Fifth Semester B.E. Degree Examination, June/July 2016

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.

PART – A

1   a.   Starting from fundamental, derive the expression for the voltage and current at any point on the transmission line. **(08 Marks)**

   b.   A transmission line has the following primary constants R = 10.4 Ω/km, L = 0.00367 H/km, G = 0.8×10^{-6} ℧/km, C = 0.00835 µF/km. Find α, β, γ, λ and z_0. **(06 Marks)**

   c.   Define and derive expression for reflection coefficient and transmission coefficient for a transmission line. **(06 Marks)**

2   a.   A load of $Z_R = 115 - j75\Omega$ terminates at a lossless 100 Ω line. Use Smith chart to determine: (i) SWR, (ii) I/P impedance of a 0.2 λ long line, (iii) the distance from load to first voltage maximum. **(08 Marks)**

   b.   With neat diagram, explain Faraday's rotation isolator. **(05 Marks)**

   c.   With diagram, explain working of two hole direction coupler and also derive s-matrix for the same. **(07 Marks)**

3   a.   Explain with a neat diagram the construction and working of PIN diode and Schottkey barrier diode. **(10 Marks)**

   b.   An M-Si-M BARITT diode has the following parameter:
   i)   Relative dielectric constant of silicon $\varepsilon_r = 11.8$
   ii) Donor concentration, $N = 2.8 \times 10^{21}/m^3$
   iii) Silicon length, L = 6 µm
   Determine the breakdown voltage and the breakdown electric field. **(05 Marks)**

   c.   What is Gunn effect? Explain with constructional details of a Gunn diode. **(05 Marks)**

4   a.   Derive the following losses in a microwave network in terms of S-parameter:
   i)   Insertion loss
   ii) Transmission loss
   iii) Reflection loss
   iv) Return loss **(06 Marks)**

   b.   State and explain properties of S-parameters. **(06 Marks)**

   c.   Two transmission lines of characteristic impedance z_1 and z_2 are joined at plane pp^1. Express s-parameter in terms of impedance. **(08 Marks)**

PART – B

5   a.   With neat diagram, explain the working of rotary precision phase shifter. **(10 Marks)**

   b.   Explain H-plane Tee junction and derive the S-matrix also. **(06 Marks)**

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

6 a. Explain the various losses taking place in microstriplines. (07 Marks)
   b. Explain the construction and field pattern for microstripline. (08 Marks)
   c. Compare stripline and microstripline. (05 Marks)

7 a. Derive Radar range equation in terms of effective aperture, radar cross section of target and minimum detectable signal power of receivers. (08 Marks)
   b. Discuss various application of Radar. (06 Marks)
   c. With respect to Radar system, explain:
      i) Maximum unambiguous Range
      ii) Clutter attenuation
      iii) Improvement factor
      iv) Doppler shift (06 Marks)

8 a. Explain MTI Radar with neat block diagram. (10 Marks)
   b. Write short notes on any two:
      i) Delay line canceller
      ii) C.W. Doppler Radar
      iii) Pulsed Radar
      iv) Blind speed (10 Marks)

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