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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3094 Roll No.

B.Tech.

(SEM VI) EVEN SEMESTER THEORY EXAMINATION, 2009-2010

MICROWAVE AND RADAR ENGINEERING

Time : 3 Hours *Total Marks : 100*

Note : *(i) Attempt **ALL** questions.*

*(ii) All questions carry **equal** marks.*

1. Attempt **any four** parts of the following : **(4x5=20)**

(a) Derive the solutions of TE modes in Rectangular waveguides.

(b) Prove that TEM mode can not exist in the hollow waveguide.

(c) An air filled rectangular waveguide has dimension of a = 6.0 cm and b = 4.0 cm. The signal frequency is 3.0 GHz. Compute the following for the TE_{10} modes.

(i) cut off frequency

(ii) Wavelength in the waveguide

(iii) Phase constant and phase velocity in the waveguide.

(iv) Group velocity and wave Impedance in the waveguide.

(d) A TE_{11} mode is propagating through a circular waveguide. The radius of the guide is 5 cm, and the guide contains an air dielectric, (X'np = 1.841). Determine :

(i) Cut off frequency

(ii) Wavelength in the guide for an operating frequency of 3.0 GHz,

(iii) Determine the wave impedance in the guide.

(e) Drive the equation of TM - modes in Circular Waveguides.

(f) Define :

(i) dominant mode

(ii) degenerate mode

(iii) excitations of modes in circular waveguides.

2. Attempt **any four** parts of the following : (4x5=20)

(a) What do you mean by microwave cavities ? Describe the Rectangular - Cavity Resonator.

(b) Explain the series Tee, and prove that the diagonal elements of the S-matrix of a Tee - junction are not all zeros.

(c) Explain the characteristics of Directional coupler.

(d) Describe the properties of multiport microwave circulator.

(e) Explain, how isolator is used to isolate one component from reflection of other components in the transmission line.

(f) Describe the characteristics of Hybrid Tees.

3. Attempt **any two** parts of the following : **(2x10=20)**

(a) What are the limitation of conventional active devices at microwave frequency ?

(b) Describe the velocity modulation process, bunching process of two Cavity Klystron amplifiers.

(c) A two - cavity Klystron amplifier has the following parameters :

$V_0 = 1000$ V, $R_0 = 40$ KΩ

$I_0 = 25$ mA, $f = 3$ GHz.

Gap spacing in either cavity : $d = 1$ mm.

Spacing between the two cavities : $L = 4$ cm.

Effective shunt impedance, excluding beam loading $Rsh = 30$ KΩ.

(i) Find the input gap voltage to give maximum voltage V.

(ii) Find the voltage gain, neglecting the beam loading in the output cavity.

(iii) Find the efficiency of the amplifier, neglecting beam loading.

(iv) Calculate the beam loading conductance.

4. Attempt **any two** parts of the following : (2x10=20)

(a) Describe the physical structures and principles of operation of TRAPATT diodes.

(b) Explain the Two - valley model theory and Gunn oscillation modes of GUNN diodes.

(c) Describe the RF structure and principle of operation of Magnetrons.

5. Write short notes on **any two** of the following : (2x10=20)

(a) M.T.I. Radar and application

(b) CW Radar

(c) Radar Antennas

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