ONE TIME EXIT SCHEME

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10EC54

Fifth Semester B.E. Degree Examination, April 2018
Microwaves and Radar

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Use of Smith Chart is permitted.

PART – A

1 a. Find the solutions of transmission line equations. **(08 Marks)**

b. Find the equation for generalized reflection co-efficient. **(06 Marks)**

c. Given the normalized load impedance $Z_l = 1 + j1$ and operating wavelength $\lambda = 5$cm. Determine first V_{max}, first V_{min} from load and VSWR using Smith chart. Refer Fig.Q1(c).

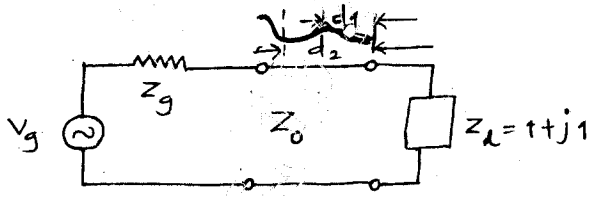

Fig.Q1(c) **(06 Marks)**

2 a. Derive TM_{mn} modes field equation in rectangular waveguide. **(06 Marks)**

b. An air filled rectangular waveguide of inside dimensions 7×3.5 cm operates in dominant TE_{10} mode as shown in Fig.Q2(b).

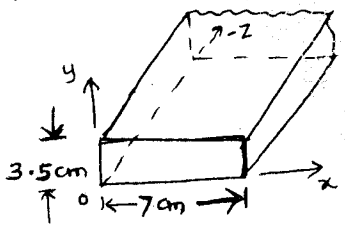

Fig.Q2(b)

i) Find cut off frequency
ii) Determine phase velocity of the wave in the guide at a frequency of 3.5 GHz.
iii) Determine guided wavelength at same frequency. **(06 Marks)**

c. Explain microwave circulators and give the S-matrix. **(08 Marks)**

3 a. Differentiate between μwave transistors and TED's. **(03 Marks)**

b. A typical n type GaAs Gunn diode has following parameters:
Threshold field $E_{th} = 2800$ V/cm Applied field $E = 3200$ V/cm
Device length $L = 10$ μm Doping concentration $n_0 = 2\times10^{14}$ cm^{-3}
Operating frequency $f = 10$ GHz.
(i) Compute electron drift velocity
(ii) Calculate current density
(iii) Estimate negative electron mobility. **(04 Marks)**

c. With the aid of diagrams for structure of Read diode, field distribution, applied as voltage and $J_o(t)$ and $J_e(t)$. Explain how carrier current $I_o(t)$ and external current $I_e(t)$ are generated in a read diode when mounted in a microwave resonant circuit. (07 Marks)

d. Write equivalent circuit for a parametric amplifier. Explain parametric up-converter. (06 Marks)

4 a. For a reciprocal microwave N port network prove that the admittance and impedance matrices are symmetrical. (06 Marks)

b. State and prove the following properties of S-parameters :
(i) Symmetry property for a reciprocal network
(ii) Unitary property for a lossless junction. (08 Marks)

c. Two transmission lines of characteristic impedance Z_1 and Z_2 are joined at plane P. Explain S-parameters in terms of impedance when each line is matched terminated. (06 Marks)

PART – B

5 a. With neat diagram explain E plane Tee and find the S-matrix. (07 Marks)

b. Explain Magic Tee with S-matrix and give the applications of Magic Tee. (08 Marks)

c. Discuss the basic phase shifters with S-Matrix. (05 Marks)

6 a. Show that, for a microstrip line, quality factor $Q_C = 0.636h\sqrt{\sigma f_{GHz}}$. (07 Marks)

b. A lossless parallel strip line has a conducting strip width w. The substrate dielectric separating the two conducting strips has a relative dielectric constant ϵ_{rd} of 6 & a thickness of 4 mm. Calculate
(i) The required width 'w' of the conducting strip in order to have a characteristic impedance of 50 Ω.
(ii) Strip line capacitance
(iii) Strip line inductance
(iv) Phase velocity of wave in parallel strip lines. (06 Marks)

c. With equations explain shielded strip lines. (07 Marks)

7 a. Define Radar. Explain the operation of Radar with neat diagram. (08 Marks)

b. Derive the equations for max radar range in simple form. (06 Marks)

c. Give and explain any three applications of Radar system. (06 Marks)

8 a. What is Doppler frequency shift? Find the equation for Doppler frequency shift fd. (06 Marks)

b. With block diagram explain MTI Radar system. (07 Marks)

c. Explain with diagram Blind phases, I and Q channels. (07 Marks)

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