2002 SCHEME

USN | | | | | | | | | | |

EC53

Fifth Semester B.E. Degree Examination, June 2012

Transmission Lines and Waveguides

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions.***
2. ***Use of Smith chart is allowed.***

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.

1 a. Define the terms : i) Characteristic impedance, ii) Propagation constant. **(04 Marks)**
b. Derive expressions for voltage and current at any point on an uniform transmission line and hence deduce an expression for input impedance. **(10 Marks)**
c. Design a constant – K low pass T-section filter to be terminated in 600 Ω having cut-off frequency of 3 kHz. Also determine attenuation at 6 kHz. **(06 Marks)**

2 a. Explain the distortions in a transmission line. **(05 Marks)**
b. Derive a condition for distortionless line. **(05 Marks)**
c. Find the primary and secondary constants of the line 50 km long when Z_{oc} measured by a bridge at 700 Hz is 286 $\underline{|-40^o}$ Ω and Z_{sc} is 1520 $\underline{|16^o}$ Ω. **(10 Marks)**

3 a. Sketch voltages and currents:
i) on an open circuited dissipationless line
ii) if $R_R = 3R_o$
iii) if $R_R = R_o$
iv) on a short-circuited line. **(08 Marks)**
b. Derive a relation between standing wave ratio and reflection coefficient. **(06 Marks)**
c. A certain transmission line, working at radio frequencies, has following constants. L = 9 μH/m, C = 16 pf/m. The line is terminated in a resistive load of 1000 Ω. Find the reflection coefficient and standing wave ratio. **(06 Marks)**

4 a. A lossless transmission line in air has a characteristic impedance of 300 ohms and is terminated by an unknown impedance. When the frequency is 200 MHz, the standing wave ratio is 4.48 and first voltage minima is situated at 6 cm from the load, determine the complex reflection coefficient and the terminating impedance of the line. **(10 Marks)**
b. A low loss line with Z_o = 70 ohms is terminated in an impedance Z_R = 11s – j80 ohms. The wave length of the transmission is 2.5metres; using the given Smith chart find the following:
i) Standing wave ratio
ii) Maximum and minimum line impedances
iii) Distance between the load and first voltage maximum. **(10 Marks)**

5 a. Derive the input impedance of open circuited and short circuited line and sketch the variations of the normalized value of reactance with distance 's'. **(10 Marks)**
b. A UHF loss less transmission line working at 1 GHz is connected to an unmatched line producing a voltage reflection coefficient of 0.5$\underline{|30^o}$. Calculate after deriving necessary relations, the length and the position of the stub to match the line. **(10 Marks)**

6 a. Obtain the condition for voltage step-up on the resonant line. **(05 Marks)**

b. Derive expressions for the field components for transmission of TM waves between parallel planes. **(10 Marks)**

c. For a frequency of 6000 MHz and plane separation of 7 cm, find the critical frequency and phase constant for TE_1 mode. **(05 Marks)**

7 a. Starting from the Maxwell's equations, obtain all the field components for TM wave in a rectangular wave guide. Plot the field pattern for any one mode. **(14 Marks)**

b. Consider a guide of 8 cms × 4 cms. Given critical wavelength of TE_{10} = 16 cms, TM_{11} = 7.16 and TM_{21} = 5.6 cms. What modes are propagated at a free space wave length of (i) 10 cm and (ii) 5 cm. **(06 Marks)**

8 Write notes on the following :

a. Excitation of wave guides **(07 Marks)**

b. Quarter wave line **(06 Marks)**

c. Application of Smith chart **(07 Marks)**

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