Roll No. ..... Total Pages : 3

**BT-7/D-20** **47011**

## MICROWAVE ENGINEERING

Paper - ECE-407 E

Option : I

*Time allowed : 3 Hours* *Maximum Marks : 100*

***Note :*** Attempt five questions in all selecting at least one question from each unit.

### UNIT-I

1. (i) An air filled rectangular copper waveguide with dimensions 1×2 $cm^2$ and a length of 30 cm is operated in the dominant mode at 10 GHz. Determine (a) cut off frequency, (b) guided wavelength, (c) phase velocity, (d) characteristic impedance and the (e) power loss ? 5×2=10

   (ii) Derive the expressions to calculate the Q factor for a coaxial cavity resonator ? 10

2. Explain the followings : 10+10=20

   (i) High VSWR Measurements ?

   (ii) Impedance Measurements ?

### UNIT-II

3. (i) Explain the velocity modulation process in Two Cavity Klystron Amplifier? 10

(ii) Explain the high frequency limitations of conventional vacuum tubes ? 10

4. (i) Explain the amplification process in Helix Travelling Wave Tube? 10

(ii) A cylindrical magnetron is operated at 5 GHz with a = 3 cm, b = 5 cm, N = 16, $V_0$ = 30 kV and $B_0$ = 0.05 tesla. Compute (i) Hull cut-off voltage and (ii) Cut-off magnetic field ? 10

5. (i) The S-parameters of a two port network are $S_{11} = 0.26 - j\,0.16$, $S_{12} = S_{21} = 0.42$ and $S_{22} - 0.36 - j\,0.57$. Calculate insertion loss, transmission loss, reflection loss and return loss ? 10

(ii) Explain the working of E-plane Tee and derive its S-matrix with numerical values by assuming that the port 3 (series arm) is perfectly matched ? 10

6. (i) Explain the working of precision type phase shifter and its S-Matrix in detail ? 10

(ii) Explain the operation of a 4-port directional coupler. How it can be utilized to measure the VSWR of a given load ? 10

## UNIT-IV

7. (i) Explain the high field domain formation in GUNN diode ? 10

(ii) A M-Si-M BARITT diode has relative dielectric constant for Si is 11.8, donor concentration $N = 2.8 \times 10^{21}\ m^{-3}$ and silicon length L is 6 μm. Calculate (a) breakdown voltage (b) breakdown electric field ? 10

8. (i) Explain the operation, constructional details with diagram of TRAPATT diode ? 10

(ii) Explain the working of parametric amplifiers ? 10

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