

(3 Hours)

[Total Marks : 100

Microwave Devices & Circuits

- N.B.** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions out of remaining.
 (3) **Assume** suitable data wherever **necessary**.
 (4) Attach **Smith Chart**.

1. Explain in brief any **four** of the following :— 20
- Microwave Diodes
 - Faraday Rotation in Ferrites
 - Co-axial re-entrant cavity
 - Slow wave structures
 - Limitations of Microwaves.
2. (a) Explain the working of two hole directional coupler with neat diagram and derive its S-matrix. 20
 (b) A lossless transmission line with a characteristics impedance of 500 ohms is excited by a signal of voltage $10 \angle 0^\circ$ volts at 1.2 MHz. If the line is terminated by Z_L at a 1 km distance, calculate :
 (i) Input impedance of the line for $Z_L = \infty$ and 0,
 (ii) The voltage at the midpoint of the line for $Z_L = Z_0$.
3. (a) For WR-90, find the cut off wavelength and cut off frequency. 20
 (b) Explain why waveguide can't support TEM mode.
 (c) Represent electric and magnetic field distribution in rectangular waveguide operating in TE_{10} and TE_{20} mode using schematic diagram.
 (d) What is waveguide excitation ? Explain following excitation techniques :—
 (i) Electric Excitation
 (ii) Magnetic Excitation.
4. (a) Why S-parameters are used at microwave frequencies ? 20
 List and explain properties of S-parameters matrix.
 (b) A TWT operates under the following parameters :
 Beam Voltage $V_0 = 3$ kV
 Beam Current $I_0 = 30$ mA
 Charact. 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 A_p in decibels
 (iii) the propagation constant.

5. (a) A lossless 50 ohms air-filled co-axial line has $V_{\max} = 2.5 \text{ V}$ and $V_{\min} = 1 \text{ V}$ 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 circuit single stub for impedance matching. 20
- (b) What is velocity modulation in a Reflex Klystron? Explain with suitable equations.
6. (a) Explain the working of a phase-shifter with the help of a neat diagram. 20
- (b) Explain operation of Gunn diode using two valley model and different modes.
7. (a) Explain the dielectric measurement with the help of test bench. 20
- (b) Explain any one application of microwave heating in detail.
- (c) Write advantages and applications of microstrip line.
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