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Question Paper Code : 11267

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fifth Semester

Electronics and Communication Engineering

080290031 — TRANSMISSION LINES AND WAVEGUIDES

(Regulation 2008)

Time : Three hours Maximum : 100 marks

(Use of Smith chart is permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the need of inductance loading in the transmission line?

2. Sketch the voltage and current curve on a dissipation less line when the line is terminated by characteristics impedance.

3. Enumerate the application of $\frac{\lambda}{2}$ line.

4. What is the procedure for computing the impedance from the given admittance using Smith chart?

5. Define attenuation.

6. Plot the frequency —versus-wave impedance curve for the waves between parallel conducting planes.

7. Write a short note on Impossibility of TEM waves in waveguides.

8. Mention the method of exciting TE_{11} mode in the rectangular waveguide.

9. Distinguish between rectangular and circular cavity resonator.

10. Define Q factor.

PART B — ($5 \times 16 = 80$ marks)

11. (a) Discuss in detail about Wave-form distortion and derive the condition for distortionless line. (16)

Or

(b) (i) A transmission line operating at 500 MHz has $Z_O = 80\Omega$, $\alpha = 0.04\ Np/m$, $\beta = 1.5\ rad/m$. Find the line parameters series resistance $(R\Omega/m)$, series inductance (L H/m), shunt conductance (G mho/m) and capacitance between conductors (C F/m). (8)

(ii) Derive the expression for reflection loss. (8)

12. (a) (i) Briefly discuss about the application of quarter -wave line. (6)

(ii) A 5Ω lossless line of 2m length is carrying the RF signal of 425MHz in air and is terminated by a load of $(150 + j75)\,\Omega$. Find the load Reflection coefficient, VSWR and input impedance using SMITH chart. (10)

Or

(b) A 50Ω lossless feeder line is to be matched to an antenna with $Z_L = (75 - j20)\,\Omega$ at 100MHz using SINGLE shorted stub. Calculate the stub length and distance between the antenna and stub using SMITH chart. (16)

13. (a) Derive the field expression for Transverse Electric waves between a pair of parallel perfectly conducting planes of infinite extent in the 'Y' and 'Z' directions. The planes are separated in X direction by 'a' meter. (16)

Or

(b) (i) Discuss the velocity of wave propagation along a pair of parallel perfectly conducting planes of infinite extent in the 'Y' and 'Z' directions and also derive the expression that relates different velocity components such as phase, group and light velocities. (10)

(ii) Enumerate the characteristics of TEM waves between parallel conducting planes. (6)

14. (a) Derive the field configuration, cut off frequency and velocity of propagation for TM waves in rectangular wave guide. (16)

Or

(b) A TE_{10} wave at 10 GHz propagates in a rectangular wave guide made of brass whose conductivity is $1.57 \times 10^7\ S/m$. The inner dimensions of the rectangular wave guide: 'a' = 1.5 cm and 'b' = 0.6cm, which is filled with polyethylene with $\varepsilon_r = 2.25$, $\mu_r = 1$, loss tangent = 4×10^{-4}. Calculate the Phase velocity, Phase constant, Guide wave length, Wave impedance and the effective conductivity of polyethylene at 10GHz. (16)

15. (a) Derive the TE wave components in circular wave guide using Bessel function. (16)

Or

(b) Derive the expression for the following parameters in rectangular cavity resonator supporting TE_{101} mode.

(i) Energy stored in electric field (6)

(ii) Power loss in two side walls, bottom, top, front and back walls of the rectangular cavity. (10)
