Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Microwaves and Radar

Time: 3 hrs.   Max. Marks:100

Note: 1. Answer any FIVE full questions, selecting
at least TWO full questions from each part.
2. Use of Smith Chart is permitted.

PART – A

1   a. Derive the transmission line equation by considering the elementary section of transmission lines. **(12 Marks)**

    b. A microwave generator at 1.2GHz supplies power to a microwave transmission line having following parameters $R = 0.8\Omega/m$, $G = 0.8m\mho/m$, $L = 0.01\mu H/m$, $C = 0.4\ PF/m$. Find: i) γ ii) α iii) β iv) Z_o. **(08 Marks)**

2   a. Derive the equation for reflection coefficient and transmission coefficient. **(12 Marks)**

    b. A line of $R_o = 400\Omega$ is connected to a load of $200 + j300\Omega$. Which is excited by a matched generator at 800MHz. Find the location and length of single stub nearest to the load to produce impedance match. Use switch chart. **(08 Marks)**

3   a. Explain TM mode of excitation of rectangular wave guide and derive the equation for the same. **(08 Marks)**

    b. Explain the construction, working and applications of isolator based on faraday rotation. **(06 Marks)**

    c. Indirect power to a directional coupler is 90W. The directional coupler has coupling factor of 20dB directivity of 35dB and insertion loss of 0.5dB. Find the output power at main arm, coupled and isolated ports. **(06 Marks)**

4   a. Explain S-matrix representation of multiport network. **(06 Marks)**

    b. State and explain the properties of S-parameters. **(10 Marks)**

    c. Explain the construction and working of PIN diode. Mention its advantages and application. **(04 Marks)**

PART – B

5   a. Explain with neat sketch a precision rotary phase shifter. **(08 Marks)**

    b. What are losses encountered in microstrip line? Discuss briefly. **(08 Marks)**

    c. Design a strip line transmission line for (w/b) ratio to be less than 0.5. The substrate thickness to be used is 0.32cm. Having a dielectric constant of 3.2. The characteristic impedance of the strip line so designed should be exactly 58Ω **(04 Marks)**

6   a. Derive the radar range equation. **(06 Marks)**

    b. With the help of neat block diagram, explain the operation of radar system.   **(08 Marks)**

    c. A radar is expected to detect a target of cross sectional area of $10m^2$. The antenna used is a parabolic dish of diameter of 5 mtr. The radar operates at a wavelength of 10cm and transmits peak pulse power of 0.2Mw. Receiver can detect a minimum signal power of 10^{-13} watts. Find the maximum range at which target can be detected. **(06 Marks)**

7 a. With neat block diagram, explain the operation of MTI radar. **(08 Marks)**
   b. Write brief note on: i) Delay line canceller   ii) Blind speed. **(06 Marks)**
   c. Determine the doppler frequency shift produced by an aeroplane moving with a speed of 800 KMPH and moving in trajectory inclined at an angle of 25° with the antenna axis. The CW radar operates at a wave length of 7.5cm. **(06 Marks)**

8 Write a short note on:
   a. Parametric amplifier.
   b. Shielded strip lines.
   c. Precision type variable attenuator.
   d. Bethe-hole coupler. **(20 Marks)**

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