**Subject: Microwave Engg.**

**Sub code: 2171001 Sem: 7th E.C.**

**Assignment-1**

1. What are microwaves? Explain advantages of microwave and its applications.

2. Explain advantages of microwave and its applications. Draw neat diagram of Microwave system.

3. (i) “Vessels in microwave oven should be of dielectric material.” Justify with proof.

ii) Explain impossibility of TEM wave propagation through the waveguide.

4. Derive necessary equations for attenuation constant and phase constant with reference to EM wave propagating along transmission line.

5. Sketch circular and rectangular waveguide and compare their dominant mode, advantages and disadvantages.

6. The dimension of a waveguide is 2.5X1cms.The frequency is 8.6GHz Find the possible modes that can propagate through the waveguide also find the cutoff frequencies for the same.

7. A rectangular waveguide is filled by dielectric material of εr =9, with inside dimension of 7X3.5cm. It operates in the dominant TE10 mode. Determine (i) cut off frequency (ii) phase velocity at a frequency of 2 GHz (iii) guided wavelength at the same frequency.

8. A typical transmission line has a resistance of 6Ω /km, inductance of 2.2mH/km, a capacitance of 0.005 µF/km and a conductance of 0.05µmho/km. Calculate the characteristic impedance, attenuation constant and phase constant of the transmission line at a frequency of 1kHz.Alo calculate the phase velocity of the signal.

9. A1). Define following terms: 1. Standing wave ratio and 2. Return loss.

A2). A lossless transmission line with characteristic impedance of 300 ohm is fed by a generator with impedance 100 ohm. The line is 100 m long and is terminated by a resistive load of 200 ohm. Calculate the load reflection coefficient, VSWR, the transmission loss and the return loss.

10. Draw equivalent circuit of transmission line and derive basic equations for voltage and current on transmission line. Define characteristic impedance of transmission line.

11. What is the importance impedance matching? Give your answer w.r.t. transmission line. Derive expression of the length of short-circuit stub for impedance matching on transmission line.

12. A 100 ohm line with air as dielectric is terminated by a load impedance of 75 + j40 ohm and is excited at 1 GHz by a matched generator. Find the position of a single stub of 100 ohm impedance on the line, and determine the length of the stub. Solve using Smith chart.

13. A lossless 50 ohm airline has Vmax = 2.5 V and Vmin = 1 V when terminated with an unknown load. The distance between the successive voltage minima is 5 cm and the first voltage minimum from the load end is 1.25 cm. Design a short circuited single stub for impedance matching. Solve using Smith chart.

14. Why does the TEM mode cannot propagate through hollow rectangular waveguide? Derive wave equation/s for rectangular waveguide

15. Explain with diagram the pattern of field lines observed in strip lines and microstrip lines.

16. Define following terms with respect to waveguide: 1. Phase velocity and 2. Group velocity. Derive expression for both of them.

17. Enumerate merits and demerits of microstrip line compared to other type’s transmission media at microwave frequencies. Explain briefly parallel strip lines.

18. Explain impedance matching and stub matching in transmission line.

19. An air filled waveguide with a cross section 4 \* 2 cm transports energy in the TE10 mode at the rate of 0.1 hp. The impressed frequency is 30 GHz. What is the peak value of the electric field accruing in the guide?

20. Explain reflection coefficient of transmission line and standing wave. Derive expression for impedance and reflection coefficient at any point on the line

21. A transmission line has a characteristic impedance of 50 + j 0.01 Ω and is terminated in a load impedance of 73 – j 42.5 Ω. Calculate: (a) the reflection coefficient; (b) the standing-wave ratio.

22. An air-filled circular waveguide has a radius of 2 cm and is to carry energy at a frequency of 10 GHz. Find all the TEnp and TMnp modes for which energy transmission is possible.

23. Explain in brief standing wave and reflection coefficient of transmission line and derive the expression for the impedance and reflection coefficient at any point on the line.

24.A rectangular waveguide has dimension of 2.29 cm and 1.02 cm. It is desired that this waveguide is to be operated only in dominant mode and operating frequency is at least 25% above cut off frequency of dominant mode and not higher than 95% of the next cut off frequency. What is allowable operating frequency?

