Paper Title: **Climate change, Resilience and sustainability**

Nature: Value Added Add-on
Credit: 2
Total Marks: 50
Target students: Under Graduates

Course Description:
This course provides a comprehensive understanding of climate systems and climate change, encompassing topics such as the Earth's subsystems, weather versus climate distinctions, and the role of chemical species in climate system. It delves into the causes of climate change, including natural phenomena like Milankovitch cycles and anthropogenic factors such as greenhouse gas and aerosol emissions as well as land use changes, along with insights from historic climate change periods and the contributions of organizations like the Intergovernmental Panel on Climate Change (IPCC). Additionally, the course explores the ecological, socio-economic, and health impacts of climate change, strategies for mitigation, adaptation and resilience according to the IPCC and the pursuit of sustainability goals and international climate policies from past to the recent Agreements.

Course Outcomes:
The objectives of the course are to

- Provide a comprehensive understanding of climate system and climate change
- Extract lessons from past climate change events, including insights from the Intergovernmental Panel on Climate Change (IPCC).
- Examine the opportunities and challenges associated with enhanced interdisciplinary cooperation in addressing climate change.
- Examine the diverse impacts and responses of climate change at local and regional scales and.
- Investigate strategies for climate change mitigation and adaptation according to IPCC
- Promote citizen engagement and participation in efforts aimed at mitigating the effects of climate change.

Learning Outcome
The students will be able to

- Recognize the multifaceted factors that shape global climate systems and contribute to climate change dynamics.
- Evaluate the diverse impacts of climate change at global, regional, and local levels to understand its implications across various scales.
- Actively promote awareness of climate change causes and effects within their communities and beyond, fostering engagement and advocacy.
- Evaluate the ecological, socio-economic, and health impacts of climate change on various sectors.
- Identify and explore clean technologies aimed at promoting sustainable development, aligning with efforts to mitigate climate change impacts.

Course Content

Unit I: Climate system and climate change

The climate system and subsystems- geosphere, biosphere, atmosphere, hydrosphere and cryosphere, Weather and climate: difference and importance, chemical species present in earth's atmosphere-gases, aerosols, clouds etc., natural greenhouse effect, enhanced greenhouse effect, global warming: role of greenhouse gases (GHGs), Climate Change causes-natural: Milankovitch cycle (earth's eccentricity, precession, obliquity etc.,), solar cycle, volcanic eruption, anthropogenic: emissions of GHGs and aerosols, land use land cover change, past climate change-six historic periods, lessons of past climate change, recent regional climate change, the Intergovernmental Panel on Climate Change (IPCC)

Unit II: Climate change impacts, Adaptation, Mitigation, Resilience and sustainability

Impacts: ecology-fresh water resources-surface and groundwater, glaciers melting, terrestrial ecosystem-loss of biodiversity, agriculture and food supply, marine environment- sea level rise, ocean acidification, coastal lives, socio-economic environment, human physical and mental health, gender

Mitigation: definition according to IPCC, reducing the impacts-sequester carbon emissions, enhance natural carbon sinks, conservation and efficient use of energy, carbon free and renewable energy technology, Net zero

Adaptation and resilience- definitions according to IPCC, adaptation measures by various continents, India and North-East India perspectives, community level participation, climate resilience, climate resilient development pathways, indigenous measures of climate resilience

Sustainability: definition, sustainable development goals -climate action (SDG 13)

Climate policies-COP- from Montreal to recent agreements.

Suggested Readings

1. The Atmosphere: An Introduction to Meteorology, Frederick K. Lutgens, Edward J. Tarbuck, PHI Learning
2. Climate Changes: Causes, Effects and Solutions, John T. Hardy, Wiley
3. Global Warming-The complete briefing, John Houghton, Cambridge University Press
4. Climate Change Impact, Adaptation and Mitigation in Agriculture: Methodology for Assessment and Application, *Editors:* H. Pathak P.K. Aggarwal S.D. Singh
5. Marina Fischer-Kowalski and H. Haberl (2007), Socioecological Transitions and Global Change. Trajectories of Social Metabolism and Land Use (Edward Elgar).
6. A Climate of Injustice: Global Inequality, North South Politics, and Climate Change; Robert, J. T; Parks, B.C (2006): The MIT Press: UK, Cambridge
7. Climate Change Policy – Facts, Issues and Analysis, Jepma, C.J., and Munasinghe, M., Cambridge University Press, 1998
8. Sustainable Energy Development: Issues and Policy in Energy, Environment and Economy: Asian Perspective, Munasinghe, M., Kleindorfor P. R. et. al (ed.), Edward Elgar, 1996
9. Climate Change – An Indian Perspective, Sushil Kumar Dash, Cambridge University Press India Pvt. Ltd, 2007

<u>Some useful Links</u>

https://www.ipcc.ch/
https://sdgs.un.org/goals