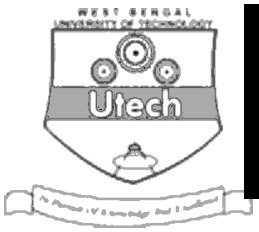
CS/M.Tech (ECE)/SEM-2/MCE-202/09

MICROWAVE AND MILLIMETREWAVE TECHNIQUES (SEMESTER - 2)



1. ..... *Signature of Invigilator*

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

Reg. No.

Roll No. of the Candidate

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CS/M.Tech (ECE)/SEM-2/MCE-202/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JULY – 2009

MICROWAVE AND MILLIMETREWAVE TECHNIQUES (SEMESTER - 2)

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. You have to answer the questions in the space provided marked 'Answer Sheet'. 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

FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

Question Number											***Total Marks***	***Examiner's Signature***
Marks Obtained												

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Head-Examiner/Co-Ordinator/Scrutineer

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MICROWAVE AND MILLIMETREWAVE TECHNIQUES
SEMESTER - 2

Time : 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.

Answer Question No. 1 any *four* of the following. 5 ∞ 14 = 70

1. Choose the correct alternatives and justify : 7 ∞ 2

i) For handling large microwave power, the best medium is

a) Coaxial line

b) Rectangular waveguide

c) Strip line

d) Circular waveguide.

ii) A reflex klystron functions as

a) microwave oscillator

b) microwave amplifier

c) a high gain cavity

d) both amplifier and oscillator.

iii) Klystron operates on the principle of

a) Amplitude modulation

b) Frequency modulation

c) Pulse modulation

d) Velocity modulation.

iv) An attenuator is used with TWT to

a) prevent oscillations

b) increase gain

c) prevent oscillation

d) help bunching.

v) Waveguide may be considered as

a) High pass filter

b) Low pass filter

c) Band pass filter

d) Band reject filter.

vi) The dominant mode of propagation in a circular waveguide is

a) TE_{11}

b) TE_{10}

c) TM_{11}

d) TM_{10}

vii) Microwave components are generally characterized by

a) *h*-parameter

b) *z*-parameter

c) *s*-parameter

d) *y*-parameter.

2. a) What are the high frequency limitations of conventional tubes ? 3

b) Explain bunching process in two Cavity Klystron with the help of Applegate diagram. 4

c) A reflex klystron has the following parameters :

d.c. accelerating voltage V_{dc} = 1·4 kV

Repeller voltage V_R = – 100 V

Resonant voltage 'f' = 8GHz

Distance between cavity and repeller (d) = 2 cm.

Compute :

i) the d.c. electron velocity

ii) the round d.c. transit time. 5

d) What is 'Mode Jumping' in Magnetron ? 2

3. a) Describe "Avalanche Multiplication" in IMPATT diode. 5

b) Describe "Two valley model theory" of Gunn diode. 5

c) Determine the conductivity of the diode which has following parameters : 4

Electron density : $\eta = 10^{18}\ cm^{-3}$

Electron density at lower valley : $\eta_l = 10^{10}\ cm^{-3}$

Electron density at upper valley : $\eta_u = 10^{8}\ cm^{-3}$

Temperature : T = 300 K

4. a) Why TEM wave can't propagate in a rectangular waveguide ? 3

b) An air filled rectangular waveguide of inside dimension a = 8 cm and b = 4 cm, operates in the dominant TE_{10} mode.

Find :

i) the cutoff frequency

ii) group velocity at a frequency of 3.75 GHz

iii) the guided wavelength at the same frequency. 6

c) Define the term "Dominant Mode." 2

d) How different Modes can be excited in a Rectangular Waveguide ? 3

5. a) Describe working principle of 4 port "Directional Coupler". 5

b) Define directivity and coupling factor. 4

c) Deduce [S]-matrix of a four port magic-Tee. 5

6. a) Describe working principle of lens antenna. 6

b) What are E-plane horn and H-plane horn ? 4

c) What are the advantages of microstrip antenna over microwave antenna ? 4

7. a) Derive Radar Range Equation. 6

b) Calculate the maximum range of a radar, which operates at a frequency of 10 GHz, peak pulse is 600 kW, if antenna crosssection is $5m^2$ and the area of the target is 20 m^2, minimum detectable power for the radar is 10^{-13} watts. 5

c) Define "Radar crosssection". 3

8. Write short notes on the following :

a) Waveguide E-plane Tee 5

b) Waveguide bends 4

c) Cavity resonators. 5

END