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10TE64

Sixth 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. Define reflection coefficient. Derive the equation for reflection coefficient at the load end and at a distance 'd' from load end, starting from equation for $Z\ell$. **(10 Marks)**

b. A load of 73 – j80 ohms is required to be latched to 50 ohm coaxial line having operating wavelength $\lambda = 30$ cm, using a short circuited shunt stub. Determine the position and length of the stub. **(10 Marks)**

2 a. Derive the relevant equations for the propagation of TE waves in a rectangular waveguide and explain how dominant mode is obtained. **(12 Marks)**

b. What is a directional coupler? Explain the working of two hole directional coupler. **(08 Marks)**

3 a. Explain the modes of operation for Gunn diode. **(10 Marks)**

b. Explain parametric up converter with necessary equations for gain, noise figure and band width. **(10 Marks)**

4 a. What is a reciprocal network? For a reciprocal microwave N port network, prove that the admittance and impedance matrices are symmetrical. **(07 Marks)**

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

c. The S-parameters of a two network are given by $S_{11} = 0.2\angle 0^\circ$, $S_{22} = 0.1\angle 0^\circ$, $S_{12} = 0.6\angle 90^\circ$ and $S_{21} = 0.6\angle 90^\circ$. Is the network reciprocal? Lossless? **(05 Marks)**

PART – B

5 a. Explain construction and working of a precision rotary type phase shifter, with neat diagram. **(08 Marks)**

b. In a H-plane T junction compute the power delivered to the loads 40 ohms and 60 ohms connected across arms 1 and 2 when 10 mW power is delivered to the matched port 3. (Assume $Z_0 = 50$ ohms). **(07 Marks)**

c. Explain working of Magic Tee as balanced microwave mixer. **(05 Marks)**

6 a. Explain the operation of micro strip line with its structure and Quasi TEM mode field distribution. **(07 Marks)**

b. With a neat diagram, explain the operation of parallel strip line. And also write the expressions for distributed parameters of parallel strip line; characteristic impedance and attenuation of the same. **(07 Marks)**

c. A certain shielded strip line has w = 63.5 mm, t = 35 mm and d = 180 mm. It has a permittivity of 2.56. Compute its characteristic impedance, K factor and Fringe capacitance. **(06 Marks)**

7 a. Derive the radar range equation. Discuss the effects of each parameter on the maximum detection range of the radar. **(08 Marks)**

b. Explain Doppler frequency shift for moving targets. **(07 Marks)**

c. A marine radar operating at 10 GHz has a maximum range of 50 km. With an antenna gain of 4000. The transmitter has a power of 250 KW and a minimum detectable signal of 10^{-11} Watts. Determine the cross section of the target the radar can sight. **(05 Marks)**

8 a. Explain the principle and working of moving target indicator radar, with the help of a block diagram. **(10 Marks)**

b. Write brief notes on:

i) Blind speed

ii) Delay line canceller **(10 Marks)**

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