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10EC54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Microwaves 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
3. Any missing data can be assumed.

PART – A

1 a. What are standing waves? Explain. **(05 Marks)**

b. Define and derive expressions for reflection coefficient, transmission coefficient and voltage standing wave ratio. **(10 Marks)**

c. An open wire transmission line has R = 5Ω/m L = 5.2×10^{-8}= H/m, G = 6.2×10^{-3} ℧/m and C = 2.13×10^{-10} F/m. Signal frequency is 4GHz. Find characteristic impendence and propagation constant. **(05 Marks)**

2 a. What is stub matching? Derive the expression for the length and location of the short circuited stub used in single stub matching. **(12 Marks)**

b. A single stub tuner is to match a lossless line of 400Ω to a load 800 – j300Ω. The frequency of operation is 3GHz.
i) Find the distance in meters from the load to the tuning stub
ii) Determine the length in meters of the short circuited stub
Note: Use Smith chart. Give the procedure in steps. **(08 Marks)**

3 a. Starting from wave equation, derive the field component expressions for TM_{mn} mode of propagation in a rectangular waveguide. **(10 Marks)**

b. Explain a two-hole directional coupler listing out its characteristics. **(06 Marks)**

c. A matched isolator has insertion loss of 1db and isolation of 30db. Find the scattering coefficients. **(04 Marks)**

4 a. Briefly explain the different modes of operation in a Gunn diode. **(08 Marks)**

b. List out the properties of S – parameters. **(06 Marks)**

c. Prove that it is impossible to construct a perfectly matched lossless reciprocal 3-part junction. **(06 Marks)**

PART – B

5 a. Explain with a neat sketch precision type variable attenuator. **(08 Marks)**

b. What are applications of Magic Tee? Briefly explain any one of them. **(06 Marks)**

c. In a H-plane Tee junction, compute power delivered to the loads 40Ω and 60 Ω connected to collinear arms 1 and 2 when 10mW power is delivered to arm 3. Assume $Z_0 = 50\Omega$. **(06 Marks)**

6 a. With relevant equation explain various losses in a microstripline. **(12 Marks)**

b. A lossless parallel strip line has its conducting strip of with W. The dielectric material of the strip line has a thickness of 4mm and its permittivity is 4. Compute :

i) Value of W so that $z_o = 75\Omega$

ii) Strip-line capacitance

iii) Strip line inductance

iv) Phase velocity of the wave propagating through the line. **(08 Marks)**

7 a. Derive the simple Radar Range equation, Discuss the factors influencing the Radar Range. **(10 Marks)**

b. Give some important application of Radar. **(04 Marks)**

Compute the range of a radar system operating at a wavelength of 3cm, peak pulse power of 400kW, effective antenna aperture of $5m^2$, radar cross sectional area of $20m^2$ and minimum detectable signal of 10^{-13}W. What will be the transmitter power needed to double the range. **(06 Marks)**

8 a. With a block diagram, explain the working of a MTI radar. **(08 Marks)**

b. Write short note on :

i) Blind speed

ii) Delay line cancellers. **(08 Marks)**

c. A MTI Radar has a PRF of 1000Hz at 4GHz. Compute lowest, second lowest and third lowest blind speeds expressed in Kmph. **(04 Marks)**

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