TABLE OF CONTENTS

| List o | of Figures | xi |
|-----------|---|------|
| List o | of Tables | xv |
| List o | of Abbreviations | xvii |
| Prefa | ıce | xix |
| Chapter 1 | Introduction to Microbiology | 1 |
| Chapter 1 | - ' | |
| | 1.1. Introduction | |
| | 1.2. What Is Microbiology? | |
| | 1.3. History of Microbiology | |
| | 1.4. Branches of Microbiology | 8 |
| | 1.5. Applications of Microbiology | 14 |
| | 1.6. Microbiology And Sustainable Future | 18 |
| | 1.7. Conclusion | 24 |
| | References | 25 |
| Chapter 2 | Introduction To Soil Microbiology | 27 |
| | 2.1. Introduction | 28 |
| | 2.2. The Soil Environment | 30 |
| | 2.3. Bioremediation and Biodegradation | 34 |
| | 2.4. The Physical and Chemical Factors That Control | |
| | Biological activity in the Soil | 36 |
| | 2.5. Bacteria, Archaea, and Fungi | 41 |
| | References | 45 |
| Chapter 3 | Soil: Natural Medium For Plant Growth | 47 |
| | 3.1. Introduction | 48 |
| | 3.2. Role of Soil | 50 |
| | 3.3. Important Functions Of Soil | 50 |

| | 3.4. Soil as a Medium For Plant Growth | 56 |
|-----------|--|-----|
| | 3.5. Problems Associated With Soil as a Growth Medium | 63 |
| | 3.6. Conclusion | 65 |
| | References | 66 |
| Chapter 4 | The Soil Microorganism: An Overview | 67 |
| | 4.1. Introduction | 68 |
| | 4.2. Setting Nutrients Free | 71 |
| | 4.3. Biological Mechanisms | 72 |
| | 4.4. Soil Microorganisms | 73 |
| | 4.5. Harnessing The Power of Soil Microbes For More Sustainable Farming | 79 |
| | 4.6. Soil Is Alive | |
| | 4.7. Fertilization Practices And Environmental Sustainability | 82 |
| | 4.8. Importance Of Soil Microorganisms In Ecosystem | 85 |
| | References | 88 |
| Chapter 5 | Advanced Technologies In Soil Microbiology | 93 |
| | 5.1. Introduction | 94 |
| | 5.2. Transition To The Modern Techniques of Soil Microbiology | 96 |
| | 5.3. Major Innovative Technologies In Soil Microbiology | 98 |
| | 5.4. Technological Advancements In The New Era of "Omics" | 101 |
| | 5.5. Innovative Agricultural Technology And Soil Microbiology | 104 |
| | 5.6. Dawn Of The Modern Technology In Soil Microbiology | 107 |
| | References | 111 |
| Chapter 6 | Soil Microbiology And Biochemistry | 117 |
| | 6.1. Introduction | 118 |
| | 6.2. Soil Microbiology | 121 |
| | 6.3. Living Soils: The Role Of Microorganisms In Soil Health | 126 |
| | 6.4. The Nitrogen Cycle – Functional Microbial Ecology | 129 |
| | 6.5. Soil Microbiology Research | 130 |
| | 6.6. Soil Biochemistry | 131 |
| | 6.7. Soil Bacterial And Fungal Diversity Differently Correlated With Soil Biochemistry In Alpine Grassland Ecosystems In Response To Environmental Changes | 132 |
| | | |

| | 6.8. Fungi And Bacteria Respond Differently To Changing Environmental Conditions Within A Soil Profile | 133 |
|-----------|--|-----|
| | 6.9. Soil Microbial Diversity | 134 |
| | References | 138 |
| Chapter 7 | Nitrogen Transformation And Nitrogen Fixation | 145 |
| | 7.1. Introduction | 146 |
| | 7.2. Mechanism of Biological Nitrogen Fixation | 149 |
| | 7.3. Symbiotic Nitrogen Fixation | 151 |
| | 7.4. Asymbiotic Nitrogen Fixation | 156 |
| | 7.5. Nitrogen Fixation And The Ecosystem | 156 |
| | 7.6. Biological Significance of Nitrogen Fixation | 157 |
| | 7.7. Advantages of Utilizing Biological Nitrogen Fixation | 159 |
| | 7.8. Nitrogen Mineralization | 160 |
| | 7.9. The Implications of The Human Alterations In The Nitrogen Cycle on Ecosystem | 167 |
| | 7.10. Issues And Concerns Related To Nitrogen Fixation Mechanism | |
| | References | |
| Chapter 8 | Soil Microbiology And Sustainable Crop Production | 171 |
| | 8.1. Introduction | 172 |
| | 8.2. Soil Microbiology | 173 |
| | 8.3. Sustainable Crop Production | 174 |
| | 8.4. Sustainable Farming Methods And Practices | 175 |
| | References | |
| Chapter 9 | Current Issues In Soil Microbiology | 201 |
| | 9.1. Introduction | 202 |
| | 9.2. The Impact Of Climate Change On Soil Microbiology | 203 |
| | 9.3. Microbial Diversity And Function In Soil From Genes to Ecosystems | 209 |
| | 9.4. Bioengineering Techniques For Soil Erosion Protection and Slope Stabilization | 214 |
| | 9.5. Composting As An Eco-Friendly Method To Recycle Organic Waste | 219 |
| | References | 222 |

| Chapter 10 | Trends And Future Prospects In Soil Microbiology | 223 |
|------------|--|-----|
| | 10.1. Introduction | 224 |
| | 10.2. Developments In Soil Microbiology | 226 |
| | 10.3. Soil Microbes For Sustainable Farming | 228 |
| | 10.4. Latest Developments In Soil Microbiology | 235 |
| | 10.5. Conclusion | 241 |
| | References | 243 |
| | Index | 245 |