

(3 Hours)

[Total Marks : 100

- N.B. :** (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** questions out of the remaining **six** questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) Assume suitable **data** wherever **necessary**.

1. (a) What are applications of Microwaves ? 5
(b) Can TEM mode exist in hollow waveguide ? Justify your answer. 5
(c) What are O-type and M-type devices in microwave ? 5
(d) Explain the terms : Cutoff frequency, Dominant mode, Phase velocity, Group velocity. 5
2. (a) Derive wave equation for TE wave and obtain all the field components in a rectangular waveguide. 10
(b) Explain the action of isolator and circulator using ferrites, mention their typical applications. 10
3. (a) Draw a neat diagram of two cavity Klystron amplifier and explain the bunching process. Derive the equation of velocity modulation. 10
(b) An X-band pulsed cylindrical magnetron has the following parameters : 10
Anode voltage : $V_o = 2.6 \times 10^4$ V
Beam current : $I_o = 27$ A
Flux density : $B_o = 0.336$ Wb/m²
Radius of cathode cylinder : $a = 5$ cm
Radius of Vane edge to centre : $b = 10$ cm.
Compute : the cyclotron angular frequency, the cutoff voltage for a fixed B, and the cutoff magnetic flux density for a fixed V_o .
4. (a) Draw and explain two-hole directional coupler. Define coupling factor, directivity and isolation. Derive S matrix for the same. 10
(b) Explain Gunn effect with the two-valley model of Gunn diode. What are the criteria that the semiconductor must satisfy in order to exhibit negative resistance ? 10
5. (a) What are slow wave structures ? Explain how helical TWT does amplification. 10
(b) Describe the types of strip line in brief. 5
(c) Explain excitation of modes in circular waveguides. 5
6. (a) Explain the methods used for power measurement in microwaves. 10
(b) With the help of sketch distinguish between IMPATT and TRAPATT diode. 10
7. Write short notes on any **three** of the following :- 20
 - (a) Limitations of conventional tubes at microwave frequencies
 - (b) Waveguide attenuators
 - (c) Measurement of VSWR
 - (d) Microwave transistor.