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10TE54

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Transmission Lines & Waveguides

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of Smith chart is permitted.***

PART – A

1 a. Derive expressions for voltage and current at any point on an uniform transmission line and hence deduce an expression for input impedance. **(12 Marks)**

b. A generator of 1.0 volt, 1000 cycles, supplies power to a 100-mile open wire line terminated in Z_O and having the following parameters ($\epsilon^{-j3.55}$ is equivalent to an angle of -3.55 radiens or -203.8 deg): R = 10.4 ohms per mile, L = 0.00367 henry per mile, G = 0.8×10^{-6} mho per mile, C = 0.00835 μF Per mile. Find α, β, γ, λ, Z_0, I_R, E_R and P_R (Received power). **(08 Marks)**

2 a. Design a constant – K high pass T and π-section filter to be terminated in 720 Ω having cut-off frequency of 6.8 kHz. **(08 Marks)**

b. Obtain the expression for input impedance in open and short circuited line. Plot the graph Z_{sc}/R_o versus distance and Z_{oc}/R_o versus **(12 Marks)**

3 a. Explain the applications of quarter waveline with a neat sketch. **(10 Marks)**

b. The characteristic impedance of the line is 50 Ω and SWR ρ = 2 when the line is loaded. When the line is shorted, the minima shifts 0.15λ towards load. Determine the load impedance. Use Smith chart. **(10 Marks)**

4 a. What are the applications and properties of Smith chart? Explain briefly with a neat sketch. **(10 Marks)**

b. A load impedance of $Z_R = 60 - j80\Omega$ is required to be matched to a 50 ohm co-axial line, by using a short circuited stub of length '*l*' located to a distance 'd' from the load. The wavelength of operation is 1 meter. Find 'd' and '*l*'. Show the co-axial line configuration of the stub with a neat sketch. **(10 Marks)**

PART – B

5 a. State and explain the properties of s-parameters. **(12 Marks)**

b. Two transmission lines of characteristic impedance z_1 and z_2 are joined at plane PP'. Express S-parameters in terms of impedances. **(08 Marks)**

6 a. Using the Helmholtz equation, derive the field equations for TM modes in rectangular waveguide. **(12 Marks)**

b. An air-filled circular waveguide having an inner radius of 1 cm is excited in dominant mode at 10 GHz (The dominant mode is TE_{11}, $X'_{11} = 1.841$. For TM_{01}, $x_{01} = 2.405$).
Find : (i) The cut-off frequency of dominant mode.
(ii) Guide wavelength.
(iii) Wave impedance
(iv) Find the bandwidth for operation in dominant mode only. **(08 Marks)**

7 a. With a neat sketch, explain the operation of Hybrid Tees and mention its applications. **(10 Marks)**

b. Explain directional coupler and obtain S-matrix of a two-hole directional coupler. **(10 Marks)**

8 a. Explain the working of a Schottky barrier diode with a neat sketch. **(07 Marks)**

b. Distinguish between Gunn, IMPATT and BARITT diodes. **(07 Marks)**

c. A sinusoidal input signal of frequency f_s and pump signal of frequency f_p are applied across a time varying non-linear capacitance. If the output circuit is a band-pass filter with resistive series load of frequencies $f_S + f_P$, calculate the power gain. **(06 Marks)**

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