GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code:

Semester – VI
Subject Name: Global Warming and Climate Change

Type of course: Professional Elective course

Prerequisite: Basic knowledge of Environmental Sciences

Rationale: To understand the Earth's Climate System and the concept of Global Warming and comprehend the impact of climate change on society and its mitigation measures**.**

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	**Basics of Climate Change:** Science of climate change, Natural climatic variability Global warming, Natural and enhanced greenhouse effect, Greenhouse gases & Carbon emissions	6
2	**Green House Gases:** Carbon dioxide & climate change, Methane & climate change, Nitrous oxide & climate change, CFCs & climate change	4
6	**Climate Change Modeling:** Elements of weather and climate modeling, Basic equation and dynamics of atmosphere, Climate variability and climate change, Elementary idea of Global climate models, Comparison of various IPCC reports, important findings of IPCC AR5, Impacts of climate change – Global and India.	8
3	**Basics of Global Warming:** Global warming and climate change, Way and means, Carbon emission, stabilizing Atmospheric Carbon Dioxide Concentrations, Global Carbon Cycle.	6
4	**Carbon Capture and Sequestration (CCS):** Projects, Carbon Capture in Cement manufacture, Petrochemical Industries. Modalities and Procedures. Fossil Power Generation with CCS: Policy, Development for Technology and Deployment **Geological Storage of Carbon Dioxide:** CO_2 Properties and Geological Storage, CO_2 Storage through Enhanced Hydrocarbon Recovery, Enhanced Oil Recovery (EOR), Enhanced Coal Bed Methane Recovery, Shale Gas, storage Options	10
5	**Policies and legislation:** International and national legislative frameworks- UNFCCC, IPCC and Kyoto protocol: Scientific and implementation bodies of Kyoto, Kyoto mechanisms- CDM, Joint implementation and Emission Trading, Decisions of Conference of Parties (COP) and Meeting of Parties (MOP), Carbon markets- CERs, Environmental Economics- Issues include the costs and benefits of alternative environmental policies to deal with air pollution, water quality, toxic substances, solid waste, and global warming.	8

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level

10	30	20	10		

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Climate Change: Science, strategies & solutions by Eileen Clausen, Vicki Arryo Cochran
2. Climate change: a multidisciplinary approach by William Kininmouth
3. Climate change: Critical Concepts in the environment by Frank Chambers, Michael Ogle
4. Cites Carbon Capture: Sequestration and Storage (Issues in Environmental Science and Technology), by R E Hester and R M Harrison
5. Carbon Capture and Sequestration Integrating Technology, Monitoring, Regulation by Elizabeth Wilson and David Gerard.
6. Climate Change and the Kyoto Protocol: The Role of Institutions and Instrumens to Control Global Change by Michael Faure Joyeeta Gupta Andries and Nentjes
7. IPCC reports (http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml)

Course Outcomes:

Sr. No.	CO statement	Marks Weightage
CO1	Understand the connection between climate change and human activities and the physical basis of the natural greenhouse effect.	22
CO2	Examine the relationship between climate and weather.	35
CO3	Identify individual carbon footprints and identify ways to lessen them	25
CO4	Discuss the policies and legislation of international and national legislative frameworks.	18

Tutorials:

1. Assignments on Climate change and Green House effects.
2. Assignments based on Global Warming.
3. Assignments based on CCS.
4. Assignments based on Policies and legislation of national and international frameworks.