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Total No. of page(s): 2

**BT-8/D-21: 48140**  
**ECE- 404N: Microwave Engineering**

Time: 3 hrs]

[Max. Marks: 75

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

**UNIT-I**

- Q.1 (a) Explain Double Bridge method for power measurements? 8.
- (b) Derive the expressions for calculation of unloaded Q-factor of rectangular cavity resonator? 7.
- Q.2 Explain the followings:
- (i) Down Conversion Method of Frequency Measurements?
- (ii) Impedance Measurements? 7+8=15.

**UNIT-II**

- Q.3 (a) A 400 kW cylindrical magnetron operating at X-band has following set of parameters: Anode voltage ( $V_{dc}$ ) = 32kV, beam current ( $I_{dc}$ ) = 84 A, radius of cathode cylinder ( $r_c$ ) = 6cm, radius of anode cylinder ( $r_a$ ) = 12cm, magnetic flux density ( $B$ ) = 0.01 Wb/m<sup>2</sup>. Calculate (i) Cyclotron angular frequency (ii) the cut off magnetic flux density for a fixed  $V_{dc}$  (iii) the cut -off voltage for a fixed  $B_0$  (iv) efficiency? 4×2=8.
- (b) Explain the working of Reflex Klystron and derive expressions for Bunching Process? 7.
- Q.4 (a) Explain the amplification process in Helix TWT? 7.
- (b) Why conventional vacuum tubes cannot be used at microwave frequencies above 1GHz? 8

### UNIT-III

- Q. 5 (a) Explain the working of precision variable attenuator and its S-Matrix in detail? 7.
- (b) The S-parameters of a two port network are  $S_{11} = 0.26 - j0.16$ ,  $S_{12} = S_{21} = 0.42$  and  $S_{22} = 0.36 - j 0.57$ . Calculate insertion loss, transmission loss, reflection loss and return loss? 4×2=8.
- Q. 6 (a) Explain the working of directional coupler and derive its S-Matrix? 8.
- (b) Explain the working of a Magic Tee and derive its S-matrix? 7.

### UNIT-IV

- Q. 7 (a) An IMPATT diode operates with carrier drift velocity ( $v_s$ ) of  $1.5 \times 10^7$  cm/s, length of drift region (L) is  $8 \mu\text{m}$ , maximum operating current ( $I_{\text{max}}$ ) equals to 180 mA, maximum operating voltage ( $V_{\text{max}}$ ) = 90 Volts and efficiency is 10%. Calculate (a) the maximum CW output power in watts and (b) the frequency of output power in GHz? 8.
- (b) Explain the negative differential resistance phenomenon in GUNN diode? 7.
- Q. 8 (a) Explain the working of Parametric Amplifiers? 8.
- (b) Compare TRAPATT and BARITT diodes in context to their principle of operation, properties and applications? 7.