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10TE64

Sixth Semester B.E. Degree Examination, Aug./Sept.2020
Microwaves and Radar

Time: 3 hrs.

Max. Marks:100

Note: 1. Answer FIVE full questions, selecting atleast TWO questions from each part.
 2. Use of Smith chart is permitted.

PART – A

- 1
 - a. Derive the expression for voltage and current at any point on the transmission line. (08 Marks)
 - b. Derive an expression for reflection coefficient in the transmission line. (04 Marks)
 - c. A lossless line of characteristic impedance $R_0 = 50\Omega$ is to be matched to a load $Z_1 = \frac{50}{[2 + j(2 + \sqrt{3})]} \Omega$ by means of a lossless short – circuited stub. The characteristic impedance of the stub is 100Ω . Find the stub position (closest to the load) and length so that a match is obtained. (08 Marks)

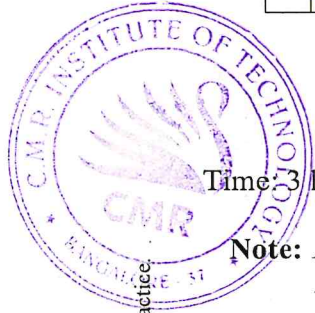
- 2
 - a. For an air filled rectangular cavity resonator, with dimensions $a = 3\text{cm}$, $b = 6\text{cm}$, $d = 9\text{cm}$, determine the resonant frequencies for the following modes : TE_{011} , TE_{110} , TE_{101} . (05 Marks)
 - b. With neat diagram, explain Bethe – hole directional coupler. (05 Marks)
 - c. With neat diagrams, explain the operation of a Faraday rotation isolator. (10 Marks)

- 3
 - a. What is “Gun effect”? With a neat diagram explain the construction details of a GUNN diode. (05 Marks)
 - b. Explain with relevant figures the fundamental concept of RWH theory. (05 Marks)
 - c. An up converter parametric amplifier has the following parameters : Ratio of output frequency to signal frequency is 25, figure of merit = 10, factor of merit figure = 0.4, diode temperature = 350K, $T_0 = 300\text{K}$. Find the power gain in dB, noise figure in dB and bandwidth. (10 Marks)

- 4
 - a. What are the different properties of scattering parameters? Explain briefly. (08 Marks)
 - b. Write the comparison between S, Z and Y matrices. (04 Marks)
 - c. Derive the relationship of ABCD parameters with S – parameters. (08 Marks)

PART – B

- 5
 - a. Discuss various types of co-axial connectors and adapters used in microwave communication. (08 Marks)
 - b. Explain with neat sketches the construction and operation of a precision – type variable attenuator. (06 Marks)
 - c. Discuss applications of Magic Tee. (06 Marks)



- 6 a. With a neat diagram, explain the construction and operation of a micro-strip line. (08 Marks)
- b. Obtain expressions for inductance, capacitance and hence the characteristic impedance of a parallel strip line. (06 Marks)
- c. A shielded strip line has the following parameters : dielectric constant of the insulator (polystyrene) : $\epsilon_r = 2.56$
- Strip width $w = 25$ mils
- Strip thickness $t = 14$ mils
- Shield depth $d = 70$ mils
- Calculate :
- i) The K – factor
- ii) The fringe capacitance
- iii) The Z_0 of the line. (06 Marks)
- 7 a. With the help of a neat block diagram, explain the working of pulse radar. (08 Marks)
- b. A marine radar operating at 10GHz has a maximum range of 50KM with an antenna gain of 4000. The transmitter has a power of 250KW and a minimum detectable signal of $10^{-11}w$. Determine the cross-section of the target the radar can sight. (06 Marks)
- c. Give a brief description of radar frequencies that are used by different kinds of radars. (06 Marks)
- 8 a. Draw the block diagram of a MTI Radar that uses a power amplifier as the transmitter. Explain the function of each block. (10 Marks)
- b. What is blind speed? Derive the equation. (05 Marks)
- c. A CW radar is operating at PRF of 1 KHz and is having wavelength of 10cm. Find first and second blind speed. (05 Marks)
