CONTENTS

Chapter 1: Fundamentals of Climate Science		01-33
1.1	Structure and Composition of the Atmosphere	01
1.2	Solar Radiation and Earth's Energy Budget	11
1.3	Greenhouse Effect: Mechanism and Importance	15
1.4	Climate Forcings: Natural and Human-Induced	23
1.5	Role of Oceans in Climate Regulation	30
Chapter 2: Evidence of Climate Change		34-56
2.1	Ice Core and Sediment Records	36
2.2	Instrumental Records (Temperature, CO ₂)	40
2.3	Changes in Sea Level and Ice Extent	46
2.4	Extreme Weather Event Trends	51
Chapter 3: Causes of Global Warming		57-91
3.1	Fossil Fuel Usage and CO ₂ Emissions	58
3.2	Methane and Nitrous Oxide from Agriculture	66
3.3	Deforestation and Land Use Changes	73
3.4	Industrialization and Urbanization	80
Chapter 4: Climate Models and Future Predictions		92-103
4.1	Introduction to Climate Models	92
4.2	Representative Concentration Pathways (RCPs)	96
4.3	Simulation Scenarios and Forecasts	98
4.4	Uncertainties and Limitations	100
Chapter 5: Impacts on Ecosystems		104-114
5.1	Marine Life and Coral Bleaching	104
5.2	Forest and Grassland Changes	107
5.3	Climate-Driven Species Migration	111
Cha	apter 6: Human and Economic Impacts	115-128
6.1	Health Risks and Disease Spread	116
6.2	Agricultural Productivity and Food Supply	119
6.3	Economic Damage from Natural Disasters	122
6.4	Population Displacement and Migration	125

Chapter 7: Climate Mitigation Strategies		129-139
7.1	Renewable Energy Technologies	129
7.2	Energy Efficiency and Smart Grids	131
7.3	Carbon Capture and Storage (CCS)	133
7.4	Transportation and Emission Controls	135
7.5	Role of Sustainable Agriculture	138
Chapter 8: Adaptation and Resilience		140-155
8.1	Urban Planning and Heat Management	140
8.2	Water Management Systems	145
8.3	Infrastructure Resilience	150
8.4	Role of Traditional Knowledge in Adaptation	154
Chapter 9: Global Climate Policy		156-174
9.1	UNFCCC and IPCC Reports	156
9.2	Kyoto Protocol and Paris Agreement	164
9.3	National and Regional Climate Policies	168
9.4	Carbon Markets and Trading Schemes	171
Chapter 10: Education, Innovation, and the Way Forward		175-188
10.1	Role of Environmental Education	175
10.2	Youth and Climate Movements	178
10.3	Technology for Climate Monitoring (IoT, AI, Satellite Imaging)	182
10.4	Ethical and Moral Responsibility	185