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B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Fifth Semester

Electronics and Communication Engineering

EC 3551 – TRANSMISSION LINES AND RF SYSTEMS

(Common to : Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

(Use of Smith Chart to be permitted – 2 Nos.)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw the lumped element equivalent circuit of a transmission line.

2. Write the relationship between characteristic impedance and propagation constant.

3. Define standing wave ratio.

4. What do you mean by line of zero dissipation?

5. Why do standing waves exist on transmission lines?

6. Mention the applications of a quarter wave transmission line.

7. Give the expression for cutoff frequency of a circular waveguide.

8. Distinguish between TE and TM waves.

9. List the basic steps in the design process of RF amplifier circuits?

10. State the condition for unconditional stability of an RF amplifier.

PART B — (5 × 13 = 65 marks)

11. (a) Illustrate the characteristic impedance and propagation constant in terms of primary constants.

Or

(b) Obtain the general transmission line equation for the voltage and current at any point on a transmission line.

12. (a) (i) Estimate the voltage and current equation on a dissipation-less line for the various terminating conditions. (8)

(ii) Write short notes on reflection losses. (5)

Or

(b) Explain how VSWR and wavelength are measured over a transmission line.

13. (a) (i) Formulate the expression for input impedance of a quarter wave transformer and mention its significance in impedance matching. (8)

(ii) Design a Quarter wave transformer to match a load of 200 Ω to a source resistance of 500 Ω which operates at the frequency of 200 MHz. (5)

Or

(b) A load of 60+j80 Ω is connected to a 75 Ω lossless transmission line of length 0.3 λ. Find the following parameters using smith chart.

(i) Reflection Coefficient at the source and load. (5)

(ii) Standing wave ratio. (4)

(iii) Input impedance. (4)

14. (a) Derive the expression for field components of a Parallel plane waveguide in TE mode of operation with illustration.

Or

(b) Explain the propagation of TM waves in a rectangular waveguide with necessary expressions for the field components.

15. (a) Explain the construction and working of RF Bipolar junction transistors with neat diagrams.

Or

(b) Illustrate the design principles of RF amplifier and impedance matching with necessary diagrams.

PART C — (1 × 15 = 15 marks)

16. (a) A 50 Ω lossless line is to be matched to a load of $Z_L = 80 + j60\Omega$ with a shorted shunt-stub tuner.

(i) Determine the required stub impedance, its distance from the load and stub length using smith chart. (8)

(ii) Draw the transmission line and Matching network mention its length, position in the diagram. (7)

Or

(b) Consider an air-filled rectangular waveguide with dimensions $a = 7$ cm, $b = 3$ cm is fed by a 6 GHz carrier signal. Determine

(i) The cutoff frequency for dominant mode of operation (6)

(ii) Phase velocity and group velocity (6)

(iii) Intrinsic impedance (3)