

*Prerequisites: NIL*

## Syllabus

### Module – I

Climate Change History; Climate System: Components of Climate System, System Dynamics; Material and Energy Balance of Earth as a Climate System; Atmosphere – Thermal and Compositional Layers, Circulation; Ocean – Layered Structure, Surface Currents, Water Flow and Hydrological Cycles; Ocean-Atmosphere Interactions; Carbon Cycle – Atmosphere-Land/Biosphere-Ocean Carbon Exchange, Atmosphere-Rock Exchange, Anthropogenic Impacts, Ocean Acidification, Long-Term Fate of CO<sub>2</sub>.

### Module – II

A Simple Climate Model; Forcing, Feedback and Climate Sensitivity – Radiation, Greenhouse Gases (GHG), Aerosols, Land-Use Change, Natural Forcing Factors, Tipping Points and Committed Warming; Using Climate Models to Predict Past Climate Events.

### Module – III

Observing Climate Change – Warming, Precipitation, Drought, Ice Cap Melting, Sea Level Rise, Storms, and Other Events; GHG Emission Trends and Drivers; Emission and Warming Scenarios – Predictions from Climate Models, 1.5°C and 2.0°C Scenarios and Beyond; Net Zero Emission Pathways; Climate Risk and Resilience.

### Module – IV

Climate Change Adaptation and Mitigation – Policies and Approaches; Technologies for Reducing GHG Emissions – Energy Systems, Transport, Industry, Agriculture and Land Use, Buildings, Urban Systems; Materials in Climate Change Mitigation Technologies; Lifestyle Modifications and Social Aspects of Mitigation, Climate Transition and Sustainable Development Goals.

### TEXTBOOK/REFERENCE:

1. “Climate Change 2022: Mitigation of Climate Change”, Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC, 2022.
2. E. A. Mathez and J. E. Smerdon, “Climate Change: The Science of Global Warming and Our Energy Future”, Second Edition, Columbia University Press, NY, 2018.
3. A. E. Dessler, “Introduction to Modern Climate Change”, Third Edition, Cambridge University Press, 2022.
4. Relevant recent journal and popular articles on Climate Change

### Course Outcomes:

CO Code 24MS801	Course outcome statement
CO.1	Describe earth and its sub-systems as climate systems, their interactions, anthropogenic impacts, and evaluate material/energy flow in climate systems.
CO.2	Develop a simple climate model, identify forcing & tipping factors, feedback and analyze their sensitivity on climate trends.
CO.3	Describe factors and methods of observing climate change, identify emissions trends and their drivers. Evaluate the various emissions and warming scenarios, net zero pathways, risks and define climate resilience.
CO.4	Evaluate climate change adaptation and mitigation approaches & technologies across sectors, lifestyle modifications & social aspects of mitigation, and connections to SDGs.

**Outcome Mapping:**

<b>CO Code</b> 24MS801	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
CO.1	2		2	2	1	1
CO.2	2		2	2	1	3
CO.3	2		2	2	1	3
CO.4	2		2	2	1	3