SWCE 508 Climate Change and Water Resources 3+0

Objectives:
To acquaint students about the concept of climate change and its impact on surface and ground water resources. To understand adaptation and mitigation strategy under climate change scenario.

Unit-I
The climate system: Definitions, climate, climate system, climate change. Drivers of climate change, characteristics of climate system components: Greenhouse effect, carbon cycle, wind systems. Trade winds and the Hadley Cell, ozone hole in the stratosphere, El Nino, La Nina–ENSO, teleconnections.

Unit-II
Impacts of climate change: Observed and projected, global and Indian scenario, observed changes and projected changes of IPCC: Impacts on water resources, NATCOM Report, impacts on sectoral vulnerabilities, SRES, different scenarios, climate change impacts on ET and irrigation demand.

Unit-III
Tools for vulnerability assessment: Need for vulnerability assessment, steps for assessment, approaches for assessment. Models: Quantitative models, Economic models, impact matrix approach, Box models, Zero-dimensional models, Radioactive-convective models, Higher-dimension models, EMICs (Earth-system models of intermediate complexity), GCMs (global climate models or general circulation models), Sectoral models.

Unit-IV
Adaptation and mitigate on water: Related adaptation to climate change in the fields of ecosystems and biodiversity, agriculture and food security, landuse and forestry, soil and water resources and economy, Adaptation, vulnerability and sustainable development.

Unit-V
Sector specific mitigation: Carbon-dioxide capture and storage (CCS), bio-energy crops, land-use change and management, crop land management, afforestation and reforestation. Potential water resource conflicts between adaptation and mitigation. Implications for policy and sustainable development.

Case studies: Water resources assessment case studies: Regional River valley project. Adaptation strategies in assessment of water resources. Hydrological design practices and dam safety, operation policies for water resources projects. Flood management strategies, drought management strategies, temporal and spatial assessment of water for irrigation, land use and cropping pattern, coastal zone management strategies.

Course Outcome:
The students will be able to understand climate change concept particularly on surface and ground water. Students can have indepth knowledge about adaptation and mitigation strategies in respect of climate change.

Teaching Schedule

S.No.	Topic	No. of Lectures
1	Definitions-climate, climate system, climate change; Drivers of Climate change	3
2	Climate system and its components; wind systems, carbon cycle, Greenhouse effect, Trade winds and the Hadley Cell, ozone hole in the stratosphere, El Nino, La Nina–ENSO, tele connections	3
3	Climate scenarios- SRES, RCP, Scenario based observed and Projected climate changes in Indian and global context	3
4	IPCC projected climate change impacts on water resources, NATCOM Report-impacts on ET and irrigation demand	3
5	Vulnerability assessment: Need, steps for assessment, approaches for assessment	2
6	Models: Quantitative models, Economic models, impact matrix approach, Box models, Zero-dimensional models, Radioactive-convective models, Higher-dimension models, EMICs (Earth-system models of intermediate complexity), GCMs (global climate models or general circulation models), Sectoral models	4
7	Adaptation to climate change in the fields of ecosystems and biodiversity, agriculture and food security, landuse and forestry, And economy.	4
8	Sector specific mitigation: Carbon-dioxide capture and storage (CCS)	2
9	Sector specific mitigation: bio-energy crops, Soil conservation measures.	2
10	Sector specific mitigation: land-use change and management, Crop land management, afforestation and reforestation	2
11	Potential water resource conflicts between adaptation and mitigation	2
12	Implications for policy and sustainable development.	2
13	Case studies-Regional river valley project	5
14	Adaptation strategies in assessment of water resources-Temporal and spatial assessment of water for irrigation, land use and cropping pattern	2
15	Adaptation strategies in assessment of water resources-	3
	Hydrological design practices and dam safety, operation policies for water resources projects	
16	Flood management strategies, coastal zone management strategies.	3
	Total	**45**

Suggested Readings:

1. Srinivasa R K and Nagesh K D Impact of climate change on water resources with Modelling Techniques and case studies. Springer publications, New York.
2. Rao Y S, Zhang T C Ojha, Gurjar B R, Tyagi R D, Kao CM (eds) Climate change Modellinng, Mitigation and Adaption. American Society of civil Engineers.
3. Tamim Y and Caitlin A G. Climate Change and Water Resources. Springer Publication.

4. Majumdar P P and Nagesh K D. Floosa in a Changing Climate: Hydrological Modelling. Cambridge University Press, New York.
5. Pathak H, Agarwal, P K and Singh, S. D. Mitigation in Agriculture: Methodology for assessment and Application. Division of Environmental Sciences, IARI New Delhi.
6. Climate smart Agriculture (Concept, Challenges and Opportunity) by Pratap Bhattacharya, Himanshu Pathak, Sharmishta Pal, Springer Pub., Singapore
7. Klein, R.J.T., S. Huq, F. Denton, T.E. Downing, R.G. Richels, J.B. Robinson, F.L. Toth, 2007: Inter-relationships between adaptation and mitigation. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.
8. Sen, D. (2010). Flood Hazards in India and Management Strategies. In: Jha, M.K. (eds) Natural and Anthropogenic Disasters. Springer, Dordrecht. https://doi.org/10.1007/978-90-481-2498-5_7