Reg. No. : | | | | | | | | | | | | |

Question Paper Code:R4501

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

Professional Elective

ELECTRONICS AND COMUNICATION ENGINEERING

R21ECV501-DEVICE MODELING

(Regulations R2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1.	State any two differences between basic and advanced MOSFET models.	CO1-U	
2.	What is the purpose of RF modeling in MOS transistors?	CO1-U	
3.	What causes mobility degradation in MOSFETs?	CO1-U	
4.	Explain short-channel effect briefly.	CO1-U	
5.	What is meant by channel profile design?	CO1-U	
6.	Give one effect of non-uniform doping in scaled devices.	CO1-U	
7.	What is carrier energy quantization?	CO1-U	
8.	Define 2-D density of states.	CO1-U	
9.	What is a Silicon-On-Insulator (SOI) device?	CO1-U	
10.	Define Fully Depleted SOI MOSFET.	CO1-U	

PART – B (5 x 16= 80 Marks)

11.	(a)	Explain the basic operation of an nMOS transistor with suitable diagrams.	CO1-U	(16)
		Or		
	(b)	Using the basic MOSFET modeling assumptions, apply the gradual channel approximation to derive and use the current-voltage equation to calculate the drain current for given values of V_{GS}=3V and V_{DS}=1V.	CO1-U	(16)

12.	(a)	Explain how MOSFET capacitances change with bias and region of operation.	CO1-U	(16)
		Or		
	(b)	Compare different MOSFET capacitances in various modes.	CO1-U	(16)
13.	(a)	Compare the short-channel effects observed in long-channel and scaled-down MOSFETs and analyze their implications.	CO5- Ana	(16)
		Or		
	(b)	Examine how different scaling approaches impact power consumption in nanoscale MOSFETs and analyze the trade-offs involved in selecting an optimal methodology	CO5- Ana	(16)
14.	(a)	Apply quantization correction to a compact MOSFET model for specified operating conditions and interpret the resulting changes in device characteristics	CO3- App	(16)
		Or		
	(b)	Given the dimensions and material properties of a scaled MOSFET, apply quantum confinement principles to calculate the resulting changes in threshold voltage and gate capacitance.	CO3- App	(16)
15.	(a)	Explain the working and advantages of Silicon-On-Insulator (SOI) devices.	CO1- U	(16)
		Or		
	(b)	Extend the use of multigate MOSFETs in nanoscale technology nodes.	CO1- U	(16)