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**Question Paper Code : 27201**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fifth Semester

Electronics and Communication Engineering

EC 6503 — TRANSMISSION LINES AND WAVE GUIDES

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

(Normalised Smith chart is to be provided)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the reflection coefficient of a  $50 \Omega$  transmission line when it is terminated by a load impedance of  $60 + j40 \Omega$ .
2. What is meant by distortion less line?
3. A lossless transmission line has a shunt capacitance of  $100 \text{ pF/m}$  and a series inductance of  $4 \mu\text{H/m}$ . Determine the characteristic impedance.
4. For the line of zero dissipation, what will be the values of attenuation constant and characteristic impedance?
5. List the applications of a Quarter-wave line.
6. Distinguish between single stub and double stub matching.
7. Determine the value of  $L$  required by a constant- $K$  T-section high pass filter with a cut off frequency of  $1 \text{ KHz}$  and design impedance of  $600 \Omega$ .
8. What are the advantages of  $m$ -derived filters?
9. A rectangular waveguide of cross section  $5 \text{ cm} \times 2 \text{ cm}$  is used to propagate  $\text{TM}_{11}$  mode at  $10 \text{ GHz}$ . Determine the cut-off wave length.
10. Write the applications of cavity resonators.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain in detail about the wave-form distortion and also derive the condition for distortion less line. (10)
- (ii) Derive the expressions for input impedance of open and short circuited lines. (6)

Or

- (b) (i) A parallel-wire transmission line is having the following line parameters at 5 KHz. Series resistance ( $R = 2.59 \times 10^{-3} \Omega/m$ ), Series inductance ( $L = 2 \mu H/m$ ), Shunt conductance ( $G = 0 \Omega/m$ ) and capacitance between conductors ( $C = 5.56 \text{ nF/m}$ ). Find the characteristic impedance, attenuation constant, phase shift constant, velocity of propagation and wavelength. (10)
- (ii) A 2 meter long transmission line with characteristic impedance of  $60+j40 \Omega$  is operating at  $\omega = 10^6 \text{ rad/sec}$  has attenuation constant of  $0 \text{ rad/m}$ . If the line is terminated by a load of  $20+j50 \Omega$ , determine the input impedance of this line. (6)
12. (a) Discuss the various parameters of open-wire and co-axial lines at radio frequency. (16)

Or

- (b) (i) A lossless line in air having a characteristic impedance of  $300 \Omega$  is terminated in unknown impedance. The first voltage minimum is located at 15 cm from the load. The standing wave ratio is 3.3. Calculate the wavelength and terminated impedance. (6)
- (ii) Derive the expression that permit easy measurements of power flow on a line of negligible losses. (10)
13. (a) (i) What is Quarter-wave line? (4)
- (ii) A  $75 \Omega$  lossless transmission line is to be matched with a  $100-j80 \Omega$  load using single stub. Calculate the stub length and its distance from the load corresponding to the frequency of 30 MHz using Smith chart. (12)

Or

- (b) (i) Discuss the principle of double stub matching with neat diagram. (8)
- (ii) A  $300 \Omega$  transmission line is connected to a load impedance of  $(450-j600) \Omega$  at 10 MHz. Find the position and length of a short circuited stub required to match the line using Smith chart. (8)



14. (a) (i) Explain the operation and design of constant-K T section band elimination filter with necessary equations and diagrams. (8)
- (ii) Design a constant K band pass filter (both T and  $\pi$  sections) having a design impedance of  $600\Omega$  and cut-off frequencies of 1 KHz and 4 KHz. (8)

Or

- (b) (i) Design an m-derived T section low pass filter having cut off frequency of 1 KHz. Design impedance is  $400\Omega$  and the resonant frequency is 1100 Hz. (4)
- (ii) Derive the equations for the characteristic impedance of symmetrical T and  $\pi$  networks. (6)
- (iii) Discuss the properties of symmetrical network in terms of characteristic impedance and propagation constant. (6)
15. (a) A rectangular air-filled copper waveguide with dimension  $0.9\text{ inch} \times 0.4\text{ inch}$  cross section and 12 inch length is operated at 9.2 GHz with a dominant mode. Find cut-off frequency, guide wave-length, phase velocity, characteristics impedance and the loss. (16)

Or

- (b) (i) Using Bessel function derive the TE wave components in circular wave guides. (10)
- (ii) Calculate the resonant frequency of an air filled rectangular resonator of dimensions  $a = 2\text{ cm}$ ,  $b = 4\text{ cm}$  and  $d = 6\text{ cm}$  operating in  $TE_{101}$  mode. (6)