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10TE54

Fifth Semester B.E. Degree Examination, June/July 2017

Transmission Lines and Waveguides

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Starting from the fundamental, derive the expression for the voltage and current at any point on the transmission line. **(10 Marks)**

b. Derive the expression for attenuation constant phase constant and velocity of propagation for an ordinary telephone cable. **(04 Marks)**

c. The primary constant of a μW transmission lines are : R = 1.5 Ω/m, G = 0.2 m℧ /m, L = 2.5nH/m and C = 0.1pF/m. The transmission line is terminated in a 400Ω pure resistance and operated at a frequency of 1.5GHZ. If the length of the line is 20m, Find :
i) Characteristic impedance ii) Propagation constant iii) Attenuation constant
iv) Phase constant v) Wavelength and vi) Phase velocity. **(06 Marks)**

2 a. Design a constant K-LPF having f_c = 2000Hz and nominal characteristic impedance = 600Ω. Also find the frequency at which the filter offers attenuation of 19.1dB. **(08 Marks)**

b. A load impedance of $z_t = 60 - j80\Omega$ is required to be matched to a 50Ω coaxial line by using a short circuit stub of length 'ℓ' and placed at a distance 'd' from the load. The wavelength of operation is 1m. Using smith chart find 'ℓ' and'd' write the suitable steps of construction. **(08 Marks)**

c. Discuss the application of smith chart. **(04 Marks)**

3 a. Derive the expression for input impedance of an open circuit and short circuit line. **(06 Marks)**

b. Derive the relation between SWR and reflection coefficient. **(08 Marks)**

c. Illustrate the SWR of a lossless line. **(06 Marks)**

4 a. Explain the S – matrix for a multipart network. **(06 Marks)**

b. Deduce the symmetrical property of S-matrix. **(06 Marks)**

c. Discuss the different losses in a microwave network. **(08 Marks)**

PART – B

5 a. With a neat diagram, explain the working of 2 hole directional coupler. **(10 Marks)**

b. With a neat diagram explain the operation of Faraday rotation isolator. **(10 Marks)**

6 a. What is GUNN effect? With a neat diagram explain the construction details of a Gunn diode. **(10 Marks)**

b. With a neat sketch explain the operation of IMPATT diode and draw the negative resistance curve. **(10 Marks)**

7 a. Explain the parametric amplifier with equivalent circuit. **(10 Marks)**

b. An IMPATT diode has the following parameters :

Carrier drift velocity V_d = 2×10^7 μm/s
Drift region length L = 6μ.m
Maximum operating voltage = 100V
Maximum operating current = 200mA
Efficiency η = 15%

Break down voltage V_{th} = 90V. Compute

i) Maximum output power and
ii) Resonant frequency. **(05 Marks)**

c. A typical Si-BARITT diode has the following parameters :

Relative dielectric constant $C_r = 12.5$
Cloner concentration $N = 3.2 \times 10^{22}/m^3$
$E_0 = 8.854 \times 10^{-12}$
Drift length L = 8μm. Calculate :

i) Critical voltage
ii) Break down voltage
iii) Break down electric field. **(05 Marks)**

8 Write short notes on :

a. TE, TEM, Modes in parallel lines
b. BARITT diode
c. PIN diode
d. Properties of S-matrix. **(20 Marks)**

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