2017

M.Sc. 4th Semester Examination

ELECTRONICS

PAPER—ELC-401

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.

(Microwave Devices and Circuits)

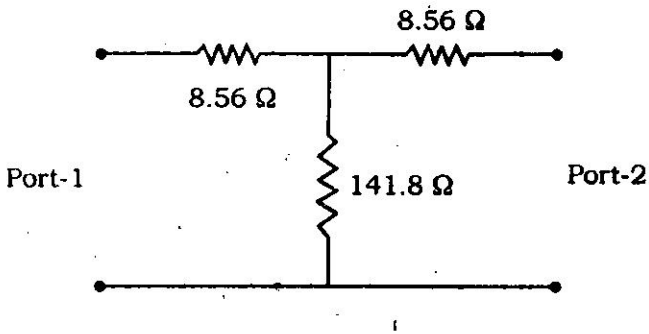
Answer Q. No. *1* and any *three* from the rest.

1. (a) Why a $\lambda/4$ transmission line (open/shoted) can be used as resonator ?

(b) Define Q-value of a cavity resonator. Write the relation between intrinsic Q and Laaded Q of coupled cavity resonator.

(c) What is Magic T junction ?

(d) Find the scattering parameter of the following circuit



(e) A n-type GaAs Gunn diode has the following informations.

Electron density at lower valley (n_l) = 10^{16} m^{-3}
Electron density at upper valley (n_u) = 10^{14} m^{-3}
Temperature = 300 K
Mobility of electrons at lower valley (μl) = .8 $m^2/v/s$
Mobility of electrons at upper valley (μu) = 0.18 $m^2/v\text{-}s$
Calculate conductivity of the given Gunn diode.

2×5

2. (a) What are TE and TM modes ?

(b) Explain why TEM mode cannot propagate in any waveguide.

(c) (i) Write down the expressions for the resonance frequency for TE_{mnp} and TM_{npq} modes in a circular wave guide.

(ii) A rectangular cavity resonator has demerisions of 2 cm × 1 cm × 4 cm. Find the resonance frequency for the dominant TE mode. 1+2+4+3

3. (a) Explain with neat sketch the operation of a cylindrical magnitron.

(b) Derive expressions for the Hall cut-off magnetic flux density and cut-off voltage for a cylendrical magnetron.

(c) A pulsed cylindrical magnetron is operated with the following parameters. Anode voltage V = 25 kW, Beam current I = 25A, Magnetic density $B = 0.34 \ wb/m^2$, Cathode radius R_c = 5 cm and Anode radius R_a = 10 cm. Calculate

(i) The angular frequency

(ii) The cut-off voltage

(iii) The cut-off magnetic flux density. 2+5+3

4. (a) Explain two valley model of Gunn diode.

(b) Show that mobility in the upper valley must be less than mobility in lower valley for negative resistance region. 3+7

5. (a) What are the advantages and disadvantages of microstrip line ?

(b) Show that there must have field in the air due to difference in dielectric constant in a microstrip line.

(c) What mode propagates through such line ? 3+6+1

6. (a) Draw the structure, doping profile and field profile of a single drift region, p^+ n n^+ IMPATT diode and hence describe the principle of operation of it.

(b) Write down the expression for dc to r.f. conversion efficiency of IMPATT diode. What it its theoretical limit ?

(c) An IMPATT diode has the following parameters :

drift velocity of carriers $V_d = 2 \times 10^7$ cm/s
drift region length $L = 5\ \mu m$
maximum operating voltage $V_{0\ max} = 100$ V
maximum operating current $I_{0\ max} = 200$ mA
efficiency $\eta = 15\%$ and
breakdown voltage $V_{bd} = 90$ V

find

(i) the maximum CW output power and

(ii) the frequency of resonance. 4+2+4

[Internal Assessment — 10 marks]