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10EC54

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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.
3. Missing data, if any, may be suitably assumed.

PART – A

1 a. Derive equations for voltage and currents for a transmission line. **(08 Marks)**

b. The characteristic impedance of a certain line is $\neg 10 \lfloor -16° $, when frequency is 1 KHz. At this frequency the attenuation is 0.071 NP/km phase constant is 0.035 rads/km. Calculate resistance, inductance, capacitance for 1 km and also velocity of propagation. **(06 Marks)**

c. Determine the input impedance of a 200Ω line, 3/8 wavelengths long terminated in a 100Ω resistance, using smith chart. Also find k in magnitude and angle. **(06 Marks)**

2 a. What are the properties of wave guide? Obtain the expression for Hz in the case of T.E. waves applying all boundary conditions. **(08 Marks)**

b. The cut-off wave lengths of a rectangular waveguide was measured to be 8 cm and 4.8 cm when excited in TE_{10} and TE_{11} modes respectively. Determine the dimensions of the wave guide. **(06 Marks)**

c. Explain the working of a four port circulator. **(06 Marks)**

3 a. With a neat sketch explain how PIN diode acts as a switch. Find the expression for insertion loss. **(08 Marks)**

b. Explain RWH theory in GUNN diodes and give its constructional details. **(06 Marks)**

c. Calculate the operating frequency of a silicon based IMPATT diode with drift length of 2 μm and drift velocity of 10^7 cm/sec. **(06 Marks)**

4 a. Give the S–matrix representation for multiport network. Also explain the properties of S – matrix. **(08 Marks)**

b. What is an H-plane Tee junction? Derive its S-matrix. **(06 Marks)**

c. What are phase shifters? Explain a rotary precision phase shifter with a neat sketch. **(06 Marks)**

PART – B

5 a. Explain a magic Tee structure and its S-matrix. Also give its various applications. **(08 Marks)**

b. What are micro strip lines? Explain the field distribution with a neat sketch. **(06 Marks)**

c. A micro strip line is composed of zero thickness copper conductors on a substrate having $\epsilon_r = 8.4$, $\tan\delta = 0.0005$ and thickness and thickness 2.4 mm. If the line width is 1 mm and operated at 10 GHz. Calculate Z_0, the attenuation due to conductors and dielectric loss. **(06 Marks)**

6 a. Name the various types of RADAR. Derive the radar range equation. **(08 Marks)**

b. A 1 kW, 3 GHz radar uses single antenna with a gain of 30 dB. The receiver has noise band width of 1 KHz and noise factor of 5 dB. A target of echoing area of 10 m^2 at a range of 10 nautical miles is to be detected. Calculate the minimum S/N. **(06 Marks)**

c. Explain block diagram of a radar with a neat diagram and explain each block. **(06 Marks)**

7 a. Explain with a neat diagram the working of a coherent MTI radar. **(08 Marks)**
b. Explain the various applications of radar. **(06 Marks)**
c. Explain the need of delay line cancellers in MTI radars. Also give the characteristics of a single delay line canceller. **(06 Marks)**

8 a. Explain with a neat block diagram the working of a simple digital MTI signal processor. **(07 Marks)**
b. Explain the working of a moving target detector with block diagram. **(07 Marks)**
c. Explain with a neat block diagram the working of a pulse Doppler RADAR. **(06 Marks)**

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