Reg. No. : | | | | | | | | | | | | |

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 $Z_0 = 745 \angle 12°$ 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 500 Ω.
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.

PART – B (5×13=65 Marks)

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 = 0.8×10^{-6} mho/km, L = 0.00367 henry/km and C = 0.00835 μF/km. Calculate Z_0, α, λ, β, v. (13)

(OR)

b) The characteristic impedance of a uniform transmission line is 2000 Ω at a frequency of 1000 Hz. At this frequency the propagation constant was found to be $0.054 \angle 60°$. 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) Ω. Calculate VSWR and the position of the voltage minimum nearest to the load if the characteristic impedance of the line is 50 Ω. (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 400 Ω line to a load of (200 – j100) Ω. 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 600 Ω 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 0.16 μF 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 $\sigma_c = 1.57 \times 107$(S/m) rectangular waveguide with inner dimensions a = 1.5 cm and b = 0.6 cm, which is filled with $\varepsilon_r = 2.25$, $\mu_r = 1$, 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 150 Ω and the maximum voltage measured in the line is 135V. Find the power delivered to the load. (5)