B.E. / B.Tech Degree Examination, May/June 2013

Fifth Semester

Electronics and Communication Engineering

EC 2305/EC 55 – TRANSMISSION LINES AND WAVEGUIDES

Time : Three Hours **Maximum : 100 Marks**

Smith Chart can be provided.

Answer ALL Questions

Part A – (10 × 2 = 20 Marks)

1. A constant-K T-section high pass filter has a cutoff frequency of 10 KHz. The design impedance is 600 ohms. Determine the value of L.
2. Define propagation constant of a transmission line.
3. What is characteristic impedance?
4. Find the reflection coefficient of a 50 ohm transmission line when it is terminated by a load impedance of 60 + j40 ohm.
5. Define SWR.
6. Design a quarter wave transformer to match a load of 200 ohm to a source resistance 500 ohm. The operating frequency is 200 MHz.
7. What is degenerate mode in rectangular waveguide?
8. State the chracteristics of TEM waves.
9. Write Bessel's function of first kind of order zero.
10. Mention the applications of cavity resonantors.

Part B – (5 × 16 = 80 Marks)

11. a) i) Derive the expression for characteritic impedance of symmetrical T and Π section networks.

    ii) Bring out the relation between Decibel and Neper.

    (OR)

    b) Obtain the design equations for m-derived

    i) Bandpass

    ii) Band elimination filters

12. a) i) Derive the expressions for voltage and current along a parallel wire transmission line and obtain its solution.

ii) A cable has the following parameters:

R = 48.75 ohm/km, L = 1.09 mH/km, G = 38.75 μ-mho/km,

C = 0.059 μF/km. Determine the characteristic impedance, propagation constant and wavelength for a source of f = 1600 Hz and E_S = 1V.

(OR)

b) i) Explain in detail the waveform distortion and also derive the condition for distortionless line.

ii) Explain the concept of reflection on a line not terminated in its characteristic impedance (Z_0).

13. a) Design a single stub matching network (use Smith chart) for a transmission line functioning at 500 MHz terimated with a load impedance = Z_L = 300 + j250 Ω and with a characteristic impedance Z_0 = 100 ohms. Use short circuited shunt stubs. Determine the VSWR before and after connecting the stub.

(OR)

b) The input impedance of a λ/8 long, 50 Ω transmission line are: $Z_1 = 25 + j\,100\,\Omega$, $Z_2 = 10 - j50\,\Omega$, $Z_3 = 100 + j0\,\Omega$ and $Z_4 = 0 + j50\Omega$, when various load impedances are connected at the order end. In each case, determine the load impedance and the reflection coefficient at the input and load ends.

14. a) Derive the expression for the field strengths for TE wave between a pair of parallel perfectly conducting planes of infinite extent in the Y and Z directions. The plates are separated in X direction by 'a' meter.

(OR)

b) i) Discuss the characteristics of TE and TM waves and also derive cut-off frequency and phase velocity from the propagation constant.

ii) A pair of parallel perfectly conducting plates is separately by 7 cm in air and carries a signal with frequency of 6 GHz in TE_1 mode. Find (1) Cut-off frequency, (2) Phase constant, (3) Attenuation constant and phase constant for f = 0.8 f_C, (4) cut-off wavelength.

15. a) Derive the expression for the field components of TE and TM waves in a circular waveguide.

(OR)

b) i) A rectangular cavity resonator excited by TE_{101} mode at 20 GHz has the dimensions a = 2 cm, b = 1 cm. Calculate the length of the cavity.

ii) With neat diagrams, explain the concept of excitation of modes.
