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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

Affiliated to Dr. A.P.J. Abdul Kalam Technical University, Uttar Pradesh, Lucknow

M.Tech

SEM: I - CARRY OVER THEORY EXAMINATION - AUGUST 2022

Subject: MOS Device Modeling

Time: 03:00 Hours Max. Marks: 70

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 marker & Question No- 2 carries 2 marks each.
3. Section B - Question No-3 is based on external choice carrying 4 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 7 marks each.
5. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A 15

1. Attempt all parts:-

1 The n-type semiconductor have _____ as majority carriers. (CO1) 1

(a) Holes

(b) Negative ions

(c) Electrons

(d) Positive ions

1 Gate area is scaled by_____. (CO2) 1

(a) α

(b) $1/\alpha$

(c) $1/\alpha 2$

(d) $\alpha 2$

1 The n-MOS transistor is made up of_____. (CO3) 1

(a) N-type source, n-type drain and p-type bulk

(b) N-type source, p-type drain and p-type bulk

(c) P-type source, n-type drain and n-type bulk

(d) P- type source, p-type drain and n-type bulk

1 SOI stands for _____. (CO4) 1

(a) Substrate On Insulator

(b) Semiconductor On Insulator

(c) Silicon On Insutlator

(d) None of the above

1 Full form of SPICE is_____. (CO5) 1

(a) Simulation Pattern with Integrated Circuit Emphasis

(b) Semiconductor Program with Integrated Circuit Emphasis

(c) Simulation Program with Integrated Circuit Emphasis

(d) None of the above

2. Attempt all parts:-

2 Compare NMOS and PMOS. (CO1) 2

2 Give the Applications of MOSFET. (CO2) 2

2 What is meant by threshold voltage and body effect related to MOSFET? (CO3) 2

2 Explain the term Fin in FinFET. (CO4) 2

2 What is PSPICE and HSPICE? (CO5) 2

SECTION B 20

3. Answer any five of the following:-

3 Distinguish between conductors, insulators and semiconductors with energy band diagram. (CO1) 4

3 Explain C-V characteristics of MOSFET in MOS device capacitance. (CO1) 4

3 Draw and explain I-V characteristic of MOSFET. (CO2) 4

3 Write the short note on high-K gate dielectric. (CO2) 4

3 Explain the low field mobility and high field mobility in details. (CO3) 4

3 Write a short note on SOI technology. (CO4) 4

3 What are the modifications made in drain current equation in Level-2 Model? (CO5) 4

SECTION C 35

4. Answer any one of the following:-

4 Explain the electrical properties of MOS transistor in detail. Draw ideal & Non ideal I-V characteristics. (CO1) 7

4	Explain MOS capacitances and calculate various charges across MOSC. (CO1)	7
5. Answer any one of the following:-		
5	Explain the operation and the characteristics of N channel MOSFET. (CO2)	7
5	Explain short channel and narrow width effect. (CO2)	7
6. Answer any one of the following:-		
6	Explain and draw large-signal equivalent-circuit model of an p-channel MOSFET. (CO3)	7
6	What is Trans-conductance? Derive the formula for trans-conductance in MOSFET. (CO3)	7
7. Answer any one of the following:-		
7	Compare and contrast the Multigate MOSFET and FinFet technology. (CO4)	7
7	Explain in detail the various applications of Multigate SOI MOSFET. (CO4)	7
8. Answer any one of the following:-		
8	Explain why several versions of NMOS transistor models and PMOS transistor models coexist despite the fact that some models are more accurate than others. (CO5)	7
8	Compare SPICE Level 1 MOSFET and SPICE Level 2 MOSFET. (CO5)	7