

Time: 3 Hours

Total Marks: 80

- Note:** 1) Each question carries 20 marks.
 2) Question no. 1 is compulsory.
 3) Solve any 3 out of remaining.
 4) Assume suitable data wherever required.

Q1 Answer any FOUR.

- a) Why strapping is used in Magnetron. (05)
 b) State and explain properties of E plane Tee. (05)
 c) An air filled rectangular waveguide with inner dimensions $a = 7\text{cm}$ and $b = 3.5\text{ cm}$ operates in the dominant TE₁₀ mode. Find the cut-off frequency. (05)
 d) Explain PIN diode with schematic structure and doping profile. (05)
 e) Compare stripline and microstrip line. (05)

- Q2 A)** In a rectangular waveguide for which $a = 1.5\text{ cm}$ and $b = 0.8\text{ cm}$, $\sigma = 0$, $\mu = \mu_0$ and $\epsilon = 4\epsilon_0$, (10)

$$H_x = 2 \sin\left(\frac{\pi x}{a}\right) \cos\left(\frac{3\pi y}{b}\right) \sin(\pi \times 10^{11} t - \beta z) \text{ A/m}$$

- Determine: a) The mode of propagation
 b) The cut-off frequency
 c) The phase constant β

- B)** Explain working of Rotary phase shifter. (10)

- Q3 A)** A 50Ω transmission line is connected to antenna with load impedance $Z_L = 80 - j80\Omega$. Find the position and the length of short circuit shunt stub at 4 GHz frequency required to match 50Ω line.

- B)** Explain Two cavity Klystron with schematic diagram. Explain velocity modulation process and derive the equation for beam –coupling coefficient. (10)

- Q4 A)** Explain principal of operation of IMPATT diode. (10)

- B)** A reflex klystron operates under the following conditions:

$$V_0 = 600\text{V}, L = 1\text{mm}, R_{sh} = 15\text{ K}\Omega, e/m = 1.759 \times 10^{11}, f_r = 9\text{ GHz.}$$

The tube is oscillating at f_r at the peak of the $n = 2$ mode. Assume that the transit time through the gap and beam loading can be neglected.

- a) Find the value of the repeller voltage. (03)
 b) Find the direct current necessary to give a microwave gap voltage of 200V. (03)
 c) What is the electronic efficiency under this condition? (04)

- Q5 A)** Explain methods of microwave frequency measurement. (10)

- B)** Explain current versus field characteristics of Gunn diode with the help of Two-Valley Model Theory. (10)

- Q6 A)** A pulsed cylindrical magnetron is operated with the following parameters
 Anode voltage = 25 KV, Beam current = 25A, Magnetic density = 0.34 Wb/m^2 ,
 Radius of cathode cylinder = 5 cm, Radius of anode cylinder = 10 cm

- Calculate a) the angular frequency (03)
 b) the cut-off voltage (03)
 c) the cut off magnetic flux density (04)

- B)** Explain working of isolator using Faraday rotation (10)
