Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Microwave and Radar

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. Derive an expression for the line impedance of a transmission line, at the sending end, in terms of load impedance (Z_l) and characteristic impedance (Z_o). **(08 Marks)**
   b. Define and derive expressions for reflection co-efficient and transmission co-efficient for a transmission line. **(08 Marks)**
   c. A transmission line has following parameters:
   R = 2Ω/m   G = 0.5m mho/m   f = 1GHz   L = 8nH/m   C = 0.23pF
   Find: i) Characteristic impedance   ii) Propagation constant. **(04 Marks)**

2 a. Derive electric and magnetic field equations in rectangular waveguides for TM_{mn} mode. **(10 Marks)**
   b. Define coupling factor, directivity of a directional coupler. Explain two hole directional coupler. **(10 Marks)**

3 a. Explain the fundamental concept of Ridley Watkins-Hilsum (RWH) theory. Derive an expression for the condition for negative resistance in the Gunn diode, with the help of two-valley model. **(10 Marks)**
   b. Draw equivalent circuit of the parametric amplifier. Explain briefly parametric up converter. **(06 Marks)**
   c. An n-type GaAs Gunn diode has following parameter:
   i)   Electron density $n = 10^{18}$ cm^{-3}
   ii)   Electron density at lower valley : $n_l = 10^{10}$ cm^{-3}
   iii) Electron density at upper valley $n_u = 10^8$ cm^{-3}
   iv)   Temperature T = 300°K
   Determine the conductivity of the diode. **(04 Marks)**

4 a. State and derive properties of S-parameters. **(10 Marks)**
   b. Define the following losses in microwave network in terms of S-parameters:
   i)   Insertion loss
   ii)   Transmission loss
   iii) Reflection loss
   iv)   Return loss. **(06 Marks)**
   c. Write S-matrix for
   i)   Directional coupler
   ii)   Four port circulator. **(04 Marks)**

PART – B

5 a. Write short note on coaxial connectors and adapters. **(05 Marks)**
   b. Explain construction and working of a precision rotary type phase shifter, with neat diagram. **(10 Marks)**
   c. Explain magic tee with neat diagram. **(05 Marks)**

6 a. With necessary equations, explain various losses in microstrip lines. (06 Marks)
   b. With a neat sketch, explain the different types of strip lines. (10 Marks)
   c. Compare strip-line and microstrip line. (04 Marks)

7 a. Explain RADAR with neat block diagram. (06 Marks)
   b. State and explain applications of RADAR. (06 Marks)
   c. Derive an expression for the basic form of RADAR-RANGE equation. (08 Marks)

8 a. Explain the principle and working of MTI RADAR with the help of a neat block diagram. (06 Marks)
   b. Explain single delay line canceller with neat block diagram. Derive an expression for the frequency response of a delay line canceller. (08 Marks)
   c. For an MTI RADAR, what are the first three blind speed at 2GHz when PRF is at 1kHz. (06 Marks)

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