USN ☐☐☐☐☐☐☐☐☐☐ **10TE64**

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020

Microwave & Radar

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Derive transmission line equations by the methods of distributed circuit theory. **(09 Marks)**

b. Define reflection coefficient and derive an expression for reflection coefficient at the load in terms of load impedance. **(05 Marks)**

c. A load impedance of $Z_L = 60 - j80\,\Omega$ is required to be matched to a 50 Ω coaxial line by using a short circuit stub of length 'l' and a distance 'd' from the load. The wavelength is 1 m. Determine the position and length of the stub. Use Smith chart. **(06 Marks)**

2 a. Briefly explain the following microwave devices :
   (i) Hybrid ring
   (ii) Two hole directional coupler. **(10 Marks)**

b. Write field components of TE_{10} mode inside a rectangular waveguide. Using this, derive the equation for power transmitted through the guide for the dominant mode in z-direction. **(10 Marks)**

3 a. Explain construction and operation of Gunn diode in the Gunn mode and LSA mode. **(10 Marks)**

b. With neat diagram, explain the construction operation of IMPATT diode and mechanism of oscillations. **(10 Marks)**

4 a. What are the advantages of [S] matrices over [Z] matrices? **(06 Marks)**

b. List the common properties for [S] and [Z] matrices. **(04 Marks)**

c. Define insertion loss, transmission loss, return loss in terms of S-parameters. **(10 Marks)**

PART – B

5 a. With a neat diagram, explain the working of precision type phase shifter. **(10 Marks)**

b. With a neat diagram, explain the working of a H-plane Tee junction. Also derive the S-matrix. **(10 Marks)**

6 a. Explain the construction and field pattern for microstrip line. **(06 Marks)**

b. Discuss the different losses in a microstrip line. **(08 Marks)**

c. Compare strip line and microstrip line. **(06 Marks)**

7 a. Define following terms related to RADAR : (i) Range to a RADAR (ii) Maximum Unambigous range. **(04 Marks)**

b. Derive the expression for the simple form of the maximum range of radar. Comment on radar range equation. **(08 Marks)**

c. State and briefly explain applications of RADAR. **(05 Marks)**

d. A 10 GHz RADAR has the following characteristics :

Peak transmitted power = $P_t = 250$ kW ;

Peak gain of antenna = $G = 2500$;

Minimum detectable peak signal power by the receiver = $S_{min} = 10^{-14}$ w

Radar cross section of the target = $\sigma = 2\ m^2$

Cross sectional area of the radar antenna $A_e = 10\ m^2$

Find the maximum range (R_{max}) possible. **(03 Marks)**

8 a. With the aid of a block diagram, explain fully the operation of an MTI radar system using a power amplifier in the transmitter. **(12 Marks)**

b. What is Doppler effect? **(04 Marks)**

c. What are the advantages offered by digital MTI processing? **(04 Marks)**

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