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Question Paper Code : 60456

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth Semester

Electronics and Communication Engineering

EC 2305/EC 55/10144 EC 504 – TRANSMISSION LINES AND WAVEGUIDES

(Regulations 2008/2010)

(Common to PTEC 2305 — Transmission Lines and Waveguides for B.E. (Part-Time) Fourth Semester–Electronics and Communication Engineering — Regulations 2009)

Time : Three hours Maximum : 100 marks

(Smith chart is to be provided).

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine the value of L required by a constant-K T-section high pass filter with a cutoff frequency of 1 KHz and design impedance of 600 Ω.

2. What are the advantages of m-derived filters?

3. How can distortion be reduced in a transmission line?

4. A transmission line has $Z_0 = 745\angle -12°\,\Omega$ and is terminated is $Z_R = 100\Omega$. Calculate the reflection loss in dB.

5. List parameters of the open wire line at high frequencies.

6. A line having characteristic impedance of 50Ω is terminated in load impedance $(75 + j75)\,\Omega$. Determine the reflection coefficient.

7. What is degenerate mode in rectangular waveguide?

8. State the characteristics of TEM waves.

9. What are the advantages and applications of cylindrical waveguides?

10. Mention the different types of guide termination.

PART B — (5 × 16 = 80 marks)

11. (a) Design a constant K band pass filter derving expressions for the circuit components. A constant K highpass filter cuts off at a frequency of 2300 Hz. The load resistance is 500 Ω. Calculate the values of components used in the filter.

Or

(b) Design a composite high pass filter to operate into a load of 600 Ω and have a cut off frequency of 1.2 KHz. The filter is to have one constant k section, one m-derived section with f_∞ =1.1KHz and suitably terminationed half section. Discuss the merits and demerits of m-derived filter and crystal filter.

12. (a) (i) Derive the transmission line equations and hence obtain expressions for the voltage and current on a transmission line. (10)

(ii) A transmission line has L = 10 mH/m, C = 10^{-7} F/m, R=20 Ω/m and G=10^{-5} mhos/m. Find the input impedance at a frequency of $\left(\frac{5000}{2\pi}\right)$ Hz, if the line is very long. (6)

Or

(b) (i) Discuss the types of waveform, distortion introduced by a transmission line. Derive the conditions for the distortionless operation of a transmission line. (10)

(ii) The characteristic impedance of a Uniform transmission line is 2309.6 Ω at 800 Hz. At this frequency, the propagation constant is 0.054(0.0366 + j 0.999) per km. Determine R and L. (6)

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_o= 100 ohms. Use short circuited shunt stubs. Determine the VSWR before and after connecting the stub.

Or

(b) The input impedances of a $\lambda/8$ long, 50 Ω transmission line are Z_1=25+j100 Ω Z_2=10-j50 Ω Z_3=100+j0 Ω and Z_4=0+j50 Ω, when various load impedances are connected at the other end. In each case, determine the load impedance and the reflection coefficient at the input and load ends.

14. (a) Explain the concept of displacement current, in free space $E = 20\cos[\omega t - 50x]a_y v/m$. Calculate displacement current density, magnetic field strength and angular frequency.

Or

(b) Discuss in detail guided waves between parallel planes with neat diagram.

15. (a) (i) Describe the propagation of TE waves in a rectangular waveguide with necessary expressions for the field components. (10)

(ii) An air filled rectangular waveguide of dimensions a = 6 cm and b = 4 cm operates in the TM_{11} mode. Find the cutoff frequency, guide wavelength and phase velocity at a frequency of 3 GHz. (6)

Or

(b) (i) Describe the principle and operation of rectangular cavity resonators with relevant expressions. (10)

(ii) Give a brief note on excitation of modes in rectangular waveguides. (6)
