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10EC54

Fifth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Microwaves and Radar

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

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. (10 Marks)
 - b. A transmission line has the following primary constants per km of the line $R = 8\Omega$, $G = 0.1\mu\text{S}$, $L = 3.5\text{mH}$, $C = 9\text{nF}$. Calculate z_0 , α , β , v_p and γ at $\omega = 5000$ rad/sec. (05 Marks)
 - c. A transmission line and characteristic impedance of $50 + j0.01\Omega$ and is terminated in a load impedance of $73 - j42.5\Omega$. Calculate: i) the reflection coefficient; ii) Standing wave ratio. (05 Marks)
2.
 - a. Derive electric and magnetic field equation in rectangular wave guides for TE modes. (12 Marks)
 - b. Write a brief note on dominant mode and degenerate mode. (04 Marks)
 - c. An air-filled rectangular waveguide of inside dimensions $7 \times 3.5\text{cm}$ operates in the dominant TE_{10} mode. Find cutoff frequency, phase velocity, guided wavelength of the wave in the guide at a frequency of 3.5 GHz. (04 Marks)
3.
 - a. Mention the four modes of operation for Gunn diode. Explain briefly the Gunn oscillation mode. (10 Marks)
 - b. Draw the equivalent circuit for parametric amplifier and explain in brief the parametric up converter. (05 Marks)
 - c. Explain the principle of operation of read diode with suitable diagram. (05 Marks)
4.
 - a. State the properties of S-parameter. Prove the symmetry property and unitary property of S parameter. (10 Marks)
 - b. Explain S-matrix representation of multiport network. (06 Marks)
 - c. Define the following losses in microwave network in terms of S parameter:
 - i) Insertion loss
 - ii) Transmission loss. (04 Marks)

PART – B

5.
 - a. Explain with a neat sketch a precision type variable attenuator. (06 Marks)
 - b. Explain magic tee and derive the S-matrix and mention its application. (10 Marks)
 - c. Write a brief note on phase shifter. (04 Marks)
6.
 - a. Explain the construction and field pattern for micro strip line. (08 Marks)
 - b. What are the losses in microstrip lines? Explain radiation losses. (08 Marks)
 - c. Compare strip line and microstrip line. (04 Marks)

- 7 a. Derive an expression for simple form of the radar range equation. (08 Marks)
- b. A ground based radar operates at 3cm. The radar transmitter using an antenna of gain 50dB produces 100kW. The receiver minimum detectable signal is $S_{\min} = 10^{-13}W$. The maximum radar range is given as 259km. Find the cross section of the target the radar can detect. (08 Marks)
- c. Write a brief note on maximum unambiguous range. (04 Marks)
- 8 a. With a neat diagram, explain the advantage of I and Q channels in digital MTI Doppler signal processor. (06 Marks)
- b. Explain the principle and working of MTI radar with the help of block diagram. (10 Marks)
- c. Explain single delay line canceller with neat block diagram. Derive an expression for frequency response of single DLC. (04 Marks)

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