separated by a dielectric material of dielectric constant of 6.85. Measurements carried out at a certain frequency yielded an a.c resistance of 3.96 ohm/km and capacitance of 6.72 x 10^{-10} f/m. Determine **08**

i) inner radius of the outer conductor ii) frequency

iii) inductance iv) R_{dc} (assume $\sigma = 5.7 \times 10^7$ mho/m for copper)

UNIT - IV

5 a) Derive the relation between aperture and beam area. Obtain an expression for maximum effective aperture of an isotropic antenna. **07**

b) Derive an expression for the power received over a radio communication link. Compute the power received by the receiving antenna at a distance of 100 km by a transmitter radiating at 3 MHz. Assume G_t = 40, G_r = 15 and P_t = 1000 kw. **07**

c) Two identical point sources are separated by a distance d = λ/2 and phase angle = 0. The total field pattern is given by E= cosϕcos(π/2cosϕ) **06**

i) Find the field pattern of each source

ii) If the two sources are short dipoles, identify the orientation of the dipoles to produce the said pattern

iii) Draw the total array pattern

OR

6 a) Find the total power radiated and the directivity for an isotropic point source with sine squared power pattern. **06**

b) Derive an expression and draw the field pattern for two isotropic point sources of the same amplitude, but opposite phase. **08**

c) Consider an isotropic antenna radiating in the free space. The total electric field measured at a distance of 150m from the antenna is 5.535V/m. Find the power radiated and the power density. **06**

UNIT - V

7 a) Obtain the expression for the far field components of a short dipole. **08**

b) Derive an expression for radiation resistance of a small loop antenna. The radius of a circular loop antenna is 0.02λ. How many turns of antenna will give a radiation resistance of 35Ω. **08**

c) The radiation resistance of a dipole antenna is 12.32Ω. Find the length of the antenna in terms of wavelength. If the equivalent loss resistance in the antenna due to finite conductivity of the dipole or losses in associated dielectric structure is 1.5Ω, also find the efficiency of the above antenna. **04**

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