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10EC54

Fifth Semester B.E. Degree Examination, June/July 2018
Microwave and Radar

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. What are distributed parameters of a Transmission line? Derive characteristic impedence (Z_0) and propagation constant for a microwave transmission line. **(06 Marks)**

b. Derive the expression for input impedance of a transmission line terminated with a load impedance of Z_L. **(06 Marks)**

c. A line of $R_0 = 400\ \Omega$ is connected to a load impedance of $200 + j300\ \Omega$, which is excited by a matched generator at 800 MHz. Find the location and length of a single stub nearest to the load to produce an impedance match. **(08 Marks)**

2 a. Derive electric and magnetic field components for TE modes in rectangular waveguide. **(08 Marks)**

b. With neat sketches, explain directional coupler and derive its s-matrix. **(08 Marks)**

c. Explain rectangular microwave cavity resonators with necessary diagrams and expressions. **(04 Marks)**

3 a. Explain RWH theory with reference to the Gunn diode operation. **(08 Marks)**

b. Describe the operating principle of IMPATT diode and obtain the expressions for output power and efficiency. **(08 Marks)**

c. An M-Si-M BARITT diode has the following parameters :
Relative dielectic constant of S_i : $\epsilon_r = 11.8$
Donor concentration : $N = 3 \times 10^{21}\ m^{-3}$
S_i length : $L = 6.2\ \mu m$
Calculate : (i) breakdown voltage
(ii) breakdown electric field **(04 Marks)**

4 a. Describe the properties of s-matrix. **(08 Marks)**

b. Prove that impedances and admittances are symmetrical for a Reciprocal network. **(06 Marks)**

c. The S-parameters of a two-port network are given by, $S_{11} = 0.2\angle 0^0$, $S_{22} = 0.1\angle 0^0$, $S_{12} = 0.6\angle 90^0$, $S_{21} = 0.6\angle 90^0$ (i) Prove that the network is reciprocal but not lossless (ii) Find the return loss at Port 1 when Port 2 is short circuited. **(06 Marks)**

PART – B

5 a. Obtain the S-matrix for a Magic-T and explain its applications. **(10 Marks)**

b. With neat sketches, explain the operation of precision type variable attenuator. **(06 Marks)**

c. A 20 mW signal is fed into one of the collinear ports 1 of a lossless H-plane Tee. Calculate the power delivered through each port when other parts are terminated in matched load. **(04 Marks)**

6 a. Explain various lossless in strip lines. **(08 Marks)**

b. Describe parallel strip lines and express distributed parameters in terms of strip line dimensions. **(08 Marks)**

c. A shielded strip line has the following parameters: Dielectric constant of insulator, $\epsilon_r = 2.56$, strip width W = 25 mils, Strip thickness t = 14 mils, shield depth d = 70 mils. Calculate (i) The K factor (ii) The fringe capacitance (iii) The characteristic impedance. **(04 Marks)**

7 a. Derive simple form of Radar range equation. **(08 Marks)**

b. Describe the various applications of Radar. **(06 Marks)**

c. A Radar operating at 3 GHz is radiating power of 200 kW. Calculate the power of the reflected signal at the Radar with a 20 m^2 target at 5.56 km. Given $A_e = 9\,m^2$. **(06 Marks)**

8 a. With a neat block diagram explain M.T.I Radar. **(07 Marks)**

b. What are delay line cancellers? Explain. **(07 Marks)**

c. A 3.25 cm pulse Doppler RADAR has a pulse repition frequency of 4000PPS. Find (i) Maximum unambiguous range. (ii) Maximum Doppler frequency shift and (iii) Maximum radial velocity of the target. **(06 Marks)**

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