

<b>Title</b>	<b>Page No.</b>
Title of Thesis	i
Certificate	ii
Declaration by the Candidate & Certificate by the Supervisor and Head of the Department	iii
Copyright Transfer Certificate	iv
Acknowledgement	v-vi
Dedication	vii
Contents	viii
List of Figures	xiii
List of Tables	xvi
Preface	xvii
<b>1. Chapter 1 Introduction</b>	<b>1-40</b>
1.1. Introduction	1
1.2. Characteristics of Biomaterials used for Implant applications	4
1.2.1. Mechanical Properties	5
1.2.2. Corrosion and Wear Resistance	8
1.2.3. Effect of Porosity	9
1.2.4. Biocompatibility	10
1.2.5. Osseointegration	11
1.3. Bone Metabolism	11
1.3.1. Bone Physiology	12
1.3.1.1. Woven Bone	13
1.3.1.2. Lamellar Bone	14
1.3.1.3. Chemical Composition of bone	15
1.3.1.4. Types of Cells in Bone	15

1.4. Types of Material Used for Orthopedic Implant Applications: Advantages and Disadvantages	16
1.5. Titanium and Its Alloy: Material of Ultimate choice for Implant Application	21
1.5.1. Methods of Preparing Titanium based foams Using Powder Metallurgy Technique	24
1.6. Hydroxyapatite: Ideal Material for Biomedical Application	24
1.6.1. Advantages and Disadvantages of HAp	25
1.6.2. Examples of applications of HAp	25
1.7. Biocompatibility of Materials	26
1.8. Thesis Outline	27
References	29
<b>2. Chapter 2 Literature Review</b>	<b>41-76</b>
2.1. Introduction	41
2.2. Titanium and its Alloy	41
2.3. Methods of Preparing Titanium Based Foam Using Powder Metallurgy Technique	
2.3.1. Space Holder Technique	42
2.3.2. Replication Technique	47
2.3.3. Entangled Metal Wire Technique	48
2.3.4. Spark Plasma Sintering (SPS) and Hot Pressing (HP)	52
2.3.5. Microwave Sintering	54
2.3.6. Casting Technique	56
2.3.7. Metal Injection Moulding	58
2.3.8. Rapid Prototyping	60
References	62
<b>3. Chapter 3 Objective of the Work</b>	<b>77-79</b>
<b>4. Chapter 4 Material and Methods</b>	<b>80-91</b>
4.1. Introduction	80

4.2. Raw Material Used	81
4.3. Synthesis of porous Ti-SiO <sub>2</sub> composite and Silica doped Tricalcium Phosphate scaffold	83
4.4. Instrumentations	83
4.4.1. X-ray Diffraction (XRD)	83
4.4.2. Scanning Electron Microscopy (SEM)	85
4.4.3. Fourier Transform Infrared Spectroscopy (FTIR)	87
4.4.4. Transmission Electron Microscopy (TEM)	89
4.4.5. Physical and Mechanical Characterization	90
<b>5. Chapter 5 -Mechanical and Biological Behaviour of Porous Ti-SiO<sub>2</sub> Scaffold for Tissue Engineering Application</b>	<b>92-127</b>
5.1. Introduction	92
5.2. Experimental Procedure	95
5.2.1. Processing and Characterization of RH	95
5.2.2. Composition Formulation and Sample Preparation	96
5.2.3. Physical and mechanical behaviour of composite samples	98
5.2.4. Biofilm Formation	99
5.2.5. Cell Culture Study	100
5.2.5.1. MTT Assay	100
5.2.6. Evaluation of Bioactivity	101
5.3. Result and Discussion	102
5.3.1. Thermal Analysis of RH and Sucrose	102
5.3.2. Processing and fabrication of porous Ti-SiO <sub>2</sub> composite	105
5.3.3. Phase analysis of Ti-SiO <sub>2</sub> composite scaffold	108
5.3.4. Porosity and Microstructure	108

5.3.5. Mechanical Properties	112
5.3.6. Evaluation of Bioactivity	113
5.3.7. Biofilm Formation	116
5.3.8. Cellular Response	119
5.4. Conclusion	121
References	122
<b>6. Chapter 6 A Low-cost approach to develop HAp-SiO<sub>2</sub> based composite scaffold by valorizing animal bone waste and rice husk for tissue engineering applications</b>	<b>128-163</b>
6.1. Introduction	128
6.2. Experimental	131
6.2.1. Raw material Synthesis and Characterization	132
6.2.2. Synthesis of the Porous Scaffold	131
6.2.3. Characterization	134
6.2.4. Evaluation of Bioactivity	135
6.3. Results and Discussion	135
6.3.1. Thermal degradation behavior of BP, RH, and Sucrose	135
6.3.2. Phase analysis of porous HAp-SiO <sub>2</sub> composite	137
<b>6.3.3. Mechanism of Transformation of HAp to TCP</b>	<b>138</b>
6.3.4. FTIR analysis	141
6.3.5. Morphological analysis of scaffold by SEM and TEM imaging	143
6.3.6. Porosity and Mechanical properties	143
6.3.7. Evaluation of Bioactivity	150
6.4. Conclusion	152
References	153

7. Conclusion

164

List of Publications