## CONTENTS

List of Figures		xi-xv
List of Tables		xvi
List of Abbreviations	xvii	-xviii
Preface	xiz	k-xxi
CHAPTER 1	INTRODUCTION AND Scope of Thesis	1-34
1.1	Introduction	1
1.2	Non-Classical MOS Transistors	
	1.2.1 Gate Dielectric Engineering	9
	1.2.2 Channel Engineering	11
	1.2.3 Gate-Electrode-Material Engineering	14
	1.2.4 Source/Drain Engineering	15
1.3	Some Common Non-Classical MOSFET structures	18
1.4	Some State-of-the-Art Works on Source/Drain Engineerin	ng:
	Elevated Source/Drain and Ultra Shallow Junction (USJ)	
	Structures 22	
	1.4.1 Review of Some Elevated Source/Drain MOS	
	Transistor Structures	22
	1.4.2 Review of Non-Abrupt Ultra Shallow Source/Drain	n
	Junction Transistor Structures	25
	1.4.3 Major Observations from the Literature Survey	29
1.5	Scope of the Thesis	31
CHAPTER 2	Analytical Modeling of Potential Distribution Threshold Voltage of Gate Underlap DG MOSFETs Source/Drain Lateral Gaussian Doping Profile 3	and with a 5-56
2.1	Introduction	35
2.2	Analytical Modeling of the 2-D Channel Potential	37

## Contents

2.3	Formulation of Threshold Voltage, DIBL and Loss of		
	Switching Speed	44	
2.4	Results and Discussion	48	
2.5	Conclusion	55	

CHAPTER 3	Subthreshold Current and Swing Modeling of Gate Underlap DG MOSFETs with Source/Drain		
	Lateral Gaussian Doping Profile	57-72	
3.1	Introduction	57	
3.2	Analytical Formulation of Subthreshold current model	59	
3.3	Analytical formulation of subthreshold swing model	62	
3.4	Results and Discussion	66	
3.5	Conclusion	72	

**CHAPTER 4 Effects of Elevated Source/Drain and Side Spacer Dielectric** on the Drivability Optimization of Non-Abrupt Ultra **Shallow Junction Gate-underlap DG MOSFETs** 73-91 4.1 Introduction 72 4.2 **Device Structure and Simulation Details** 74 4.3 **Results and Discussion** 78 4.4 Conclusion 90

CHAPTER 5Effects of Elevated Source/Drain and Side Spacer Dielectric<br/>on the Drivability Performance of Non-Abrupt Ultra<br/>Shallow Junction Gate-underlap GAA MOSFETs 92-1035.1.Introduction925.2Device Structure and Simulation Details93

5.3	Results and Discussion	95
5.4	Conclusion	102

## CHAPTER 6 CONCLUSION AND FUTURE SCOPE

## 104-109

6.1.	Introduction	104
6.2	Summary and Conclusion	105
6.2.	Future Scope of Work	108
References		109-120
Author's Relevant Publications		121