2022

M.Sc.

4th Semester Examination

ELECTRONICS

PAPER—ELC-401

MICROWAVE AND POWER ELECTRONICS

Full Marks : 50

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

1. Answer any *four* questions : 4×2

(a) Show that a quarter wave section of any transmission line can be used as an impedance inverter. 2

(b) Write down the separation equation for a circular cavity resonator and hence obtdain the resonant frequency. 1+1

(c) Define 'coupling factor' and 'directivity' of a microwave directional coupler. 1+1

(d) Write down the transportation characteristics of a microwave isolator. Explain how these characteristics can be achieved with a circulator. 1+1

(e) Write down the S-matrix of a two-port waveguide-junction and hence explain the significances of each elements there-in. 1+1

(f) The S-matrix of a microwave network is given below :

$$\begin{bmatrix} 0.2 & 0.6 \\ 0.5 & 0.2 \end{bmatrix}$$

Find whether the network is : (i) Reciprocal (ii) Loss less. 1+1

2. Answer any *four* questions : 4×4

(a) Draw the equivalent circuit of tunnel diode and find the resonant frequency. 2+2

(b) Describe how isolation in one port and 180° phase different in two output ports are achieved in a hybrid ring coupler. Design a hybrid ring coupler of system impedance 50Ω for the 2GHz frequency. 2+2

(c) Draw two-transistor equivalent circuit of PNPN device and find an expression for the anode current. 2+2

(d) What are dV/dt and dI/dt rating? How it can be improved? 2+2

(e) What is RWH theory? How negative resistance is achieved in transferred electron devices? 2+2

3. Answer any *two* questions : 2×8

(a) Find S parameters of equal split Wilkinson power divider. Design equal split Wilkinson power divider for 50Ω system impedance and for 3GHZ frequency. 4+2+2

(b) Find S parameters for the four-port symmetric and anti symmetric coupler. 4+4

(c) Find the expression for the bunching parameter of two cavity klystron. 8

(d) With a neat sketch discuss the principle of operation of a cylinderical magnetron. 3+5

(e) State and prove Floquet's theorm. Show that slow wave structure behaves like slow wave structure. 5+3

[Internal Assessment – 10]