

- N.B. (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions out of remaining **six** questions.
 (3) Assume any **suitable** data wherever **required** but justify the same.
 (4) Illustrate answer with **sketches**.
 (5) Answers to questions should be **grouped** and written **together**.

1. Attempt any **four** :— 20
 - (a) Microwave characteristics and applications,
 - (b) Microstrip and strip line transmission lines,
 - (c) Excitation of resonant cavities,
 - (d) IMPATT diodes,
 - (e) Point contact diode.

2. (a) For a distributed elements Transmission line derive the relation for characteristics impedance and propagation constant. 10
 (b) A load impedance of $130 + j 90 \Omega$ terminates a 50Ω transmission line that is 0.3λ long. 10
 Find :
 - (i) the reflection coefficient at the load
 - (ii) the reflection coefficient at the input to the line
 - (iii) the input impedance
 - (iv) the SWR on the line
 - (v) the return loss (use Smith chart).

3. (a) Determine the location and length of an open circuited stub to match a 50Ω line terminated in a load of $50 - j 100 \Omega$. Assume Z_o of stub to be same as line. (Please use Smith chart). 10
 (b) Derive the expression for the field in TE modes of circular waveguide. 10

4. (a) A rectangular WG has following characteristics, $b = 1.5 \text{ cm}$, $a = 3 \text{ cm}$, $\mu_r = 1$, $\epsilon_r = 5$ 10
 Calculate the —
 - (i) cutoff frequency for TE₁₀ and TM₁₁ mode and show dominant mode
 - (ii) λ_g and Z_o at 4.0 GHz
 - (iii) Attenuation constant at 3 GHz for dielectric field guide.
 - (iv) Total attenuation at frequencies much less than the TE₁₀ cutoff frequency.
 (b) Prove that a $\lambda/2$ short circuited transmission line acts as a series resonant circuit. 10

5. (a) Explain the working of a phase shifter with the help of a neat diagram. 10
 (b) A Travelling Wave Tube (TWT) has following characteristics :- 10

Beam voltage :	$V_0 = 2 \text{ kV}$
Beam current :	$I_0 = 4 \text{ mA}$
Frequency :	$f = 8 \text{ GHz}$
Circuit length :	$N = 50$
Characteristic impedance :	$Z_0 = 20 \Omega$.

 Determine :
 - (a) the gain parameter C
 - (b) the power gain in decibels
 - (c) the propagation constant β_e .

6. (a) A reflex klystron operates at the peak of the $n = 2$ mode. The DC power input is 40 mW and $V_1/V_0 = 0.278$. If 20% of the power delivered by the beam is dissipated in the cavity walls, find the power delivered to the load. 10
 (b) Describe the principle of operation for a normal cylindrical magnetron. Derive the Hull cutoff voltage equation. 10

7. (a) Explain the various modes of operation of a Gunn diode in detail. 10
 (b) Explain frequency measurement with its setup. 10