Question Bank

M.Sc. - PHYSICS

Course Code-MSCPH-09

Microwave Devices and Communication Systems

Very Short Answer Type Questions

Q.1 What is drift space ?

Answer 1: The separation between buncher and catcher grids is called as drift space.

Q.2 Define Velocity Modulation

Answer 2: The variation in electron velocity in the drift space is known as velocity modulation.

Q.3 What is the need of Quality factor Q?

Answer 3: Quality factor Q which is a measure of the frequency selectivity of a cavity.

Q.4 Define Scattering matrix.

Answer 4: Scattering matrix is a square matrix which gives all the combinations of the power relationships between the various input and output ports of a microwave junction.

Q.5 What are scattering coefficients ?

Answer 5: The elements of scattering matrix are called scattering coefficients or scattering parameters.

Q.6 Define- Reflection Loss

Answer 6: The reflection loss is a measure of power loss during transmission due to the reflection of the signal as a result of impedance mismatch.

Q.7 What is a wave guide?

Answer 7: A waveguide is a hollow metal tube designed to carry microwave energy from one place to another.

Q.8 What are the key characteristics of tunnel diode?

Answer 8: The key characteristics of a tunnel diode are its negative resistance region.

Q.9 Write the types of waveguide cavity resonators.

Answer 9: The types of waveguide cavity resonators are

(1)Rectangular cavity resonator

(2)Circular cavity resonator

Q.10 Why is magic tee referred to as E-H tee?

Answer 10: The magic tee is a combination of the E-plane tee and H-plane tee. It is a four port hybrid circuit. It is also known as hybrid tee.

Q.11 What is E-plane Tee?

Answer 11: An E-plane tee is a waveguide tee in which the axis of its side arm is parallel to the E-field of the main guide.

Q.12 Why magnetron is called as cross field devices?

Answer 12: In a magnetron, the dc magnetic field and dc electric field are perpendicular to each other and hence magnetron is called as a cross field device.

Q.13 What are the types of waveguide tees?

Answer 13: The two types of waveguide are i. E-plane Tee(series) ii. H-plane Tee(shunt)

Q.14 What is the use of attenuator in TWT?

Answer 14: Attenuator is used to prevent oscillations.

Q.15 Why the output cavity is called as catcher cavity?

Answer 15: The output cavity catches energy from the bunched electron beam. Therefore, it also called as catcher cavity.

Q.16 Define directivity of directional coupler.

Answer 16: D (dB) = 10log10Pf/Pb

Directivity is a measure of how well the directional coupler distinguishes between the forward and reverse traveling powers.

Q.17 Name the two configuration of klystron There are two basic configurations of Klystron tubes

Answer 17: Reflex Klystron – It is used as low power microwave oscillator 2) Two cavity (or) Multicavity Klystron – It is used as low power microwave amplifier.

Q.18 What is circulator?

Answer 18: A circulator is a multiport junction in which the wave can travel from one port to next immediate port in one direction only. They are useful in parametric amplifiers, tunnel diode, amplifiers and duplexer in radar.

Q.19 Define non-reciprocal devices?

Answer 19: A non-reciprocal device does not have same electrical characteristics in all direction.

Q.20 Write down the applications of TRAPATT diodes

Answer 20:

a) Used in low power Doppler radars. b) Used as local oscillators for radars, microwave beacon landing system, radio altimeter, phased array radar etc.

Short Answer Type Questions

Q.1 Distinguish between low frequency measurements and microwave measurements.

Q.2 Mention the application of two cavity.

Q.3 What is TWTA?

Q.4 Write the applications of TWT

Q.5 What are the applications of tunnel diode?

Q.6 Explain plasma function in TRAPATT diode.

Q.7 Write the applications of magic tee?

Q.8 Distinguish between TE, Tm and TEM waveguides.

Q.9 Define

a) Gyrator, b) Isolator, c) Circulator

Q.10 Write down advantages and disadvantages of Modulation.

Q.11 Give the comparison between TWTA and klystron amplifier.

Q.12 What are the advantages of TWT?

Q.13 What are the drawbacks available in klystrons?

Q.14 Derive the wave equation for a TM wave and obtain all the field components in a rectangular waveguide.

Q.15 Name the types of magnetron.

Q.16 What are the major disadvantages of IMPATT diodes?

Q.17 Mention the applications of IMPATT diodes.

Q.18 Explain the terms : Cut-off frequency, Dominant mode and Phase velocity.

Q.19 Why TM_{01} or TM_{10} mode is not possible in rectangular waveguide?

Q.20 State the properties of S parameter.

Long Answer Type Questions

Q.1 Write short note on

(i) Antenna theorems

(ii) Directivity (D) of an Antenna

(iii) Gain of an Antenna

(iv) Antenna impedence

(v) Capture area of an Antenna

Q.2 Discuss with neat sketches different types of Antennas.

Q.3 What are waveguide tees? What are its applications? State different types of wave guide tees.

Q.4 A TWT operates under the following parameters - 10
Beam voltage $V_0 = 3$ kV.
Beam current $I_0 = 30$ mA.
Characteristic impedance of helix : $Z_0 = 10\Omega$
Circuit length N = 50.
Frequency f = 10 GHz.
Determine-
(i) the gain parameter
(ii) the output power gain Ap in decibels and
(iii) all four propogation constants.

Q.5 What do you understand by the terms cut-off wavelength, dominant mode, guide wavelengths, phase velocity, group velocity and wave impedance, obtain the mathematical relations for each one of these and their interrelationships.

Q.6 An air filled rectangular waveguide of inside dimensions 7 x 3.5 cm operates in the dominant TE10 mode.
(i) Find the cut-off frequency.
(ii) Determine the phase velocity of the wave in the guide at a frequency of 3Â·5 GHz.
(iii) Determine the guided wavelength at the same frequency.

Q.7 Explain the operation of H-plane and E-plane Tee's and derive the scattering matrix for these Tee's.

Q.8 What are avalanche transit time device? Explain the operation, construction and applications of the following devices.
(1) IMPATT (2) TRAPATT