Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(ECE-NEW)/SEM-7/EC-701/2009-10

2009

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) The intrinsic impedance of free space is given by

a) 333Ω b) 377Ω

c) 233·5Ω d) 379Ω.

ii) The medium microwave power range is lies between

a) 0 to 10 mw b) 10 mw to 10 watt

c) 10 watt 20 watt d) none of these.

iii) Both the magnitude and phase of S parameter can be measured by

a) Spectrum Analyzer

b) Vector network analyzer

c) Digital storage Oscilloscope

d) none of these.

iv) Large microwave power can be measured by

a) VSWR meter

b) Bolometer

c) Calorimeter-wattmeter

d) Thermistor.

v) A Reflex Klystron is basically

a) an oscillator

b) a tuned amplifier

c) a wideband amplifier

d) none of these.

vi) Gunn Diode is used as

a) a phase shifter

b) an amplifier

c) an oscillator

d) an isolator.

vii) Microwave components are generally characterized by

a) *S*-parameter b) *Z*-parameter

c) *Y*-parameter d) *h*-parameter.

viii) Klystron operates on the principle of

a) Amplitude modulation

b) Frequency modulation

c) Velocity modulation

d) Pulse modulation.

ix) To overcome difficulties with strapping high frequencies, the type of cavity structure desired for magnetron is

a) hole and slot b) slot

c) vane d) rising sun.

x) TWT is sometimes preferred to magnetron for use in Radar transmitter because it

a) has broader band

b) is less noisy

c) is more efficient amplifier

d) is capable of larger duty cycle.

xi) A TRAPATT diode is preferred to an IMPATT diode because of

a) its higher efficiency

b) its lower noise

c) lesser sensitivity of harmonics

d) its larger bandwidth.

xii) A PIN diode is

a) a metal semi-conductor point contact diode

b) a microwave mixer diode

c) often used as a microwave oscillator

d) suitable to use as a microwave switch.

xiii) Solid state maser is an amplifier of type

a) paramagnetic b) diamagnetic

c) ferromagnetic d) electromagnetic.

xiv) Wave guide is a / an

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. What is bunching ? Explain with proper diagram. Deduce the expression for the minimum length at which the first bunch will be formed.

3. Explain the operation of Faraday Rotation Isolator.

4. From the properties of an E-Plane Tee, derive the S-matrix.

5. Derive the relation between directivity and effective aperture of a Horn antenna.

6. Mention briefly the different methods of measurement of microwave power and explain in detail the microwave power measurement using bolometer.

GROUP – C

(Long Answer Type Questions)

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

7. a) What do you mean by "critical magnetic field" as is used in connection with magnetrons ? Deduce an expression for cut-off magnetic flux density (B_c) in a cylindrical magnetron.

   b) A reflex klystron is to be used at 2 GHz. The repeller voltage is 2kV, acelerating voltage is 500 volt, output amplitude required is 5 volt. Calculate the change in frequency if repeller voltage gets varied by 2%. The operation is for n = 1 and s = 2 cm. Derive the formula you use. 2 + 6 + 7

8. a) Find the expression of cut-off frequency of a rectangular waveguide for TE mode of propagation ?

   b) Why can TEM mode not exist in rectangular wave-guide ?

   c) Calculate the following for TE_{10} mode for hollow silver plated rectangular waveguide of dimension 2.3 × 1 cm at 10 GHz :

      i) The cut-off frequency

      ii) Guide wavelength. 6 + 3 + 6

9. a) Find out the expressions for the different components of electric and magnetic fields inside a rectangular wave-guide for TE mode of propagation. Hence find out the expression for guide wavelength and propagation constant.

   b) When the dominant mode is propagating in an airfilld rectangular waveguide, the guide wavelengths for a frequency of 9 GHz is 4 cm. Calculate breadth of the guide. 9 + 3 + 3

10. a) Evaluate the *S* matrix of *E*-plane Tee.

    b) Describe the operation of circulator using two Magic Tee. 7 + 8

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

a) Micro-strip line structure

b) Unlink Budge of satellite communication

c) Two industrial applications of microwave

d) Micro-strip antenna

e) Pulsed RADAR.