14. REVIEW QUESTIONS

1. The conductor in a transmission line is required for one or more of the following reasons (mark all that apply):

(**a**) To conduct current.

(**b**) To guide the waves.

(**c**) To physically support the line.

2. Transmission line parameters for general lines are defined by the following (mark correct answers):

(**a**) Permittivity, permeability, and conductivity of the dielectric.

(**b**) As in (**a**) plus conductivity of the conductors.

(**c**) As in (**a**) plus conductivity of the conductor and physical dimensions of the line.

(**d**) As in (**a**) plus physical dimensions of the line.

3. In a lossless line, line parameters are dependent only on (mark correct answer):

(**a**) Permeability and permittivity of the dielectric between the conductors.

(**b**) As in **(a)** plus physical dimensions of the line.

(**c**) As in **(a)** plus properties of the conductor.

(**d**) As in **(c)** plus physical dimensions of the line.

(**e**) None of the above.

4. Define the following parameters of transmission lines and discuss their physical meaning.

(**a**) Resistance per unit length.

(**b**) Conductance per unit length.

(**c**) Capacitance per unit length.

(**d**) Inductance per unit length.

(**e**) Electrical length.

5. Explain why the line parameters calculated per unit length lead to valid line equations even when the wavelength is much shorter than 1 m.

6. The transmission line equations rely on an important approximation. What is it? Discuss what would be required for an "exact" treatment and why this is not necessary.

7. Propagation on lossless transmission lines is identical in all respects to that of plane waves in a lossless medium *T/F*.

8. Discuss the equivalency between the characteristic impedance in a lossless transmission line and the intrinsic impedance in an unbounded lossless material with the same permeability and permittivity.

9. Discuss the equivalency between the phase velocity in a lossless line and in a lossless material with the same permeability and permittivity.

10. Can one produce a lossless line with available materials? What would be necessary to achieve a true lossless line?

11. For a given line which must have a given characteristic impedance Z_0 and phase velocity υ_p, and assuming the line is made of copper, which of the three lines in **Table 14.1** will have lower losses?

12. Define a "long" transmission line.

13. What is a distortionless transmission line and why is it an important line?

14. How do you define a finite transmission line?

15. The load reflection coefficient is defined at the load. What is the relation between it and the generalized reflection coefficient?

16. Describe how the line impedance varies along a line if:

(**a**) Load is matched to the line.

(**b**) Load is not matched to the line.

17. On a general mismatched line, the generalized reflection coefficient and the characteristic impedance are (mark correct answer):

(a) Both real.

(b) Both complex.

(c) Z_0 is real but the generalized reflection coefficient is complex.

(d) Z_0 is complex but the generalized reflection coefficient is real.

18. All line parameters repeat at intervals of (mark correct answer):

(**a**) λ

(**b**) $\lambda/2$

(**c**) $\lambda/4$

(**d**) 2λ

19. Define standing wave ratio.

20. What does a standing wave ratio of 1 and ∞ mean?

21. Define the conditions for matching on a line. Are these the same as conjugate matching? Explain.

22. The line impedance of a shorted transmission line can be (mark all that apply):

(**a**) Real.

(**b**) Zero.

(**c**) Infinite.

(**d**) Negative, imaginary.

(**e**) Positive imaginary.

23. The line impedance of an open transmission line can be (mark all that apply):

(**a**) Real.

(**b**) Zero.

(**c**) Infinite.

(**d**) Negative, imaginary.

(**e**) Positive imaginary.

24. By measuring the impedance of a shorted or open transmission line you cannot tell the difference between them *T/F*.

25. If measurement anywhere on the line shows any real part, the line cannot be shorted or open *T/F*.

26. If one wishes to increase the variation in line voltage along the line, one needs to produce a mismatch as large as possible. What is the easiest way to do so?

27. Discuss the location of minima and maxima on a resistively loaded transmission line for

(**a**) RL > R0,

(**b**) RL < R0.

28. Plot the voltage, current, line impedance, and reflection coefficient for a line with characteristic impedance R_0, load impedance $2R_0$, and $V_L = V_0$.

29. Plot the voltage, current, line impedance, and reflection coefficient for a line with characteristic impedance R_0, load impedance $R_0/2$, and $V_L = V_0$.

30. Plot the power on the line in Question 28.

31. Plot the power on the line in Question 29.

32. What is the minimum and maximum impedance on a line with real characteristic impedance Z_0 and real load Z_L. Where do these occur?

33. Describe the idea behind transmission line resonators.