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BTECH
(SEM VIII) THEORY EXAMINATION 2024-25
MODELING OF FIELD-EFFECT NANO DEVICES

TIME: 3 HRS**M.MARKS: 100****Note:** Attempt all Sections. In case of any missing data; choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

Q No.	Question	CO	Level
a	Define short channel effects and mention one challenge in scaling.	1	K2
b	What are multigate transistors? Name at least two types.	1	K2
c	State the difference between 1D and 2D MOS electrostatics.	2	K2
d	What is electron tunneling in the context of double-gate MOS systems?	2	K2
e	Define degenerate and non-degenerate carrier statistics.	3	K2
f	Write a short note on carbon nanotube band structure.	3	K2
g	What are total ionizing dose effects in SOI MOSFETs?	4	K2
h	Define single event effects in scaled devices.	4	K2
i	What is transconductance in analog circuits?	5	K2
j	Define the term 'flicker noise' and explain its impact.	5	K2

SECTION B**2. Attempt any three of the following:****10 x 3 = 30**

Q No.	Question	CO	Level
a	Explain SOI MOSFET and compare it with bulk MOSFETs.	1	K3
b	Discuss the role of gate voltage and oxide thickness in double gate MOS systems.	2	K3
c	Compare and contrast the I-V characteristics for degenerate and nondegenerate carrier statistics.	3	K3
d	Describe radiation effects in multigate devices with examples.	4	K3
e	Discuss operational amplifier design considerations in nano-scale analog circuits.	5	K3

SECTION C**3. Attempt any one part of the following:****10 x 1 = 10**

Q No.	Question	CO	Level
a	Explain channel and source/drain engineering in scaled MOSFETs.	1	K4
b	Discuss strain engineering and its effect on MOSFET performance.	1	K4

4. Attempt any one part of the following:**10 x 1 = 10**

Q No.	Question	CO	Level
a	Explain the semiconductor thickness effect in double gate MOS systems.	2	K4
b	Describe the impact of 2D confinement on carrier mobility and scattering.	2	K4



Paper ID : 250136

Printed Page: 2 of 2
Subject Code: KOE095

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(SEM VIII) THEORY EXAMINATION 2024-25
MODELING OF FIELD-EFFECT NANO DEVICES

TIME: 3 HRS**M.MARKS: 100****5. Attempt any one part of the following:****10 x 1 = 10**

Q No.	Question	CO	Level
a	Describe the working of carbon nanotube MOSFETs with energy band diagrams.	3	K4
b	Explain the model and principles behind single electron transistors.	3	K4

6. Attempt any one part of the following:**10 x 1 = 10**

Q No.	Question	CO	Level
a	Describe the types of radiation effects and mitigation strategies in nano MOSFETs.	4	K4
b	Discuss scaling limitations due to single event effects and propose solutions.	4	K4

7. Attempt any one part of the following:**10 x 1 = 10**

Q No.	Question	CO	Level
a	Describe design strategies for low-leakage SRAMs in nano-scale digital circuits.	5	K4
b	Explain the working of a successive approximation DAC in a mixed-signal environment.	5	K4