[4859] - 1038
B.E. (E & TC) (Semester - I)
Microwave Engineering
(2012 Pattern) (End Sem.)

Time : 2.30 Hours]   *[Max. Marks : 70*

Instructions to the candidates:

  1)   *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

  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)   The TE_{10} mode is propagated in a rectangular waveguide of dimensions $a = 6cm$ and $b = 4$ cm, by means of a travelling detector. The distance between a maximum and minimum is found to be 4.55 cm. Find the frequency of the wave. **[7]**

     b)   State different types of stripline and distinguish between Stripline and Microstrip line in detail. **[7]**

     c)   What is the significance of scattering matrix? Write the properties of S-matrix. **[6]**

<div align="center">OR</div>

Q2) a)   Explain the terms with respect to waveguide: **[7]**

         i)   Dominant Mode.

         ii)   Cut-off Frequency.

         iii)   Guide Wavelength.

     b)   Explain any two applications of circulator. **[7]**

     c)   The collinear ports 1 and 2 of a Magic Tee are terminated by impedances of reflection coefficients $\rho_1 = 0.5$ and $\rho_2 = 0.6$. The difference port 4 is terminated by an impedance with reflection coefficient of 0.8. If 1W power is fed at sum port 3, calculate the power reflected at port 3 and the power divisions at the other ports. **[6]**

<div align="right">*P.T.O.*</div>

Q3) a) What are the limitations of conventional tubes at microwave frequencies and how to overcome these limitations? **[9]**

b) How the oscillations are sustained in Cavity Magnetron? Explain the process of phase focusing effect. **[9]**

OR

Q4) a) Explain the operation of Travelling Wave Tube with its slow wave structure. **[9]**

b) A two cavity Klystron amplifier has the following specifications: **[9]**

Beam Voltage : V_0 = 900 V

Beam Current : I_0 = 30 mA

Frequency : f = 8GHz

Gap spacing in either cavity : d = 1mm

Spacing between centers of cavities : L = 4cm

Effective shunt impedance : R_{sh} : 40kΩ

Determine :

i) The electron velocity.

ii) The dc transit time of electron.

iii) The input voltage for maximum output voltage.

iv) The voltage gain in decibels.

Q5) a) Draw equivalent circuit of Varactor diode. Explain in detail its construction and operation. **[8]**

b) Explain principle of operation, IV characteristics and equivalent circuit of microwave Tunnel diode. **[8]**

OR

Q6) a) Explain Gunn effect using two valley model. Mention its typical characteristic and applications of Gunn diode. **[8]**

b) With suitable expression explain power frequency limitations of microwave transistor. **[4]**

c) In a Gunn diode with active length $20\,\mu m$, the drift velocity of electrons is 2 * 10[7] cm/s. Calculate natural frequency of the diode and its critical voltage. **[4]**

Q7) a) Explain any two methods of measuring impedance of a terminating load in a microwave system. **[8]**

b) Enlist methods of measuring the Q of a cavity resonator. Explain any one method in detail. **[8]**

OR

Q8) a) Explain with neat block diagram power measurement of microwave generator using **[8]**

     i) Bolometer.

     ii) Calorimeter.

b) Describe in detail the techniques used for VSWR measurement. **[8]**

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