MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EC-703A

RF AND MICROWAVE ENGINEERING

Time Allotted : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Reflex Klystron is a/an
   a) amplifier b) oscillator
   c) attenuator d) filter.

ii) Magnetron is a/an
   a) amplifier
   b) oscillator
   c) both amplifier and oscillator
   d) phase shifter.

iii) A Travelling Wave Tube is basically
   a) An oscillator
   b) Tuned amplifier
   c) Wideband amplifier
   d) Both amplifier and oscillator.

iv) The most powerful solid state microwave device is
   a) Gunn diode b) IMPATT diode
   c) MESFET d) Varactor.

v) In microwave frequency range, the most noisy semiconductor device is
   a) IMPATT b) TRAPATT
   c) GUNN d) TUNNEL.

vi) A matched load is a
   a) Fixed attenuator b) Variable attenuator
   c) Phases shifter d) Rotary attenuator.

vii) Large microwave power can be measured by
   a) calorimeter wattmeter
   b) bolometer
   c) wattmeter
   d) wave meter.

viii) Microwave frequency can be measured with the help of a
   a) frequency meter b) wave meter
   c) counter d) CRO.

ix) Scattering parameters can be measured with the help of
   a) Spectrum Analyzer b) Network Analyzer
   c) CRO d) Bolometer.

x) Microstrip power divider is a
   a) two port network b) four port network
   c) three port network d) one port network.

xi) A cavity is a

a) band pass filter b) high pass filter

c) band stop filter d) low pass filter.

xii) Waveguide is a

a) band pass filter b) high pass filter

c) low pass filter d) all pass filter.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Discuss the high frequency limitation of transistors, comparing and contrasting them with those of vacuum tube. 2 + 3

3. Why ferrite device are called non reciprocal device.

4. What are the various sources of error in microwave power measurements and how can they be minimized ? 3 + 2

5. Why the conventional tubes like triode, tetrode cannot generate microwave power ?

6. Why TM_{01} or TM_{10} mode is not possible in rectangular waveguide ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) A 20 mW signal is fed into one of a lossless H-plane T-junction. Calculate the power delivered through each port when other port are terminated in matched load.

b) Derive the wave equation for a TM wave and obtain all the field components in a rectangular waveguide.

c) How are waveguide different from two wire transmission line ? Discuss the similarities and dissimilarities. 5 + 5 + 5

8. a) For a directional coupler the incident power is 550 mW. Calculated the power I the main arm and auxiliary arm. The coupling factor is 30dB.

b) Describe the operation of Rate-Race junction.

c) Explain the double minimum method of measuring VSWR. 5 + 5 + 5

9. a) A wave is propagated in a rectangular waveguide at 6 GHz. Calculate cutoff wavelength and group velocity for dominant mode.

b) Describe the operations of 2-hole directional coupler. Give the various parameters of the directional coupler.

c) Describe the scattering matrix relation between the input and output of a ($n \times n$) junction. 5 + 5 + 5

10. a) How is slotted line used for measurement of impedance of unknown load ?

b) Explain the working principle of two cavity klystron amplifier by giving the apple-gate diagram.

c) Explain the impedance matching network. 5 + 5 + 5

11. Write short notes on any *three* of the following : 3 × 5

a) Magnetron

b) IMPATT

c) Microstrip line

d) MESFET

e) Microwave filter.