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B.E / B.TECH. DEGREE EXAMINATION, MAY 2023

Eighth Semester

EE18024 – NANO ELECTRONICS

(Electrical and Electronics Engineering)

(Regulation 2018)

TIME: 3 HOURS

MAX. MARKS: 100

- CO 1** Understand the fundamentals of Nano electronics.
- CO 2** Understand the transport phenomenon at the nanoscale.
- CO 3** Understand the functionality of MOS capacitors.
- CO 4** Analyze the Characteristics of MOSFET.
- CO 5** Model and characterize various MOS devices.

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1	How do high-K dielectrics solve the problem of Gate leakage?	1	4
2	State Moore's law.	1	1
3	Write the Matthiessen's rule for conductivity.	2	2
4	What is Einstein relation in semiconductor?	2	2
5	Draw the energy band diagram of an ideal MOS capacitor at negative gate bias.	3	3
6	Mention some methods to control the threshold voltage in a MOS device.	3	2
7	Write the drain current equation of MOSFET in terms of channel length.	4	3
8	What is velocity saturation and what is its effect on the I-V relation of a MOSFET?	4	3
9	List the advantages of SOI Devices.	5	3
10	What are the applications of FINFET?	5	2

PART- B (5 x 14 = 70 Marks)

	Marks	CO	RBT LEVEL
11. (a) What is the need for high-K dielectrics and discuss the parameters to be considered while choosing a suitable alternative material to SiO ₂ .	(14)	1	3

(OR)

- (b) Describe in detail about the various short channel effects in MOS device. (14) 1 3
12. (a) Briefly discuss about the electron transport in quantum wells and quantum wires. (14) 2 3
- (OR)**
- (b) Write in detail about the electron transport in semiconductors, drift and diffusion model and related their models. (14) 2 3
13. (a) Sketch the C–V characteristics of a MOS capacitor with an n-type substrate under the low-frequency condition. How do the characteristics change for the high-frequency condition? (14) 3 4
- (OR)**
- (b) Analyze the effect of fixed oxides charges and interface trapped charges in the MOS capacitors. (14) 3 4
14. (a) Discuss the I–V characteristics of the MOSFET when biased in the non-saturation and saturation regions. (14) 4 3
- (OR)**
- (b) Discuss in detail about the field dependent mobility and subthreshold current in MOSFET. (14) 4 3
15. (a) With neat diagrams, explain the construction and working of FINFET. (14) 5 3
- (OR)**
- (b) What is SOI devices? List and explain the different types of SOI devices. (14) 5 3

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

- | | | Marks | CO | RBT
LEVEL |
|-----|---|-------|----|--------------|
| 16. | Analyze the various issues faced due to the scaling down of MOSFET devices. | (10) | 1 | 4 |
