

(REVISED COURSE)

(3 Hours)

[Total Marks : 100

- N.B. : (1) Question No. 1 is compulsory.  
 (2) Attempt any four out of the remaining six questions.  
 (3) Assume suitable data wherever necessary and justify the same.

1. Explain in brief (any four) :— 20
  - (a) Microwave characteristics and applications.
  - (b) Characteristic impedance, Reflection coefficient and V.S.W.R. of a microwave transmission line.
  - (c) Microstrip and stripline transmission lines.
  - (d) Reflex klystron.
  - (e) Parametric amplifier.
  
2. (a) A Lossless Line has a characteristic impedance of  $50 \Omega$  and is terminated in a Load resistance of  $75 \Omega$ . The Line is energized by a generator which has an output impedance of  $50 \Omega$  and an open-circuit output voltage of  $30 \text{ V (rms)}$ . The line is assumed to be  $2.25$  wavelengths long. Determine :— 8
  - (i) The input impedance.
  - (ii) The magnitude of the instantaneous load voltage.
  - (iii) The instantaneous power delivered to load.
- (b) Why impedance matching is required for microwave circuits ? Explain various methods of impedance matching for microwave circuits. 12
  
3. (a) If the characteristic impedance of the Line  $R_0$  is  $50 \Omega$  and  $VSWR = e = 2$  when the line is loaded. When the load is shorted, the minima shift  $0.15 \lambda$  toward the load. Determine the load impedance using Smith chart. 8
- (b) (i) Explain coaxial resonators. 8  
 (ii) Derive the equation of resonating frequency for rectangular cavity resonator. 4
  
4. (a) A rectangular air-filled waveguide of inside dimensions  $7 \times 3.5 \text{ cm}$  operates in the dominant mode at  $3.5 \text{ GHz}$  frequency. 14  
 Find :—
  - (i) cut-off frequency.
  - (ii) phase constant  $\beta_g$ .
  - (iii) phase velocity  $v_g$ .
  - (iv) Guide wavelength  $\lambda_g$ .
  - (v) Characteristic wave impedance  $Z_g$ .
  - (vi) Attenuation constant  $\alpha_c$ .
- (b) Explain advantages and disadvantages of circular waveguide. What are the applications of circular waveguide ? 6
  
5. (a) Explain the working of two-hole directional coupler with neat diagram and derive its S-matrix. 12  
 (b) Explain the working of isolator with neat diagram. 8
  
6. (a) Differentiate between TWT amplifier and klystron amplifier and explain the working of Helix TWT amplifier. 12  
 (b) A pulsed cylindrical magnetron is operated with the following parameters. 8

Anode voltage $V_0$	=	25 kv.
Beam current $I_0$	=	25 Amp.
Magnetic flux density $B_0$	=	$0.34 \text{ wb/m}^2$ .
Radius of cathode cylinder a	=	5 cm.
Radius of anode cylinder b	=	10 cm.

Calculate :—

  - (i) The angular frequency
  - (ii) The Hull-cut-off voltage.
  - (iii) The Hull cut-off magnetic flux density.
  
7. (a) Explain operation of Gunn diode using two valley model and explain different modes of Gunn diode. 12  
 (b) Explain frequency measurement with its set up. 8