Course Title:	**Global Climate Change**	Semester	I /II
Course Code:	**BETCK105G/205G**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Course Learning Objectives

CLO 1. To know the climate, atmosphere and its components

CLO 2. the impacts of climate change and its causes

CLO 3. To know the causes of climate change and its mitigation measures

Teaching-Learning Process

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical skills.
2. State the need for the subject in the present scenario and Provide real-life examplesto understand them
3. Support and guide the students for self–study.
4. Teacher will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures related to each module :
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).

Module-1: Climate systems, processes & phenomena (8 hours)

Self-study: Consequences of ozone depletion, Sources and sinks of greenhouse gases, Melting polar ice and sea level rise

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Greenhouse gases and greenhouse effect, Hydrological cycle and Carbon cycle, Global warming and its impacts.

Applications: Environmental protection and policy management, public health, Disaster

preparedness and mitigation

(RBT Levels: L1, L2 and L3)

Module-2: Atmosphere & its components (8 hours))

Self-study: Atmospheric chemistry, pollutants and their sources, Atmospheric radiation. Atmosphere and its layers, Characteristics of Atmosphere, Structure of Atmosphere, Composition of Atmosphere, Atmospheric stability, Temperature profile of the atmosphere, Temperature inversion and effects of inversion on pollution dispersion.

Applications: short term weather prediction, climate modeling and prediction, Air quality management.
(RBT Levels: L1, L2 and L3)

Module-3 : Impacts of climate change (8 hours)

Self-study: Historical climate patterns, biological impacts of climate change, socio-economic impact of climate change

Causes of Climate change, Change of Temperature in the environment, Melting of ice and sea level rise, Impacts of Climate Change on various sectors, Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

Applications: conservation strategies, sustainable land use, Urban planning and infra-structure.
(RBT Levels: L1, L2 and L3)

Module-4: Observed changes and its causes (8 hours)

Self-study: carbon markets, mechanisms under the Kyoto Protocol, climate sensitivity

Climate change and Carbon credits, Clean Development Mechanism (CDM), CDM in India, Kyoto Protocol, Intergovernmental Panel on Climate Change (IPCC), Climate Sensitivity, Montreal Protocol, United Nations Framework Convention on Climate Change (UNFCCC), Global change in temperature and climate and changes within India (12)

Applications: Policy development, Regulatory framework, sustainable development, climate finance.
(RBT Levels: L1, L2 and L3)

Module-5: Climate change and mitigation measures (8 hours)

Self-study: Energy sector, carbon capture and storage, waste management, national and local policies.

CDM and Carbon Trading, Clean Technology, biodiesel, compost, biodegradable plastics, Renewable energy usage as an alternative, Mitigation Technologies and Practices within India and around the world, Non-renewable energy supply to all sectors, Carbon sequestration, International and regional cooperation for waste disposal- biomedical wastes, hazardous wastes, e-wastes, industrial wastes.

Applications: Sustainable agriculture, policy development and advocacy, climate research
(RBT Levels: L1, L2 and L3)

Course outcome

At the end of the course, the student will be able to :

1. Analyze the role of various atmospheric components in influencing global climate patterns and identify the impacts of changes in these components
2. Apply knowledge of climate change causes to evaluate specific case studies or.
3. regions affected by climate change, such as rising sea levels or extreme weather patterns
4. To understand about the carbon changes
5. To understand the effectiveness of different mitigation measures in reducing the impacts of climate change, considering feasibility and economic costs.

Course Assessment and Evaluation Details (both CIE and SEE)

Continuous Internal Evaluation: 50 marks		
Theory Assessment Tool	**Marks**	**Reduced marks**
IAT-1	25	25
IAT-2	25	
Assessment -1(activity based)	25	25
Assessment-2(activity based)	25	
Semester End Examination (SEE) : 50 marks		
SEE	**Marks**	**Reduced marks**
Course end examination (Answer any one question from each unit – Internal choice)	100	50

Activity Based Learning / Practical Based learning

Suggested Activities are:

1. Research and write case studies on specific climate events, such as the ozone hole or a particular heat wave- One case study
2. Create a public awareness campaign on the importance of reducing greenhouse gas emissions.
3. List out different satellites used in climate studies with its characteristics and images.
4. Techniques to enhance Climate-Smart Agriculture – Explain with the help of any 2 case studies.
5. Meteorological instruments- Thermometers, barometers, anemometers-Enumerate the principle and working with the help of images.

6. Early warning systems for storms, hurricanes, floods etc.-Prediction and monitoring- Any 2 case studies
7. Historical Climate Patterns- Ice ages and interglacial periods, -An overview.
8. Ocean Acidification: Causes and effects on marine life- A case study
9. Study successful mitigation projects and policies from different regions- Any 2 case studies
10. Analyze the impact of carbon pricing in various countries.

Suggested Learning Resources:

Text Books

1. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Private limited 2007.
2. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press ,Cambridge,2006.
3. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
4. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge university press ,2003

Reference Books:

1. Critchfield H. J. (1987) General Climatology, Prentice-Hall of India, New Delhi
2. Lutgens F. K., Tarbuck E. J. and Tasa D. (2009) The Atmosphere: An Introduction to Meteorology
3. Oliver J. E. and Hidore J.J. (2002) Climatology: An Atmospheric Science, Pearson
4. Barry R. G. and Corley R. J. (2003) Atmosphere, Weather and Climate, Routledge, New York. (12)

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/c/ClimateReality/videos
- https://www.noaa.gov/climate
- https://science.nasa.gov/climate-change/

COs and POs Mapping (CO-PO mappings are only Indicative)

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2				1	2	3	1			1	1
CO2	2				1	2	3	1			1	1
CO3	2				1	2	3	1			1	1
CO4	2				2	2	3	1			1	2
CO5	2				1	2	3	2			2	1

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped (