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Question Paper Code : 71736

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

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. A transmission line has $Z_0 = 745\angle -12^\circ\ \Omega$ and is terminated in $Z_R = 100\,\Omega$. calculate the reflection factor.

2. Define Smooth line.

3. Define Standing Wave Ratio.

4. A lossless line has a characteristic impedance of $400\,\Omega$. Determine the standing wave ratio if the receiving end impedance is $800 + j0.0\,\Omega$.

5. List the applications of a Quarter-wave line.

6. Why a short-circuited stub is ordinarily preferred to an open-circuited stub?

7. What are the major disadvantages of constant-k prototype filter section?

8. Sketch an m-derived band-pass section.

9. Calculate the cut-off frequency of a rectangular waveguide whose inner dimensions are a = 2.5 cm and b = 1.5 cm operating at TE_{10} mode.

10. Enumerate the parameters describing the performance of a cavity resonator.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss the general Solution of a transmission line in detail. (10)

(ii) A generator of 1.0 volt, 1000 cycles, supplies power to a 100 mile open-wire line terminated in Z_0 and having the following parameters : Series resistance R = 10.4 Ω/mile, Series inductance L = 0.00367 H/mile, Shunt conductance G = 0.8×10^{-6} Ʊ/mile and capacitance between conductors C = 0.00835×10^{-6} F/mile. Find the characteristic impedance, Propagation constant, attenuation constant, phase shift constant, velocity of propagation and wavelength. (6)

Or

(b) (i) Discuss in detail about lumped loading and derive the Campbell's equation. (8)

(ii) A 2 meter long transmission line with characteristic impedance of 60 + j40 Ω is operating at $\omega = 10^6$ rad/sec has attenuation constant of 0.921 Np/m and phase shift constant of 0 rad/m. If the line is terminated by a load of 20 + j50 Ω, determine the input impedance of this line. (8)

12. (a) Discuss in detail about the voltages and currents on the dissipation less line. (16)

Or

(b) (i) Derive the expression that permit easy measurements of Power flow on a line of negligible losses. (10)

(ii) A radio frequency line with $Z_0 = 70$ Ω is terminated by $Z_L = 115 - j80$ Ω at $\lambda = 2.5$ m. Find the VSWR and the maximum and minimum line impedances. (6)

13. (a) A 300 Ω transmission line is connected to a load impedance of 450-j600Ω at 10 MHz. Find the position and length of a short circuited stub required to match the line using Smith Chart. (16)

Or

(b) (i) A load impedance of 90-j50Ω is to be matched to a line of 50 Ω using single stub matching. Find the length and position of the stub. (10)

(ii) Design a quarter wave transformer to match a load of 200Ω to a source resistance of 500 Ω. The operating frequency is 200 MHz. (6)

14. (a) (i) Explain the design of constant-k T section low pass filter with necessary equations and diagrams. (8)

(ii) Explain the design of constant-k T section high pass filter with necessary equations and diagrams. (8)

Or

(b) (i) Design an m-derived T section low pass filter having cut off frequency of 1 KHz, design impedance of 400 Ω and the resonant frequency as 1100 Hz. (8)

(ii) Design an m-derived π section low pass filter having cut off frequency of 2 KHz, design impedance of 800 Ω and the frequency of infinite attenuation as 2050 Hz. (8)

15. (a) Derive the field components of Transverse Electric wave in rectangular waveguide. (16)

Or

(b) When dominant mode is transmitted through a circular waveguide, the wavelength measured is to be 13.33 cm. The frequency of the microwave signal is 3.75 GHz. Calculate the cut-off frequency, inner radius of guide, phase velocity, group velocity, phase constant, wave impedance, bandwidth for operation in dominant mode only. (16)
