

2023**M.Sc.****4th Semester Examination****ELECTRONICS****PAPER : ELC-401**

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks.

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

Illustrate the answers wherever necessary.

Answer **all** questions.

(MICROWAVE AND POWER ELECTRONICS)

1. Answer *any four* questions from the following :

2×4=8

(a) Draw the forward characteristic curve of PNPN device and show its different regions.

1+1=2

(b) How does conductivity modulation take place in UJT?

2

- (c) Describe the reverse recovery time of diode. 2
- (d) Why is magnetron known as cross-field device? 2
- (e) What are the limitations of conventional tubes in producing signals at microwave frequency? 2
- (f) What is mode jumping in magnetron and how can it be overcome? 1+1=2

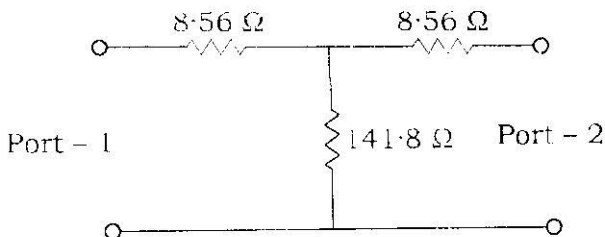
2. Answer **any four** questions from the following : 4×4=16

- (a) Find whether the following network is matched at all ports, lossless and reciprocal:

$$[S] = \begin{bmatrix} 0 & 0.2 & 0.6 \\ 0.3 & 0 & 0.5 \\ 0.4 & 0.1 & 0 \end{bmatrix}$$

2+1+1

- (b) With the help of band structure diagram, describe how negative resistance region is obtained in tunnel diode. 4
- (c) Find the S-matrix of a 3-dB attenuator 4



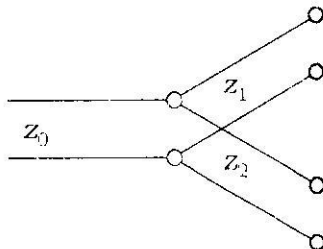
(3)

(d) Show that, for a directional coupler

4

$$I = D + C$$

(e) A lossless T-Junction is given by



Find the output characteristic impedance so that input power is divided in a 2 : 1 ratio. Compute reflection coefficient looking into the output ports. $2+2=4$

(f) Draw the Applegate diagram of a two-cavity klystron and explain the velocity modulation process therein. $2+2=4$

3. Answer **any two** questions from the following : $8 \times 2 = 16$

(a) (i) A 3-port network matched at all ports, lossless but non-reciprocal is a circulation. Deduce the S-matrix of such network.

(4)

- (ii) Find the S-matrices of RHC and LHC. 4+2+2=8
- (iii) Show how a circulator can be used as an isolator. 4+2+2=8
- (b) Describe two-valley model. Deduce that for negative resistance region, $\mu_c > \mu_u$ and $\frac{dx_c}{dE} = -ve$. 2+6=8
- (c) (i) Describe the construction and operation of a Magic Tee junction. Find the S-matrix of the Tee junction.
- (ii) How can you construct a 4-port circulator with 2-magic tees and a 180° phase shifter. Explain. 4+4=8
- (d) A square based cavity ($a = c$) of a rectangular cross-section has the inner dimension $a = 2.286$ cm and $b = 1.016$ cm. For dominant TE_{101} mode, determine the resonant frequency and Q of the cavity. 4+4=8

[Internal Assessment : 10 Marks]

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