Sem VII / Rev / E&TC / M.D. & C / Dec. 09

14 : Oct.09-AM(c)

Con. 5773-09. **SP-6629**

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

N.B.: (1) Question No. 1 is **compulsory.**
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assume **suitable** data whenever **necessary** and justify the same.

1. Explain in brief any **four** of the following :— **20**
   (a) Coupled cavity TWT
   (b) Microwave Ferrites
   (c) Transmission line sections as resonant circuits
   (d) Coaxial reentrant cavity
   (e) Slow wave structures.

2. (a) Explain wave propagation in rectangular wave guide. Hence derive the relation for group velocity and phase velocity. **5**
   (b) For a rectangular wave guide with a = 1·6 cm, b = 0·9 cm, $\sigma = 0$, $\mu = \mu_0$ and $\in = 4\in_0$ **10**

$$H_x = 2\,\text{Sin}\left(\frac{\pi x}{a}\right)\text{Cos}\left(\frac{3\pi y}{b}\right)\text{Sin}\,(\pi \times 10^{11} t - Bz)\,A/m$$

   Determine : (i) Mode of operation
   (ii) The cut-off frequency
   (iii) The phase constant (β)
   (iv) Propagation constant (γ)
   (v) Intrinsic wave impedance (η)
   (c) Explain with neat diagram operation of variable phase changer. **5**

3. (a) For Gunn diode explain following modes :— **5**
   (i) Limited space charge accumulation mode
   (ii) Stable amplification mode.
   (b) A n-type Gunn diode has following parameters :— **5**
   Electron drift velocity $V_d = 3 \times 10^5$ m/s
   Negative electron mobility $|\mu_n| = 0{\cdot}018\ m^2/V{\cdot}S$
   Relative dielectric constant $\in_r = 12{\cdot}2$
   Determine criterion for classifying modes of operation.
   (c) What is waveguide excitation ? Explain following excitation techniques :— **5**
   (i) Electric excitation
   (ii) Magnetic excitation
   (iii) Aperture excitation.
   (d) Explain principle and applications of Microwave Heating. **5**

4. (a) Antenna with impedance 50+j30 Ω is to be matched to 100 Ω lossless line with a shorted stub. **10**
   Determine :—
   (i) Required stub admittance
   (ii) Distance between stub and antenna
   (iii) Stub length
   (iv) Standing Wave ratio between stub and load, stub and source, along the stub. (Use Smith Chart)
   (b) Explain Bathe-hole, Two-hole and multi-hole directional couplers. Which is preferable for broad band application ? Justify. How directional couplers are used in reflectometer for measurement of R.C of the mismatch. **10**

[TURN OVER

5. (a) A certain transmission line is operating at $\omega = 10^6$ rad/s has $\alpha = 8$ dB/m, $\beta = 1$ rad/m and $Z_o = 60+j40\ \Omega$ is 2 m long. 10

If the line is connected to a source of $10\angle 0^0$ V, $Z_g = 40\Omega$ and terminated by load $30 + j60\ \Omega$.

Determine :—

(i) Input impedance

(ii) Sending end current

(iii) Current at the middle of line.

(b) Compair waveguide, co-axial transmission line and microstrip lines. 5

(c) Write a short note on microwave Hazzards, Electromagnetic interference and Electromagnetic compacitibility. 5

6. (a) An air filled Rectangular resonant cavity with dimensions a = 5 cm, b = 4 cm, c = 10 cm is made up of copper ($\sigma_c = 5{\cdot}8 \times 10^7$ mho/m). Find the five lowest order modes. 5

(b) A Reflex klystron has following parameters dc accelerating voltage $V_{dc} = 1{\cdot}5$ KV 5

Repeller Voltage = –100V

Resonant frequency f = 8 GHz

Distance between cavity and repeller (d) = 2 cm

Compute :—

(i) D. C electron velocity

(ii) The round trip d.c transit time.

(c) With help of suitable diagram explain mechanism of operation of magnetron. What is mode jumping in magnetron ? How are various modes separated ? Explain the terms frequency pulling and frequency pushing with reference to magnetron. 10

7. (a) Draw the schematic diagram of IMPATT diode and explain the two effects that combine to produce 180° Phase Shift difference between applied voltage and resultant current pulse. Also describe one waveguide mount IMPATT diode microwave Oscillator. 5

(b) Compair circular waveguides, Elliptical waveguides and Ridged waveguides. 5

(c) With help of block diagram explain measurement of unknown microwave frequency using slotted waveguide. 5

(d) A two cavity Klystron ampere has following parameters : 5

DC Voltage for acceleration of electron = 1000 V

DC beam resistance 35 KΩ

DC Current 20 mA

Frequency of operation 3·1 GHz

Gap Spacing in cavity = 1 mm

Spacing between two cavities = 4 cm

Effective Shunt impedance including beam loading = 30 KΩ

$J_1(x)$ is maximum at 1·841 and $J_1(1{\cdot}841) = 0{\cdot}582$.

Find Voltage gain.
