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**Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017**  
**Microwaves and Radar**

Time: 3 hrs.

Max. Marks:100

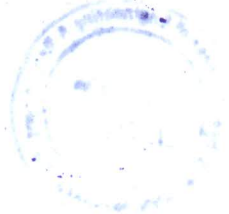
- Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.**  
**2. Use of Smith chart is permitted.**  
**3. Missing data, if any, may be suitably assumed.**

**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  $\sqrt{10} \angle -16^\circ$ , 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  $200\Omega$  line,  $3/8$  wavelengths long terminated in a  $100\Omega$  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  $2 \mu\text{m}$  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  $10 \text{ m}^2$  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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