EC-704

Microwave Engineering

Time : Three Hours

Maximum Marks : 70

Note: Attempt all the questions. All the questions carry equal marks. Assume suitable data if any missing. Answer must be to the point.

1. A rectangular waveguide is filled by dielectric material of dielectric constant 9 and has inside dimensions of 7 x3.5 cm. It operates in the dominant TE_{10} mode.

a) Determine the cutoff frequency
b) Find the phase velocity in the guide at a frequency of 2GHz
c) Find the guided wavelength at the same frequency.

OR

An air filled circular waveguide has a radius of 1.5cm and is to carry energy at a frequency of lOGHz. Find all TE and TM modes for which transmission is possible.

2. A three way power divider has an insertion loss of 0.5dB. If the input power is OdBm, what is the output power in dBm and milliwatts at any one of the output ports?

OR

A 10-dB directional coupler has a directivity of 40dB. 1 f the input power at port 1 is 10mW what are power outputs at port 2,3 and 4? Assume the coupler

(a) is lossless and (b) has an insertion of 0.5dB.

3. A certain microwave tunnel diode has a negative resistance of (69+j9.7) ohms. Determine the resonant circuit impedance . so that the microwave tunnel -diode amplifier will produce a power gain of 15dB.

OR

Describe the operating principle ofIMPATT diode, TRAPAI lode and BARITT diode.

4 A two cavity amplifier klystron has the following parameters

Beam voltage = 900V earn current = 30mA

frequency = 8GHz Gap spacing in either cavity = 1 mm

spacing between centers of cavities = 4 cm effective shunt impedance = 40 Kohms

Determine

a) The electron velocity
b) The dc transit time of electron
c) The input voltage for maximum output voltage
d) The voltage gain in dB

OR

A normal circular magnetron has the following parameters Inner radius = 0.15m, Outer radius = 0.45m Magnetic flux density = 1.2 mWb / sq.m.

a) Determine the Hull cutoff voltage

b) Determine the cutoff magnetic flux density if the beam voltage is 6000V.

5. How is frequency meter used in a microwave system? Explain the different methods used for frequency measurement of a microwave signal.

OR

Explain the working of a thermistor for microwave power measurement. Draw a complete setup for Wheatsone's bridge method, having its one arm as thermistor for microwave power measurement.