

III B.Tech. I Semester Supplementary Examinations, May -2005
MICROWAVE ENGINEERING
(Electronics & Telematics)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain clearly the different high frequency effects in electron tubes and show how these are eliminated in the design of a high frequency microwave tube.
 (b) The bunching grids of a Klystron amplifier are 2 mm apart. The beam voltage is 2KV and the drift space is 2.8 cm. Long. What must be the value of the rf voltage at the bunching grid to produce a maximum fundamental components of the current at the catcher. Assume the operating frequency is 2.8 GHz. On what factors does the bunching parameter depend upon?
2. (a) Distinguish between different types of slow wave structures. Why is a slow wave structure used in TWT?
 (b) Compare the performance characteristics applications and limitations of Klystron amplifiers, TWT amplifiers and parametric amplifiers.
3. (a) What is a cylindrical Multicavity Travelling magnetron oscillator? Explain.
 (b) Write short notes on "Hartree resonance condition"
4. (a) What is transferred electron effect? Explain clearly how a GUNN diode is different from a tunnel diode both being a negative resistance devices.
 (b) What is parametric amplifier? Explain it as an amplifier and frequency converter.
5. (a) A rectangular wave-guide has a cross section of 1.5 cm x 0.8 cm, $\sigma=0$, $\mu=\mu_0$ and $\epsilon=4\epsilon_0$. The magnetic field component is given as

$$H_x = 2 \sin\left(\frac{\pi x}{a}\right) \cos\left(\frac{3\pi y}{b}\right) \sin(\pi \times 10^{11} t - \beta z) \text{ A/m}$$
 Determine
 - i. The mode of operation
 - ii. The cut off frequency
 - iii. The phase constant
 - iv. The propagation constant
 - v. The wave impedance.
 (b) Write short notes on "Rectangular resonant Cavity".
6. Write short notes on the following.
 - (a) Multi hole directional coupler.
 - (b) Rotary phase shifter.

7. Write short notes on
 - (a) Properties of S matrix.
 - (b) Gyrator and its applications.
8. (a) How do you measure impedance of an unknown load at microwave frequencies?
Discuss in detail.
 - (b) Write short notes on “Microwave power measurement”

III B.Tech. I Semester Supplementary Examinations, May -2005
MICROWAVE ENGINEERING
(Electronics & Telematics)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain clearly the different high frequency effects in electron tubes and show how these are eliminated in the design of a high frequency microwave tube.
(b) The bunching grids of a Klystron amplifier are 2 mm apart. The beam voltage is 2KV and the drift space is 2.8 cm. Long. What must be the value of the rf voltage at the bunching grid to produce a maximum fundamental components of the current at the catcher. Assume the operating frequency is 2.8 GHz. On what factors does the bunching parameter depend upon?
2. (a) What is a backward wave oscillator? Write brief notes on its configuration and characteristics.
(b) Describe the merits and demerits of helix as a slow wave structure.
3. (a) Explain the growth of oscillations in a traveling wave magnetron.
(b) Compare the features of rising Sun magnetron with cavity magnetron.
4. (a) With the help of a schematic diagram of an IMPATT diode, explain the two effects that combine to produce a 180° phase difference between the applied voltage and the resulting current pulse.
(b) Describe the advantages and disadvantages of a parametric amplifier? What are its applications?
5. (a) Derive the expressions for cutoff frequency, phase constant, group velocity, phase velocity and wave impedance in rectangular wave guide, for TE modes.
(b) An air filled circular waveguide is to be operated at a frequency of 6 GHz and is to have dimensions such that $f_c = 0.8f$ for the dominant mode.
Determine
 - i. The diameter of the guide
 - ii. Guide wave length and
 - iii. Phase velocity in the guide
6. Write short notes on the following.
 - (a) Multi hole directional coupler.
 - (b) Rotary phase shifter.
7. Explain the construction, operation and applications of the following microwave components.

- (a) Circulator
 - (b) Gyrator.
8. (a) Write short notes on “ Microwave frequency measurement”
- (b) Draw a neat sketch of a microwave test bench for making impedance measurements, naming the various components connected.

III B.Tech. I Semester Supplementary Examinations, May -2005
MICROWAVE ENGINEERING
(Electronics & Telematics)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What is transit time effect? Why is it so important at microwave frequencies?
(b) Explain the mechanism of formation of BUNCH in a transit time device with the help of Applegate diagram.
2. (a) With the aid of neat sketches, describe the construction and operation of TWT.
(b) Starting with the assumption that there are three forward traveling waves in TWT, derive an expression for power gain of the tube.
3. (a) Explain the growth of oscillations in a traveling wave magnetron.
(b) Compare the features of rising Sun magnetron with cavity magnetron.
4. (a) Write short notes on "Parametric up converter".
(b) What is a MASER? What does its name signify? What applications does it have?
5. (a) Show that the TEM, TM₀₁ and TM₁₀ modes in a rectangular wave-guide do not exist.
(b) Discuss the merits and demerits of circular wave guide over rectangular wave guide.
6. (a) Discuss and compare the characteristics of E-plane Tee and H-Plane Tee.
(b) Write short notes on "Inductive and capacitive posts".
7. (a) Obtain the S-Matrix of an ideal 3dB directional coupler.
(b) Write short notes on "Ferrite Devices".
8. (a) Distinguish between slotted line and directional coupler methods of VSWR measurement.
(b) Write short notes on "frequency meters".

III B.Tech. I Semester Supplementary Examinations, May -2005
MICROWAVE ENGINEERING
(Electronics & Telematics)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Write short notes on “Two cavity Klystron oscillator”.
(b) Derive the expression for transadmittance of Reflex Klystron Oscillator and explain the condition of oscillation from admittance spiral.
2. (a) What is TWT amplifier? Explain the process of amplification in such an amplifier.
(b) Compare performance and applications of a TWT amplifier with that of Klystron amplifier.
3. (a) Describe how microwave frequencies are generated in a magnetron tube with a neat sketches.
(b) What is Π mode? What are the various modes that are possible in a magnetron.
4. (a) Explain the GUNN effects where by negative resistance and therefore oscillations are present in bulk gallium arsenide? Why GUNN devices are called diodes?
(b) An IMPATT diode has a drift length of $2\text{ }\mu\text{m}$.
determine
 - i. The drift time of the carries and
 - ii. The operating frequency of the diode.
5. (a) Show that the TEM, TM_{01} and TM_{10} modes in a rectangular wave-guide do not exist.
(b) Discuss the merits and demerits of circular wave guide over rectangular wave guide.
6. (a) What is a directional coupler? A 20dB coupler has a directivity of 30dB. Calculate the value of isolation, defining all the forms involved.
(b) Explain the functioning of “rotary Vane attenuators”.
7. (a) Derive the S matrix of a magic Tee.
(b) Discuss the properties and applications of a Gyrator.
8. (a) Explain the method to measure VSWR and reflection co-efficient.
(b) Describe the measurement of impedance using slotted line and Smith chart.
