

Code: A-20**Subject: MICROWAVE THEORY & TECHNIQUES****Time: 3 Hours****June 2006****Max.****Marks: 100****NOTE: There are 9 Questions in all.**

- Question 1 is compulsory and carries 20 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or best alternative in the following: (2x10)

a. For a distortion less transmission line we have the condition

(A) $\frac{R}{L} = \frac{G}{C}$
 (C) $R = G$

(B) $\frac{R}{G} = \frac{C}{L}$
 (D) $L = C$

b. Series stubs are used in

(A) Transmission lines
 (C) co-ax lines

(B) waveguides
 (D) cables

c. The cut-off frequency of a TEM wave is

(A) infinity only
 (C) zero

(B) equal to that of TM wave
 (D) equal to that of TE wave

d. S-parameters are complex quantities with [s] matrix of

(A) ∞ property
 (C) +ve property

(B) -ve property
 (D) zero property

e. "Rat race" is a phenomenon referred to

(A) Hybrid Tee
 (C) E plane Tee

(B) H plane Tee
 (D) waveguides

f. The normalized value of the input impedance of a waveguide terminated in matched load is

(A) zero
 (C) ∞

(B) unity
 (D) -ve value

- g. Microstrip used for microwaves is a
- (A) homogeneous line (B) LP line
(C) HP line (D) inhomogeneous line.
- h. The dominant modes in microwaves for wave guide propagation are
- (A) TM_{11} & TE_{10} (B) TM_{10} & TE_{10}
(C) TM_{01} & TE_{11} (D) TM_{11} & TE_{11}
- i. The reflection co-efficient for a termination $R_L = Z_0$
- (A) zero (B) infinity
(C) one (D) any value
- j. Magnetron is a
- (A) Low power amplifier. (B) High power amplifier.
(C) Low power oscillator. (D) High power oscillator.

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. Give a table of the position of microwave bands in the entire Radio spectrum giving the frequency-band, wavelength band and designation (IR_{CC}) band. (4)
- b. Mention some important applications of microwaves. Briefly explain two of them. (4)
- c. Starting from fundamentals derive the transmission line equations. (8)
- Q.3** a. With neat diagrams describe how double stub impedance matching is achieved. Give sequence of matching in this case. (8)
- b. Using wave equations develop the expressions for the fields in Transverse Electric modes in parallel conducting planes. (4)
- c. A lossless line of characteristic impedance $R_0 = 50$ ohms is terminated in a load of $Z_L = (50 + j50)$ ohm. The operating wavelength is 4 cms. Determine the first V_{\max} and first V_{\min} from the load. Find VSWR use Smith chart. (4)
- Q.4** a. Explain mathematically the characteristics of TE and TM waves. Describe why TEM wave cannot propagate in a wave-guide. (6)

b. A wave-guide operating in TE_{10} mode has dimensions $a = 2.26$ cms and $b = 1$ cm. The measured guide wavelength is 4 cms. Find cut-off frequency, of the propagation mode, the frequency of operation and maximum frequency of propagation in this guide. (6)

c. Write a short note on microwave integrated circuits. (4)

Q.5 a. Develop mathematically the scattering matrix representation of a microwave network with two ports. (6)

b. With a neat sketch explain the principle of operation of a rotary joint for circular waveguides. (4)

c. Starting from Maxwell's equations derive the field components existing in hollow rectangular metallic waveguide for TE waves. (6)

Q.6 a. Prove that TEM waves cannot exist in hollow metallic waveguides. (6)

b. Obtain an expression for the Q factor of a cavity resonator. (6)

c. Compare stripline and micro strip lines. (4)

Q.7 a. List the various components that make up a microwave test bench. Briefly mention their role in the setup. (4)

b. With a neat circuit diagram describe how microwave frequency is measured. (6)

c. Explain the various modes of operation of a Gunn diode. (6)

Q.8 a. Explain with neat diagrams, the principle of Magnetron tube. (8)

b. Explain the working of a Travelling Wave Tube with the help of neat diagrams. (8)

Q.9 Write short notes on any **TWO** of the following:

(i) Varactor diode – operation in detail.

(ii) IMPATT and TRAPATT – their operation.

(iii) Fading and Diversity reception.

8)

(2 x