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Question Paper Code : 91453

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fifth Semester

Electronics and Communication Engineering

EC 6503 – TRANSMISSION LINES AND WAVE GUIDES

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. What are the primary and secondary constants of a transmission line ?
2. What is a distortionless line ? What is the condition for a distortionless line ?
3. Define insertion loss.
4. A transmission line has $Z_0 = 745 \angle 12^\circ$ and is terminated as $Z_R = 100 \Omega$. Calculate the reflection loss in dB.
5. Write down the expression to determine the length of the stub.
6. What is the application of quarter wave line matching section ?
7. What are called crystal filters ?
8. Design a low pass filter T section having cut off frequency of 2 KHz to operate with a terminated load resistance of 500Ω .
9. What is TEM wave or principal wave ?
10. An air filled resonant cavity with dimensions $a = 5$ cm, $b = 4$ cm and $c = 10$ cm is made of copper. Find the resonant frequency of lowest order mode.



11. a) A generator of 1V, 1000 Hz supplies power to a 100 km open wireline terminated in Z_0 and having the following parameters. $R = 10.4$ ohm/km, $G = 0.8 \times 10^{-6}$ mho/km, $L = 0.00367$ henry/km and $C = 0.00835$ μ F/km. Calculate Z_0 , α , λ , β , v . (13)

(OR)

- b) The characteristic impedance of a uniform transmission line is 2000Ω at a frequency of 1000 Hz. At this frequency the propagation constant was found to be $0.054 \angle 60^\circ$. Determine the values of line constants. (13)
12. a) Explain the parameters of open-wire and co-axial lines at radio frequency. (7+6=13)

(OR)

- b) The terminating load of UHF transmission line working at 300 MHz is $(50 + j50) \Omega$. Calculate VSWR and the position of the voltage minimum nearest to the load if the characteristic impedance of the line is 50Ω . (13)
13. a) Explain the technique of single stub matching and discuss operation of quarter wave transformer. (13)

(OR)

- b) A single stub is to match a 400Ω line to a load of $(200 - j100) \Omega$. The wavelength is 3m. Determine the position and length of the short circuited stub. (13)
14. a) Derive the relevant equations of m derived low pass filter and design a m derived T type low pass filter to work into the load of 600Ω and cut off frequency at 5 KHz and peak attenuation at $1.25f_c$. (6+7)

(OR)

- b) Explain the structure and application of crystal filter. A π section filter network consists of a series arm inductance of 20 mH and two shunt capacitor of 0.16μ F each. Calculate the cut off frequency, attenuation and phase shift at 15 kHz. What is the value of nominal impedance in the pass band? (3+3+3+4=13)



15. a) For a frequency of 10 GHz and plane separation of 5 cm in air, find the cut off frequency, cut off wavelength, phase velocity and group velocity of the wave. (13)

(OR)

- b) Derive the expressions for TE and TM mode in rectangular wave guide. (13)

PART – C

(1×15=15 Marks)

16. a) A TE₁₀ wave at 10 GHz propagates in a brass $\sigma_c = 1.57 \times 10^7$ (S/m) rectangular waveguide with inner dimensions $a = 1.5$ cm and $b = 0.6$ cm, which is filled with $\epsilon_r = 2.25$, $\mu_r = 1$, loss tangent = 4×10^{-4} . Determine :

- 1) the phase constant,
- 2) the guide wavelength,
- 3) the phase velocity,
- 4) the wave impedance,
- 5) the attenuation constant due to loss in the dielectric and,
- 6) the attenuation constant due to loss in the guide walls. (15)

(OR)

- b) i) Discuss in detail about the variation of input impedance along open and short circuited lines with relevant graphs. (10)
- ii) A lossless line has a standing wave ratio of 4. The R_0 is 150Ω and the maximum voltage measured in the line is 135V. Find the power delivered to the load. (5)
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10. For a frequency of 10 GHz and phase separation of 2 cm, the phase difference between the two waves is approximately 1000 degrees.

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QUESTION

12. A wave with a wavelength of 10 cm is incident on a surface. The angle of reflection is 30 degrees. The angle of refraction is 45 degrees. The refractive index of the medium is approximately 1.41.

- (a) The phase velocity
- (b) The wave number
- (c) The wave frequency
- (d) The wave amplitude

13. The attenuation constant for a wave in a medium is 0.5 dB/m. The distance over which the wave intensity is reduced to 1/e of its initial value is approximately 20 m.

14. The phase velocity of a wave in a medium is 300 m/s. The wavelength is 10 cm. The frequency is 3000 Hz.

15. A medium has a refractive index of 1.5. The wavelength of a wave in the medium is 10 cm. The wavelength in vacuum is 15 cm.