Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Transmission Lines and Waveguides

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.***

PART – A

1 a. Define a transmission line and derive the equations for voltages and current at any point on a transmission line and also write the expression for α, β wavelength and velocity of propagation. **(12 Marks)**

   b. A Generator of 10V, 1000 Hz supplies power to a 100 km transmission line having the following parameters: R = 10.4 Ω/km, L = 0.00367 H/km, G = 0.8 * 10^{-6} $\mho$/km, c = 0.0835 μF/km. Find Z_0, Γ, λ, V_p of the transmission line. **(08 Marks)**

2 a. Mention the condition for K-low pass filter and derive the expression for cut-off frequency, characteristic impedance and design values for L and C for K-low pass filter of T type. **(12 Marks)**

   b. What are standing waves? Construct standing wave patterns for (i) Z_R = open circuited (ii) Z_R = short circuited (iii) $Z_R = 3Z_0$ (iv) $Z_R = Z_0/3$ **(08 Marks)**

3 a. Explain the applications and properties of Smith chart. **(10 Marks)**

   b. A 300 Ω line feeding an antenna has a standing wave ratio of 4 and the distance from load to the first voltage minimum is 28 cm, if the frequency is 150 MHz. Design a single stub matching system to eliminate standing wave. **(10 Marks)**

4 a. Explain the steps involved in double stub matching. Using: (i) Quadrature spacing between two stubs (ii) Three Eighths wavelength spacing between the stubs. **(10 Marks)**

   b. For a load of $Z_R = 46 + j115\Omega$ and a line of characteristic impedance $Z_0 = 400$ Ω, design a double stub matching system choosing the distance between the stubs equal to $(3\lambda/8)$ at an operating frequency of 75 MHz. **(10 Marks)**

PART – B

5 a. State the properties of 'S' parameters. Prove the symmetry properties and unitary properties of 'S' parameters. **(10 Marks)**

   b. With necessary condition, write the Scattering matrix representation of Multiport Network. **(10 Marks)**

6 a. Derive the expression for propagation constant, cut off frequency, group velocity, phase velocity for TE_{min} mode in rectangular waveguide. **(10 Marks)**

   b. Explain the constructional features and working principles of the following directional couplers: (i) Two hole directional couplers (ii) Bathe Hole directional couplers **(10 Marks)**

7 a. Explain construction features and working principle of the Gunn diode and explain mode of operation. **(10 Marks)**

   b. Explain the RWH theory. **(10 Marks)**

8 a. What are the Avalanche Transit-Time devices? Explain the Impatt diode with necessary diagrams. **(10 Marks)**

   b. Explain the operation of parametric amplifiers with equivalent circuit. **(10 Marks)**

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