T.E. Electronics SEM VI REV EXAM.

Microwave Devices and Circuits

29 May 2010

Con. 3491-10. **(REVISED COURSE)** **AN-4442**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.
(3) **Figures** to the **right** indicate **full** marks.

1. Attempt any **four** :– **20**
   (a) Explain group velocity and phase velocity in rectangular waveguide.
   (b) What is back heating ? How can it be avoided ?
   (c) Explain Gunn effect using two valley theory.
   (d) What are the advantages of microwave frequencies over low frequency ?
   (e) Explain Rat-Race junction.

2. (a) Compare the multicavity Klystron and TWT from the point of view of basic construction, performance and applications. **10**
   (b) A pulsed cylindrical magnetron is operated with the following parameters :– **10**
   Anode voltage = 25 kV, Beam current = 25A
   Magnetic flux density = 0·34 wb/m^2
   R_a = 5 cm, R_b = 10 cm.
   Calculate – (i) Angular frequency
   (ii) The cut off voltage
   (iii) Cut off magnetic flux density.

3. (a) Derive the wave equation for a TM wave and obtain all the field components in a rectangular waveguide. **12**
   (b) A TE11 mode is propagating through a circular waveguide having an air dielectric and a radius of 5 cms. Calculate the cut off frequency, guide wavelength and the wave impedance. **8**

4. (a) (i) For TE101 mode in a rectangular cavity resonator of width 'a', height 'b' and length 'd'. Show that the frequency of resonance is given by – **5**

$$f_r = \frac{c}{2d}\sqrt{1+\frac{d^2}{a^2}}$$

   (ii) For a = 2cm, b = 1cm, choose d so that cavity will resonate at 10 GHz for TE101 mode.
   (b) Why is hybrid Tee is referred as magic Tee ? Derive the scattering matrix for the same. **10**
   (c) Explain the operation of microwave isolator. **5**

5. (a) Describe the operation of IMPATT diode compare it with TRAPATT diode. **10**
   (b) Explain RF substitution method for measuring attenuation. **10**

6. (a) A symmetric directional coupler with infinite directivity and a forward attenuation of 20 db is used to monitor the power delivered to the load Z_l. Bolometer 1 introduces VSWR 2·0 on arm 4. Bolometer 2 is matched to arm 3. If Bolometer 1 reads 8 mW and bolometer 2 reads 2 mW. Find (i) the amount of power dissipated in the load Z_l. (ii) VSWR on arm 2. **10**

(b) Explain the construction and working principle of Reflex Klystron. **10**

7. Write short notes on any **four** :– **20**

(a) Working of circulator
(b) Strapping in Magnetron
(c) Double minimum method for measuring VSWR
(d) Excitation in Waveguides
(e) E-plane Tee.
