Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (ECE)/SEM-1/MMC-104/2009-10

2009
MICROELECTRONICS DEVICES

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 the following : 10 × 1 = 10

   i) Purity of MGS (Metallurgical Grade Sillicon) is

   a) 90% b) 95%

   c) 98% d) none of these.

   ii) Electro-migration is a problem in

   a) metallization b) lithography

   c) epitaxy d) none of these.

   iii) Dislocation is

   a) point defect b) area defect

   c) line defect d) none of these.

   iv) Sputtering occurs in

   a) etching b) diffusion

   c) lithography d) none of these.

v) Channel resistance of MOSFET is

a) directly proportional to aspect ratio

b) inversely proportional to aspect ratio

c) not related to aspect ratio

d) none of these.

vi) Body effect of MOSFET can be overcome by using

a) forward bias b) reverse bias

c) no bias d) none of these.

vii) Hot electron in MOSFET appears due to

a) short channel effect

b) long channel effect

c) body effect

d) none of these.

viii) Number of gates of a MOSFET in PROM is

a) one b) two

c) three d) none of these.

ix) Among the following lowest power dissipation occurs in

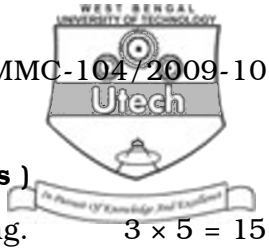
a) TTL b) PTL

c) CMOS d) none of these.

x) Aluminium is used for metallization because of

a) low resistance b) low cost

c) low melting point d) none of these.



GROUP – B
(Short Answer Type Questions)

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

2. Briefly explain the capacitance-voltage characteristics of MOSFET.

3. Briefly explain how a MOS-ROM can be programmed and it can be erased.

4. Compare diffusion and ion-implantation process for IC fabrication.

5. Explain, why power dissipation of CMOS is low.

GROUP – C
(Long Answer Type Questions)

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

6. What is thermal oxidation ? By Deal-Groove model, show that the oxide thickness (x) is related to oxidizing time (t) as $x^2 + Ax = B(t + \tau)$. Symbols have their usual meanings. Calculate the oxide thickness in both cases —

   i) for small values of t and

   ii) for large values of t.

   What are linear rate constant and parabolic rate constant ? How are they related to temperature ? 2 + 5 + 4 + 2 + 2

7. Briefly explain different types of MOSFET capacitance. Draw the low and high frequency model of a common-source MOSFET. What is meant by unity gain frequency ? Find its value in high frequency model. 5 + 3 + 2 + 5

8. What is channel length modulation ? Derive the saturation drain current of an N-channel MOSFET when channel length modulation has occurred. Explain which is advantageous among the two input CMOS NAND gate and NOR gate. What is transmission gate ? 2 + 7 + 4 + 2

9. What do you mean by Metallization ? Give a brief description of sputtering technique for metallization. Why is Aluminium used extensively for metallization ? What are junction spiking and electro-migration ? Mention the different techniques to minimise them. 2 + 5 + 1 + 4 + 3

10. Write short notes on any *two* of the following : $2 \times 7\frac{1}{2}$

    a) CCD

    b) MOS resistance

    c) CVD.