B.E./B.TECH. Degree Examination, December 2020

Fifth Semester

EC16503-Transmission Lines and Waveguides

[Smith chart to be used]

(Regulation 2016)

Time: Three hours Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. A lossless transmission line operating at 100 MHz is terminated in pure inductance of $+jZ_0$. The reflection coefficient is
   a. $+j$
   b. $-j$
   c. 1
   d. 0
2. A transmission line is terminated in short circuit. Which of the following statement(s) is (are) correct?
   a. Current is maximum at the load
   b. The magnitude of the reflection coefficient is unity
   c. Voltage is maximum at the load
   d. A standing wave pattern exists on the transmission line
3. With the change in the frequency band, dimensions of the waveguide
   a. may increase or decrease
   b. remain same
   c. 'a' will remain same only 'b' changes
   d. none of these
4. To maximize power transfer, a lossless transmission line is to be matched to resistive load impedance via a λ/4 transformer. The input impedance is 50Ω and load impedance is 100Ω The characteristic impedance (in Ω) of the λ/4 transformer is _____.
   a. 70.72
   b. 100
   c. 200
   d. 80.82
5. Estimate the reflection coefficient of a 50 Ω transmission line when it is terminated by a load impedance of 60+j40Ω.
6. Measure the VSWR and reflection co efficient of a perfectly matched line with no reflection from load.
7. A rectangular waveguide with a=7cm and b=3.5cm is used to propagate TM10 at 3.5GHz. Determine the guided wavelength.
8. Assess the features of TEM waves

PART B - (4 X16 = 64 marks)

09. (a) (i) Summarize how an infinite line equal to finite line terminated in its characteristic impedance **(8)**

    (ii) Illustrate in detail about input impedance and transfer impedance of transmission lines **(8)**

(OR)

(b) (i) A parallel wire transmission line is having following parameters at 5 KHz. Series resistance 2.59×10^{-3} Ω/m, series inductance 2μH/m, shunt conductance 0Ω/m and capacitance between conductors 5.56nF/m. Find the Z_o, γ, α, β, velocity and wavelength of propagation. **(8)**

(ii) The Z_o of uniform transmission line is 2000Ω at a frequency of 1KHz. At this frequency, $\gamma = 0.054\angle 60^\circ$. Determine R,L,C and G. **(8)**

10. (a) (i) Analyze the voltage and currents at any point on the dissipation less line along with incident and reflected voltage wave phasor diagrams which should satisfy the conditions such as open circuit, short circuit, $R_R = R_0$. **(8)**

(ii) Summarize the relation between standing wave ratio (S) and magnitude of relation co-efficient. **(8)**

(OR)

(b) (i) A lossless transmission line in air has a characteristic impedance of 300 Ω and is terminated by unknown impedance. When the frequency is 200MHz, the standing wave ratio is 4.48 and first voltage minima are situated at 6cm from the load. Evaluate the complex reflection coefficient. **(8)**

(ii) Deduce an expression for the input impedance of a dissipation less line and also find the input impedance is maximum and minimum at a distance 'S'. **(8)**

11. (a) (i) A RF transmission line with $Zo = 300\angle 0^\circ$ Ω is terminated in an impedance of $100\angle 45^\circ$Ω. This load is to be matched to the transmission line by using a short-circuited stub. With the help of smith chart, Find the length and location of the stub. **(10)**

(ii) Examine the operation and application of quarter wave transformer **(6)**

(OR)

(b) A 50 Ω transmission line feeds an inductive load 35+j35Ω. Analyze and design a double stub tuner to match this load to the line using smith chart. Spacing between the two stubs is λ/4. **(16)**

12. (a) (i) Discuss the operation and design of constant-K T section band pass filter with necessary equations and diagrams **(8)**

(ii) Analyze and design a Band pass filter to operate into input and output resistance of 100Ω and have a pass band between 4.8KHz and 5.2KHz **(8)**

(OR)

(b) Develop a composite High pass filter to operate into the load of 600Ω and have a cutoff frequency of 1.2 KHz. The filter is have one constant k section, one m derived section with $f_\infty = 1.1$ KHz and suitably terminated half section. **(16)**