2009

M.Sc.

4th Semester Examination

ELECTRONICS

PAPER—EL-2201

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

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

1. Answer any *five* questions :   2×5

    (a) Distinguish between transferred electron devices and avalanche transit time devices.

    (b) Discuss the advantages of TE_{011} mode over TE_{111} mode of a circular resonator.

    (c) What is a slow-wave structure ? Why does TWT need such a structure ?

(d) What is meant by insertion loss, directivity and coupling of a directional coupler?

(e) What is resonance absorption in ferrites? How does it take place?

(f) How is π-mode separated from other modes in a cavity magnetron?

(g) What are the advantages of Microwave Monolithic Integrated Circuits over discrete circuits?

(h) Why is the transit time so important in reflex klystron?

2. (a) How does a reflex klystron differ from a klystron amplifier?

(b) What is bunching parameter of a reflex klystron? What is depth of modulation of it?

(c) A reflex klystron is to be operated at frequency of 10 GHz, with dc beam voltage 300V, repeller space 0·1 cm for $1\frac{3}{4}$ mode. Calculate P_{RFmax}, and corresponding repeller voltage for a beam current of 20mA.

2+(2+3)+3

(Continued)

3. (a) Derive the scattering matrix of magic-Tee.

(b) Write down the scattering matrix for an ideal 4–port circulator.

(c) A matched isolator has insertion loss of 0.5 dB and isolation 25 dB. Find the S-matrix for the isolator.

4+2+4

4. (a) What is a directional coupler? Describe with illustration the principle of operation of a two-hole directional coupler. Define its various parameters.

(b) Discuss with diagram how microwave hybrid ring or rat-race circuit works.

(2+3+1)+4

5. (a) Explain the construction and working principle of an IMPATT diode.

(b) Why microstrip transmission line is preferred over any other type of transmission line?

(c) Draw the equivalent circuit of a PIN Diode.

If $C_p = 0.3$ pf, $C_j = 0.2$ pf, $R_s = 0.3 \, \Omega$, $L_s = 0$,

calculate the admittance of the Diode of 5 GHz.

4+2+4

6. (a) Draw the schematic diagram of a GaAs MESFET and its small signal equivalent circuit. State the intrinsic and extrinsic elements of a MESFET.

(b) A typical MESFET has the following parameters :

$R_g = 2.5\,\Omega$, $R_i = 2.5\,\Omega$, $g_m = 50\,m$ mho

$R_d = 425\,\Omega$, $R_s = 3.2\,\Omega$, $C_{gs} = 0.66\,pF$

Determine :

   (i) the cutoff frequency and

   (ii) the maximum operating frequency.

((2+2)+2)+(2+2)

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