

[Contd...]

1

131603]

[12675]

- 1
- Attempt any four parts of the following : 5×4=20
- (a) What are waveguides ? Explain the following terms :  
(i) Phase velocity  
(ii) Group velocity  
(iii) Cut-off wavelength.
- (b) Derive the field distribution of TE<sub>10</sub> mode in rectangular waveguide and draw its field pattern.
- (c) Show that TE<sub>01</sub> and TM<sub>10</sub> modes do not exist in rectangular wave guide.
- (d) What is microstrip line ? How does its characteristic impedance change with change in width to height ratio.

Note : Attempt all the questions.  
Each question carries equal marks.

Time : 3 Hours] [Total Marks : 100

**B. Tech.**  
**(SEM. VI) THEORY EXAMINATION, 2014-15**  
**MICROWAVE ENGINEERING**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 131603

Roll No.

EECC603



Printed Pages : 4

struction, fabrication and  
of Gunn diode.  
and TRAPATT diodes and  
formance.  
s of the  
10×2=20  
le detector  
ount technique  
 wattmeter technique  
carriage and its importance  
bench.  
ent features of microwave  
escribe a voltage standing  
(R) meter.  
ean by insertion loss and  
ssess any one method for  
attenuation using  $\mu$  wave

- (e) A rectangular wave guide has a cross sectional area  $2.29 \text{ cm} \times 1.45 \text{ cm}$  and the operating frequency is  $9.0 \text{ GHz}$ . Calculate the value of  
(a) free space wavelength, (b) cut off frequency, (c) cut off wave length.
- (f) Define quality factor of a cavity resonator. Derive expression for quality factor  $Q$  of a rectangular cavity resonator.

2

- Attempt any four parts of the following :  $5 \times 4 = 20$
- (a) What do you mean by microwave passive devices ? Describe E-plane tee, H-plane tee and Magic tee.
- (b) What are S-parameters ? Why are they used at microwave frequencies to describe multiport network ?
- (c) Describe rotary-vane attenuator. Show that its [S] matrix is given by

$$[S] = \begin{bmatrix} 0 & \sin^2 \theta \\ \sin^2 \theta & 0 \end{bmatrix}$$

- (d) What is a phase shifter ? Describe a rotary phase shifter and explain its principle.
- (e) Show that the scattering matrix of four port circular using magic tees is

$$[S] = \begin{bmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

131603]

2

[Contd...

- (f) With support of figures explain the working of an isolator.

3

Attempt any two parts of the  $10 \times 2 = 20$  following :

- (a) A two cavity klystron amplifier has the following specifications : Beam voltage =  $900 \text{ V}$ , Beam current =  $30 \text{ mA}$ , frequency =  $8 \text{ GHz}$ , gap spacing in either cavity =  $1 \text{ mm}$ , spacing between centers of cavities =  $4 \text{ cm}$  and effective shunt impedance =  $49 \text{ k}\Omega$ . Determine
- Electron velocity
  - D.C. transit time of electron
  - Input voltage for maximum output voltage
  - Voltage gain in dB
- (b) By means of an appropriate diagram explain the operation of a reflex klystron. Calculate the modulated velocity of electron if the electron enters the cavity at the instant when the R.F. signal is at its negative peak. Assume cavity gap to be  $2 \text{ mm}$  and the frequency of R.F. signal to be  $9 \text{ GHz}$  with peak to peak value of  $10 \text{ mV}$  and  $V_a = 1000 \text{ V}$ .
- (c) With support of figure explain the working of TWT.

4

Attempt any two parts of the  $10 \times 2 = 20$  following :

- (a) Give the construction of tunnel diode. Explain its volt-ampere characteristics.

131603]

3

[Contd...

- (b) Explain the construction, fabrication and domain formation of Gunn diode.
- (c) Explain IMPATT and TRAPATT diodes and compare their performance.

5 Attempt any two parts of the following : 10×2=20

- (a) Explain :
  - (i) Thermocouple detector
  - (ii) Bolometer mount technique
  - (iii) Calorimeter wattmeter technique
  - (iv) Slotted line carriage and its importance in  $\mu W$  test bench.
- (b) Discuss the salient features of microwave measurements. Describe a voltage standing wave ratio (VSWR) meter.
- (c) What do you mean by insertion loss and attenuation ? Discuss any one method for measurement of attenuation using  $\mu$  wave test bench.

Printed Pages : 4



(Following Paper ID and Roll No)

PAPER ID : 131603

Roll No.   

B. T

(SEM. VI) THEORY E  
MICROWAVE

Time : 3 Hours]

Note : Attempt all the  
Each question ca

- 1 Attempt any four par
  - (a) What are waveg terms :
    - (i) Phase veloc
    - (ii) Group veloc
    - (iii) Cut-off wav
  - (b) Derive the field rectangular wav pattern.
  - (c) Show that TE01 in rectangular v
  - (d) What is micro characteristic in in width to hei

131603]

4

[12675]

131603]