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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 400Ω . 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 $a = 2.5 \text{ cm}$ and $b = 1.5 \text{ cm}$ 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 $R = 10.4 \Omega/\text{mile}$, Series inductance $L = 0.00367 \text{ H/mile}$, Shunt conductance $G = 0.8 \times 10^{-6} \text{ U/mile}$ and capacitance between conductors $C = 0.00835 \times 10^{-6} \text{ F/mile}$. 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 $60 + j40 \Omega$ is operating at $\omega = 10^6 \text{ rad/sec}$ 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 $20 + j50 \Omega$, 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 $Z_0 = 70 \Omega$ is terminated by $Z_L = 115 - j80 \Omega$ at $\lambda = 2.5 \text{ m}$. Find the VSWR and the maximum and minimum line impedances. (6)
13. (a) A 300Ω 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. (16)

Or

- (b) (i) A load impedance of $90 - j50 \Omega$ is to be matched to a line of 50Ω 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 500Ω . 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 400Ω 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 800Ω 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 out-off frequency, inner radius of guide, phase velocity, group velocity, phase constant, wave impedance, bandwidth for operation in dominant mode only. (16)