CEEY 181 SDG: 13	CLIMATE CHANGE AND WATER RESOURCES	L	T	P	C
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COURSE OBJECTIVES: The objectives of the course are

COB1: To impart knowledge on the climate system

COB2: To expose knowledge on the impact of climate change on different sectors.

COB3: To provide exposure to the tools available for vulnerability assessment.

COB4: To acquire knowledge on the guidelines of adaptation and mitigation carried out during climatic changes.

COB5: To familiarize the computation using downscaling methods in water resources.

MODULE I GLOBAL CLIMATE SYSTEM 9

Climate - Drivers of Climate change - Components of Global Climate System: Atmosphere,
hydrosphere, Lithosphere, and biosphere, atmospheric circulation - redistribution of heat - Global Energy Balance - Greenhouse effect- Hydrological cycle - Reservoirs, flows (or Fluxes), Residence Times, Water Vapor.

MODULE II CLIMATE VARIABILITY AND CHANGE 9

Climate variability and change: Factors Responsible for Natural Climate Variability and Change: large scale variability - El Nino, La Nina – ENSO, Teleconnections, Sun-Moon-Earth interaction - Factors Responsible for Anthropogenic Climate Change, Detection and Attribution of Climate Change; Global and Indian Scenarios – Observed changes and projected changes of IPCC - Impacts on water resources – Scenarios: SRES and RCPs.

MODULE III TOOLS FOR VULNERABILITY ASSESSMENT 9

Need for vulnerability assessment - Approaches for assessment – Types of climate models, History of climate modelling, Sensitivity of climate models, parameterization of climate process, simulation. Box models - Zero-dimensional models - Radiative-convective models - Higher- dimension models
- EMICs (Earth-system models of intermediate complexity) - GCMs (global climate models or general circulation models) – Regional Models - Sectoral models - CMIP

MODULE IV ADAPTATION AND MITIGATION 9

Water-related adaptation to climate change in the fields of Ecosystems and biodiversity, - Agriculture and food security, land use and forestry, Human health, water supply and sanitation, infrastructure and Economy (insurance, tourism, industry and transportation) - Adaptation, vulnerability and sustainable development Sector-specific mitigation - Carbon dioxide capture and storage (CCS) , Bio-energy crops, Biomass electricity, Hydropower, Geothermal energy, Energy use in buildings, Land-use change and management, Cropland management, Afforestation and Reforestation.

MODULE V IMPACTS ON WATER RESOURCES 9

General Circulation Models – downscaling – statistical downscaling – dynamic downscaling. Case studies on impacts of climate change on Water resources assessment, water quality, groundwater, irrigation and agriculture.

L –45; TOTAL HOURS –45

TEXT BOOKS:

1. Sangam Shrestha, Mukand S. Babel and Vishnu Prasad Pandey,2014, Climate Change and Water Resources, CRC Press an imprint of the Taylor & Francis Group
2. McGuffie., K, and Henderson-Sellers.A, 2005, A Climate Modelling Primer, Third Edition, John Wiley & Sons, Ltd .

REFERENCES:

1. John M. Wallace and Peter V. Hobbs,2006, Atmospheric Science: An Introductory Survey, Second Edition, Academic Press an imprint of Elsevier
2. David Neelin., J, 2011, Climate Change and Climate Modeling, University Press, Cambridge, United Kingdom.
3. Thomas T. Warner, 2011, Numerical Weather and Climate Prediction, Cambridge University Press, New York 6. Intergovernmental Panel on Climate Change: https://www.ipcc.ch.

COURSE OUTCOMES: At the end of the course the students will be able to

CO1: describe the earth's climate system and the interaction among the subsystems of the earth components

CO2: illustrate the basics of climate variability and change including the observations and Projections

CO3: demonstrate the tools for vulnerability assessment at global and at regional scale

CO4: describe the options available for adaptation and mitigation for different sectors