

QP Code : MV-18074

(3 Hours)

[ Total Marks : 100

- N. B. :** (1) Question No. 1 is compulsory.  
 (2) Solve any four questions of remaining six questions.  
 (3) Assume suitable data if necessary.

1. Answer any four :- 20
- (a) Why S parameters are used at microwave frequencies ?  
 (b) TEM waves do not propagate through hollow waveguide. Justify.  
 (c) An IMPATT diode has following parameters :-  
 Carrier drift velocity  $v_d = 2 \times 10^7$  cm/s  
 Drift region length  $L = 6 \mu\text{m}$   
 Maximum operating voltage  $V_{0\text{max}} = 100\text{V}$   
 Maximum operating current  $I_{0\text{max}} = 200$  mA  
 Efficiency  $\eta = 15\%$   
 Breakdown voltage  $V_{bd} = 90\text{V}$ .
- Find :-
- (i) The maximum power in watts.  
 (ii) The resonant frequency.  
 (d) What is back heating in microwave oscillator ?  
 (e) Differentiate between  $TE_{mn}$  and  $TM_{mn}$  modes in rectangular waveguides.
2. (a) Derive wave equation for TE wave and obtain all field components in rectangular wave guide. 12  
 (b) Define group velocity and phase velocity for wave propagating in rectangular waveguide. 8  
 A wave guide has cutt off-frequency of 3.75 GHz. Find the group velocity for this rectangular waveguide at 5 GHz.
3. (a) With neat schematic diagram, explain the bunching of electrons in Reflex Klystron. Hence derive the expression for bunching parameter. 10  
 (b) A pulsed cylindrical magnetron is operated with following parameters :- 10  
 Anode voltage = 25 kV  
 Beam current = 25 A  
 Magnetic flux density = 0.34 wb/m<sup>2</sup>  
 Radius of cathode cylinder,  $a = 5$  cm  
 Radius of vane edge to center,  $b = 10$  cm
- Calculate :-
- (a) The cyclotron angular frequency  
 (b) The cutt off voltage  
 (c) The cutt off magnetic flux density.

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4. (a) What are ferrite devices ? Explain with neat schematic circulator and mention its uses. 10
  - (b) Explain a method to measure VSWR at microwave frequencies when VSWR is greater than 10. 10
  5. (a) Explain the different operating modes of Gunn diode. 10
  - (b) With neat diagram explain the operation of Travelling Wave Tube. 10
  6. (a) Explain the operation of two hole directional coupler. Derive its S-matrix. 10
  - (b) Explain power frequency limitation in microwave transistors. 10
  7. Write short notes on (any four) :- 20
    - (a) Measurement of power
    - (b) Microwave resonator
    - (c) Magic TEE
    - (d) Striplines
    - (e) Applications of microwaves
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