25. Explain reflection coefficient of transmission line and standing wave. Derive expression for impedance and reflection coefficient at any point on the line.

26. A transmission line has a characteristic impedance of 50 + j 0.01 Ω and is terminated in a load impedance of 73 – j 42.5 Ω. Calculate: (a) the reflection coefficient; (b) the standing-wave ratio

27. Define following: (i) Guide wave length (ii) Group velocity (iii) Phase velocity (iv) Wave impedance (v) VSWR (vi) Return loss (vii) Characteristics impedance

28. Draw and explain equivalent circuit of length ∆x of a transmission line at microwave frequencies. Derive basic equations for voltage and current on transmission line.

29. Write advantage of wave guide over co-axial cable and Explain working of Circular wave guide with necessary diagram and waveforms

30. What do you mean by stub? Explain impedance matching by use of stub with necessary circuit, waveforms and derivation.

31. Write properties of smith chart and explain its application with any one example.

32. Define: Blind speed, Group velocity, Wavelength, Microwave, Mode, Characteristic Impedance, Transmission coefficient

33. Define Standing wave and derive equation of the voltage standing wave. Find equations for the minimum and maximum amplitude and distance between any two successive maxima or minima.

34. A transmission line has a characteristic impedance of 50 + j 0.01 Ω and is terminated in a load impedance of 73 – j 42.5 Ω. Calculate: (a) the reflection coefficient; (b) the standing-wave ratio

35. A transmission line has Characteristic Impedance Zo= 75 + j0.01ohm and it is terminated in load impedance Zl= 70 + j50 ohm. Find Reflection coefficient, Transmission coefficient.

36. A 5.2cm length of lossless 100 ohm line is terminated in a load Zl= 30+j50 ohm, calculate magnitude of reflection coefficient, phase of reflection coefficient, and SWR using smith chart. Also find the Impedance at input from Load. The signal frequency is 750 MHz and λ= λ0.

37. What is microstrip line? Derive equation of characteristic impedance and quality factor of microstrip line.

38. Discuss the advantages of microwave frequencies compare with low-frequency waves and list out the various applications of microwaves.

39. What are the types of distortion present on a transmission line? Starting from derivation of α and β, derive the condition for distortion less transmission

40. A 75Ω transmission line is terminated in a load of (150 + j 225) Ω Design a suitable stub line to match the load to the line. The operating frequency is 500 Mhz. Use Smith chart for solving the problem

41. Explain TE , TM and TEM modes in a waveguide. What is meant by the Dominant mode in a rectangular waveguide? Explain why TEM mode cannot propagate through a rectangular waveguide.

42. Explain the terms: Cut off wavelength (λc) , Guide wavelength (λg) and free space wavelength (λo). What is the relationship between them? (2) Distinguish between Phase Velocity and Group Velocity.

43. Write the advantages and disadvantages of rectangular waveguide over circular wave guide .List out the differences between the TE mode and TM mode

44. A transmission line has the following parameters: R=2Ω/m G=0.5mmho/m L=8nH/m C=0.23pF f=1GHz Calculate the characteristic Impedance and the propagation constant.

45. Write properties of smith chart and explain its application with example.

46. An air filled rectangular waveguide has dimensions of 6cm × 4cm. It propagates a signal at 3 GHz. Compute the Cut-off frequency, Guide wavelength, Phase constant, Phase velocity, Group velocity and Wave impedance for TE10 mode.

47. The Dimensions of Waveguide are 2.5 X 1 cms. The Frequency is 8.6GHz. Find the (I) Possible Modes (II) Cut off Frequency and (III) Guide Wavelength

48. Compare: (I) Transmission Line and Wave Guide (II) Rectangular Wave Guide and Circular Wave Guide

49. A transmission line has a characteristic impedance of 75+j0.01Ω and is terminated in a load impedance of 70+j50Ω. Calculate the reflection coefficient and Transmission coefficient. Also verify the relationship T2= Zl/Z0(1-Γ2). Where T= Transmission coefficient and Γ=Reflection coefficient

50. Explain the terms cutoff wavelength and dominant mode. Determine the cutoff wavelength for the dominant mode in a rectangular waveguide of breadth 10 cms. For a 2.5 GHz signal propagated in this waveguide in the dominant mode; calculate the guide wavelength, the group and phase velocities?