

[5354]-603

B.E. (E & TC) (Semester - I)
MICROWAVE ENGINEERING
(2012 Pattern)

*Time : 2½ Hours]**[Max. Marks : 70**Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary*

Q1) a) Explain the terms with respect to waveguide : [7]

- i) Cut off Wavelength
- ii) Wave Impedance

A cavity resonator with dimensions $a = 3$ cm, $b = 2$ cm is excited by mode of 90 MHz. Calculate the length of the cavity.

- b) Explain the properties of Hybrid Tee with the help of a neat diagram. Also state its Scattering matrix. [7]
- c) Explain Stripline in detail. [6]

OR

Q2) a) Define dominant mode and describe rectangular waveguide in detail. [7]

- b) A directional coupler has the scattering matrix given below. Find the directivity, coupling and isolation. [7]

$$[s] = \begin{bmatrix} 0.05\angle 30 & 0.96\angle 0 & 0.1\angle 90 & 0.05\angle 90 \\ 0.96\angle 0 & 0.05\angle 30 & 0.05\angle 90 & 0.1\angle 90 \\ 0.1\angle 90 & 0.05\angle 90 & 0.04\angle 30 & 0.96\angle 0 \\ 0.05\angle 90 & 0.1\angle 90 & 0.96\angle 0 & 0.05\angle 30 \end{bmatrix}$$

- c) Why network analysis is preferred over Maxwell's equation? [6]

P.T.O.

- Q3)** a) With the help of applegate diagram explain the operation of two cavity Klystron. [6]
- b) Explain construction and principal of operation of Cylindrical Magnetron. [6]
- c) A helical TWT has diameter of 2 mm with 50 turns per cm. Calculate axial phase velocity and anode voltage at which TWT can be operated for useful gain. [6]

OR

- Q4)** a) Explain the different types of slow wave structures. Brief the operation of Travelling Wave Tube with the help of neat diagram. [9]
- b) A reflex Klystron operates under the following conditions. [9]

$$V_0 = 600 \text{ V}$$

$$R_{sh} = 15 \text{ k}\Omega$$

$$e/m = 1.759 \times 10^{11}$$

$$f_r = 9 \text{ GHz}$$

$$L = 1 \text{ mm}$$

L is the spacing between repeller and cavity. The tube is oscillating at f_r at the peak on $n = 2$ mode or $\frac{3}{4}$ mode. Assume that the transit time through the gap and through beam loading can be neglected.

- i) Find the value of repeller voltage V_R
- ii) Find the dc necessary to give microwave gap of voltage of 200 V
- iii) Calculate the electronic efficiency.

- Q5)** a) Explain the four modes of operation of Gunn Diode. [8]
- b) What are avalanche transit time devices? Explain construction, working and applications of IMPATT diode. [8]

OR

Q6) a) Explain working principal of varactor diode. Enlist the advantages and applications for the same. [8]

b) Write a short note on the following : [8]

i) Schottky Barrier diode

ii) PIN diode

Q7) a) Describe the set up for the measurement of Q of a cavity resonator. [8]

b) Explain attenuation measurement technique in detail. [8]

OR

Q8) a) Describe the techniques used to measure Voltage Standing Wave Ratio. [8]

b) Describe the technique of measuring phase shift introduced by network. [8]

