CS/B.TECH(ECE-NEW) (SUPPLE)/SEM-7/EC-701(N)/09
RF AND MICROWAVE ENGINEERING (SEMESTER - 7)

1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

CS/B.TECH(ECE-NEW) (SUPPLE)/SEM-7/EC-701(N)/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JULY – 2009

RF AND MICROWAVE ENGINEERING (SEMESTER - 7)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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Marks Obtained

	Group – A										Group – B			Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

.....
Head-Examiner/Co-Ordinator/Scrutineer

S-53009 (27/07) (N)

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RF AND MICROWAVE ENGINEERING

SEMESTER - 7

Time : 3 Hours] [Full Marks : 70

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Group velocity is denoted by V_g where

a) $V_g = d\omega/d\beta$ b) $V_g = d\beta/d\omega$

c) $V_g = 1/\sqrt{\mu\in}$ d) $V_g = \omega/(2\pi/\lambda g)$. ☐

ii) Cut-off wavelength λ_C of a rectangular waveguide is

a) $2\pi / (\omega_C \sqrt{\mu\in})$ b) $2\pi / (\omega_C (\mu/\in))$

c) $2\pi/\omega_C$ d) $\lambda / \sqrt{1 - (f_c/f)^2}$. ☐

iii) The power flowing through the waveguide in the TE_{10} mode in a rectangular waveguide is given by

a) $P_T = \dfrac{ab\omega^2\mu^2\beta^2}{4Z_{TE}(\pi/a)^2}$ b) $P_T = \dfrac{a^2\omega^2\mu^2\beta^2}{4Z_{TE}(\pi/b)^2}$

c) $P_T = \dfrac{b^2\omega^2\mu^2\beta^2}{4Z_{TE}(\pi/a)^2}$ d) $P_T = \dfrac{ab\omega^2\mu^2\beta^2}{16Z_{TE}(\pi/a)^2}$. ☐

iv) In case of bends the radius of curvature for the minimum reflection is given by

a) $R = 1{\cdot}5\ b$ for E–bend

$R = 1{\cdot}5\ a$ for H–bend

b) $R = 2{\cdot}5\ b$ for E–bend

$R = 1{\cdot}5\ a$ for H–bend

c) $R = 1{\cdot}5\ a$ for E–bend

$R = 2{\cdot}0\ b$ for H–bend

d) $R = 2{\cdot}0\ a$ for E–bend

$R = 2{\cdot}0\ b$ for H–bend. ☐

v) Gyrator causes α° change in phase of the waves propagating in the forward direction as compared to the backward direction where

a) $\alpha = 90^\circ$ b) $\alpha = 45^\circ$

c) $\alpha = 180^\circ$ d) $\alpha = 270^\circ$. ☐

vi) In most of the Klystron, the electronic efficiency ranges between

a) 25% to 50% b) 15% to 30%

c) 45% to 60% d) 30% to 50%. ☐

vii) For the Gunn diode oscillator the electric field required is of the order of

a) 3 – 5 kV/cm b) 500 V/cm – 1000 V/cm

c) 100 V/cm – 500 V/cm d) 5 V/cm – 10 V/cm. ☐

viii) Large microwave power can be measured by

a) Bolometer b) Thermistor

c) Wattmeter d) VSWR meter. ☐

ix) The expression for the radiation resistance of a current element radiating power is

a) $R_{rd} = 80\ \pi^2 (dl/\lambda)^2$ b) $R_{rd} = 75\ \pi^2 (dl/\lambda)^2$

c) $R_{rd} = 80\ \pi^2 (dl/\lambda)$ d) $R_{rd} = 80\ \pi (dl/\lambda)^2$. ☐

x) The up-link and down-link frequencies of a satellite communication are

a) 6 GHz, 4 GHz b) 4 GHz, 6 GHz

c) 6 GHz, 6 GHz d) 3 GHz, 5 GHz. ☐

xi) The energy band gap of GaAs is

a) 1·43 ev b) 2·5 ev

c) 0·7 ev d) 1·0 ev. ☐

xii) The substrate material used for MMIC should have

a) Low thermal conductivity

b) Very low thermal conductivity

c) High thermal conductivity

d) Moderately high thermal conductivity. ☐

xiii) For a homogeneous dielectric medium, the propagation delay time per unit length is

a) $T_d = \sqrt{\mu/\in}$ b) $T_d = \sqrt{\mu\in}$

c) $T_d = \sqrt{\in/\mu}$ d) $T_d = \mu\in$. ☐

xiv) A hollow waveguide behaves as

a) low pass filter b) band pass filter

c) high pass filter d) all pass filter. ☐

xv) The dominant mode of propagation is a circular waveguide is

a) TE_{11} b) TE_{10}

c) TM_{11} d) TM_{10} . ☐

GROUP – B

(Short Answer Type Questions)

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

2. A rectangular waveguide has a = 3·0 cm, b = 1·5 cm, μ = 1 and $\in$ = 2·25. Find the cut-off wavelength for TE_{10} mode.

3. What is Busch's theorem ?

4. What are the roles of the Ferrites in microwave devices ?

5. What is stripline filters ?

6. Write the causes of noise in microwave tubes.

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions. 3 × 15 = 45

7. a) Why is GaAs superior to silicon as the microwave semiconductor material ?

   b) Explain the principle of operation of Gunn diode.

   c) Why is the tunnel diode important in microwave work ? 2 + 8 + 5

8. a) What are the advantages of using MIC ?

   b) What are the limitations of MIC ? 10 + 5

9. a) Find the expression for the Hull cut-off magnetic field and Hull cut-off voltage.

   b) A 250 kW pulsed cylindrical magnetron is operated with the following parameters :

   Anode voltage = 25 kV

   Peak anode current = 25 A

   Magnetic field = 0.35 Wb/m^2

   Radius of cathode cylinder = 4 cm

   Radius of cylinder = 8 cm.

   Calculate

   i) The cyclotron frequency

   ii) Hull cut-off magnetic field. 5 + 5 + 5

10. a) Draw current distribution and the field pattern in a cylindrical resonator at TM_{010} resonator mode.

    b) A Co-axial resonator is constructed of a section of Co-axial line 6 cm long and is shorted at both ends. The circular cavity has an inner radius of 1.5 cm and an outer radius of 3.5 cm. The line is filled with dielectric $\in$ = 2·25. Calculate the *Q* of the cavity. 10 + 5

11. a) Describe the method of measurement of *Q* using slotted line method.

    b) A slotted line is used in association with an *X*-band microwave source. When the line is terminated by a short circuit, adjacent nulls are found at position which are shown as 9.27 and 11.05 cm. What is the value of the guide wavelength ?

7 + 8

END