MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Department of Electronics and Communication Engineering
Question Bank - Academic Year (2020-21)

Course Code & Course Name : 19ECC11 / Microwave Engineering

Name of the Faculty : Ms.S.Priya,AP/ECE

Year/Sem/Sec : III/V/C

Unit-I: GUIDED WAVES
Part-A (2 Marks)

1. What are guided waves?
2. Define TEM wave.
3. Define cutoff frequency.
4. Distinguish group velocity and phase velocity.
5. List the different characteristics of TE wave
6. Differentiate TE wave and TM wave.
7. Define cutoff wavelength.
8. List the characteristics of TEM waves.
9. Write the relation between guide wavelength and cut-off wavelength
10. Define wave impedance.

Part-B (16 Marks)

1. Derive the characteristic equations of Transverse Electric wave. A parallel plane wave guide with plate separation of 0.03 m with TE10 mode is excited at 6 GHz. Find the cutoff frequency, cutoff wavelength, guide wavelength and group velocity. (16)
2. Derive the equation for the field components of a Guided wave. (16)
3. Derive the equation for the field components of a Transverse Electric wave. (16)
4. Discuss the nature of field components of a Transverse Magnetic wave. (16)
5. Derive the characteristic equations of Transverse Magnetic wave. A parallel plane wave guide with plate separation of 20 cm is excited at 1 GHz. Find the propagation constant, cutoff frequency, and guide wavelength in the dominant mode if the medium of propagation is having a dielectric constant of 4. (16)

Unit-II : RECTANGULAR WAVEGUIDES
Part-A (2 Marks)

1. Define degenerate modes.
2. Distinguish TE and TM waves.

3. Mention the dominant modes of a rectangular and circular waveguide.
4. Rectangular waveguides are preferred over circular waveguide. Justify
5. List the characteristics of a TEM wave.
6. Write the applications of circular waveguide?
7. What is a Waveguide?
8. List the possible modes for TM waves in a circular waveguide?
9. Compute the cutoff wavelength and cutoff frequency of the TE 10 mode in a rectangular waveguide?
10. Write the relation between guide wavelength and cut-off wavelength.

Part-B (16 Marks)

1. Derive the expression for field components in a rectangular waveguide. (16)
2. Derive the expression for field components of TE & TM wave in a rectangular waveguide (16)
3. A rectangular waveguide measures 3 X 5 cm internally and has a 10 GHz signal propagated in it. Calculate the cut-off wave length the guide wavelength and the characteristic impedance for the TE_{10} mode. (16)
4. Derive the expression for Transverse Electric waves in Cylindrical Waveguides (16)
5. Derive the expression for field components in a Cylindrical Waveguides (16)

Unit-III: Two Port Network Theory

Part-A (2 Marks)

1. Why low frequency parameters are not used in microwaves?
2. Draw the equivalent circuit of a resistor and inductor at RF.
3. Mention the low frequency parameters used in low frequencies.
4. Discuss the principle advantage of microwave frequency over lower frequency.
5. Write the unitary properties of S matrix.
6. Mention the problems caused by resistor at high frequencies.
7. Examine the characteristics of reciprocal and symmetrical networks.
8. Define Reflection Co-efficient at the input side and output side of a two-port network in terms of S-parameters.
9. Represent the zero proper of S-matrix.
10. What is Insertion Loss and Return loss?

Part-B (16 Marks)

1. Formulate scattering matrix for a 2-port microwave network and generalize the concept of n-port S-matrix representation. (16)
2. Discuss the properties of S-matrix with proof. (16)
3. (i) What are transmission matrices? Explain them and obtain the relationship with S-Matrix. (8)
   (ii) Prove that the S-matrix for a lossless network is unitary. (8)

4. (i) Explain in detail about low frequency parameters. (8)

(ii) Categorize various losses in microwave devices and explain? (8)

5. Derive the S –matrix for n-port network. Prove that the S-Matrix for a reciprocal network is symmetric. (16)

Unit-IV : Microwave Generation

Part-A (2 Marks)

1 List the high frequency effects in vacuum tubes.

2 Write the classification of microwave tubes and explain the difference between them.

3 What do you mean by guide wavelength?

4 Define reentrant cavity.

5 What is the need for slow wave structures?

6 List the drawbacks available in klystron?

7 State the two parameters that describe a directional coupler? Define them.

8 Outline the need for attenuator.

9 Compare TWT and Klystron.

10 Demonstrate the Negative resistance in Gunn diode?

Part-B (16 Marks)

1. Analyze the theory of oscillations in a magnetron. Examine the expressions for Hull Cut off magnetic and voltage equations. (16)

2.(i) A travelling wave tube operates under the following parameters: Beam voltage Vo= 3kV; Bean current Io = 30mA; Characteristics impedance of helix Zo = 10 ohm; Circuit length = N=50 m; Frequency f = 10 GHz. Determine (i) Gain parameters, (ii) Output power Ap in dB. (4+4)

(ii) Identify the important points about Backward wave Crossed field amplifier. (8)

3. What is the bunching process of a two-cavity klystron? Define optimum bunching distance $L_{opt.}$ and derive the expression for it. (16)

4. Explain the operation of reflex klystron with neat diagram. (16)

5. Describe the operation of cylindrical Magnetron and crossed field amplifier. (16)

Unit-V : Microwave Measurements

Part-A (2 Marks)

1. What are the uses of network analyzer? What are the types of network analyzers?

2. What is the significance of VSWR measurements?

3. Name the methods used in the measurement of cavity Q.

4. What are the errors occur in attenuation measurement?

5. Mention the sensors used in the power measurement.

6. Distinguish between low frequency measurement and microwave measurements.

7. List the methods used to measure impedance.

8. What do you mean by slotted line?

9. Compare thermistor and barretter.

10. Why direct microwave measuring instruments are not used in laboratory?

Part-B (16 Marks)

1.(i)	Explain the any one impedance measurement with neat diagram.	(8)
(ii)	Explain the principle of operation of VSWR meter.	(8)
2.(i)	Explain a method for high power measurement.	(8)
(ii)	Draw the block diagram for the slotted line method of VSWR measurement and explain.	(8)
3.	Discuss the VSWR, impedance, wavelength and frequency measurement using slotted line method.	(16)
4.(i)	Write short notes on power sensors used for microwave power measurement.	(8)
(ii)	Explain the experimental set-up for S-parameter measurement of magic Tee and explain.	(8)
5.	Explain the operation of network analyzerr with neat sketches.	(16)

Course Faculty **HoD**