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Question Paper Code : X 67563

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fifth Semester
Electronics and Communication Engineering
EC 1303 – TRANSMISSION LINES AND WAVEGUIDES
(Regulations 2008)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What are the conditions for a perfect line ? What is a flat line ?

2. Give the relationship between the input impedance and characteristic impedance of an infinite line.

3. Define standing wave ratio.

4. Calculate the characteristic impedance of a quarter wave transformer to match a load of 100 Ω to a source of 250 Ω.

5. Write the expression for the characteristic wave impedance for the TE and TM waves between parallel planes.

6. A 6 GHz signal propagates between parallel planes with separation of 3 cm. Find the group velocity for the dominant mode.

7. Mention the characteristics of TEM waves.

8. Determine the characteristic impedance of TM_{11} mode in a rectangular waveguide with a = 9 cm and b = 4.5 cm at 3 GHz.

9. What are the disadvantages of circular waveguides ?

10. Mention the applications of cavity resonators.

PART – B **(5×16=80 Marks)**

11. a) i) Derive expressions for the input and transfer impedances of a transmission line. **(12)**

ii) An open wire transmission line has R = 10 Ω/km, L = 0.0037 H/km, G = 0.4×10^{-6} mhos/km and C = 0.0083×10^{-6} F/km. Determine the attenuation and phase constants at a frequency of 1000 Hz. **(4)**

(OR)

b) i) What are the types of waveform distortion in a transmission line ? Derive the condition for the distortionless operation of a transmission line. **(12)**

ii) A lossless transmission line of length 0.434 λ and characteristic impedance 100 Ω is terminated in an impedance of (260 +180) Ω. Find the voltage reflection coefficient and SWR. **(4)**

12. a) i) Explain the technique of double stub matching with necessary diagrams and equations. **(8)**

ii) The VSWR measured on a line at 300 MHz is 2. If the distance between the load and voltage minimum is 0.8 m, calculate the value of normalized load impedance. **(8)**

(OR)

b) i) Determine the input impedance and SWR for a transmission line 1.25 λ long with a characteristic impedance of 50 Ω and a load impedance of (30 + j40) Ω using the Smith chart. **(8)**

ii) A single short circuited stub is to match a 40 Ω line to a load of (200 – j 100) Ω. The wavelength is 3m. Find the position and length of the stub required to match the line using relevant formulas. **(8)**

13. a) i) Explain the attenuation of TE waves guided between parallel conducting planes. **(10)**

ii) A pair perfectly conducting planes is separated by 8 cm in air. For a frequency of 5 GHz with TE_{10} mode excited, find the cut-off frequency, characteristic impedance, phase and group velocities. **(6)**

(OR)

b) Deduce the expressions of electric and magnetic fields of TM waves guided between parallel planes.

14. a) i) Find the broad wall dimension of a rectangular waveguides when the cut-off frequency for TE_{10} modes (1) 3GHz (2) 30GHz. **(6)**

ii) Prove that TEM wave does not exist in hollow waveguides. **(5)**

iii) Explain how various modes can be excited in a rectangular waveguide. **(5)**

(OR)

b) i) A hollow rectangular waveguide operates at f = 1GHZ and it has the dimensions of 5 × 2 cm. Check whether TE_{21} mode propagates or not. **(6)**

ii) Derive the expressions for the field components of TE_{10} waves in a rectangular waveguide. Sketch the field distributions. **(10)**

15. a) Discuss the propagation of TE and TM waves in a circular waveguide with relevant expressions and diagrams for the field components. **(16)**

(OR)

b) Explain the principle and operation of circular and semicircular cavity resonators and also discuss the Q factor of cavity resonators. **(16)**

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