Course title: Mitigation of Climate Change			
Course code: NRC 132	**No. of credits:** 3	**L-T-P:** 24-18-0	**Learning hours:** 42
Pre-requisite course code and title (if any): None			
Department: Energy and Environment			
Course coordinator: Dr Kamna Sachdeva		**Course instructor:** Dr Kamna Sachdeva	
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Course type: Core		**Course offered in:** Semester 2	

Course Description

The course focuses on mitigation strategies applicable to different sectors for climate change. The strategies are discussed from the perspectives of the developing countries. It is based on the preamble of IPCC assessment reports on mitigation of climate change and provides answers to questions such as: • What can be done to avoid climate change from anthropogenic activities? • What are the strategies to implement these actions? • How climate mitigation policies are aligned with Sustainable Development policies?

Course objectives

1. Impart knowledge about different climate change mitigation strategies and options
2. Provide overview of GHG emission calculation methods and approaches
3. Provide the knowledge and tools to devise effective strategies for climate mitigation on a global, sectoral and local scale.

Course content

Module	Topic	L	T	P
1.	**Introduction to the concept of mitigation & Stabilization Scenarios** In this module basic concept related to mitigation (long term and short term) and contribution of GHG emissions in current global change will be discussed. The major topics which will be covered in this module are: Climate change response measures: definition and evolution. Introduction to mitigation of GHGs and stabilization scenario; characteristics of mitigation in regional and national context; long term and short-term mitigation options; mainstreaming climate change in development agenda.	6	4	
2.	**Emission computation techniques** The module discusses various GHG emissions calculation techniques based on scientific principles of energy and carbon intensities. It will cover integrated assessment models, EIA & Life Cycle Assessment based techniques; Methodologies for regional GHG inventories; IPCC good practice guidelines for National greenhouse gas inventories.	6	4	
3.	**Sector Based Approaches** The module will focus on available sectoral specific approaches of mitigation, the major sectors will be covered are– transport, power, agriculture, municipal waste, specific industries, and buildings. Mitigation from cross sector perspective and its linkages with sustainable development will also be discussed using case study-based approach	4	6	
4.	**National and international Policy approaches to deal with GHG emissions** The module will discuss evolution and postulates of available Policy Instruments in the domain of mitigation of climate change, scientific	8	4	

	standing of all the policy instruments will also be discussed. In general mitigation policies (market-based approaches and Regulatory approaches) and its Co-operatives arrangements for implementation will be discussed. At National level various polices such as: National Action Plan on Climate Change (mitigation specific missions); alternate energy programmes; alternate energy crops programmes and afforestation; other flexible mechanism and voluntary mechanisms such as REC and PAT program, Micro level policy initiative (Panchayti Raj institutions) will also be discussed.			
	Total	**24**	**18**	

Evaluation criteria

Tes1: **Written test** [at the end of teaching of modules 1] - 15%

Test 2: **Written test** [at the end of teaching of modules 2] - 15%

Test 3: (Assignment based on module 3) - 20%

The assignment will cover sector specific mitigation policies: candidate need to include all the available technological, policy and practices of mitigation for the chosen sector. National and International perspective in term of case study should be included.

The assessment indicators will be: a) number of mitigation strategies discussed, b) case studies included, c) basic knowledge of working of the technology/policy discussed in the presentation, d) content clarity and quality of presentation.

Test:4: **Written test** [at the end of the semester, full syllabus]- 50%

Learning outcomes

Upon completion of this course, a fully-engaged student will be able to:

- Understand integrated assessment models. [test 1 and 2]
- To calculate GHG emissions using different approaches. [test 2 and 3]
- Use the scientific method to prepare regional or National inventory of GHGS [test 1 and 2]
- Demonstrate knowledge of the important policy instruments available nationally or internationally in mitigation [test 4]

Pedagogical approaches

- Assignments and hand-on classroom tutorials on GHG calculations
- Cases study discussions
- Field visits and role play exercises

Materials

Required text

1. Banerjee K.K. (1995) Global Warming Database Technology Options in Power and End-use Sectors Using Fossil Fuels, New Delhi.
2. Gupta M. (2006) Restricting Greenhouse Gas Emissions: Economic Implications for India, New Delhi.
3. Gilbert M. Masters and Wendell P. Ela (Author) (2007) Introduction to Environmental Engineering and Science. 3rd edition. PHI learnings New Delhi

Suggested readings

1. Hardy J. (2003) Climate Change: Causes, Effects and Solutions, John Wily & Sons.
2. Nakicenovic N. (Eds) (1993) Integrative Assessment of Mitigation, Impacts and Adaptation to Climate Change, Austria.
3. Sathaye J. and Meyers S.D. (1995) Greenhouse Gas Mitigation Assessment: A Guidebook, Kluwer.
4. Thomas S. (2003) Policy Instruments for Environment and Natural Resource Management, RFF Publication, Washington DC.
5. Tiwari G.N. (2003) Greenhouse Technology for Controlled Environment, New Delhi

Case studies https://www.c2es.org/document/regional-impacts-of-climate-change-four-case-studies-in-the-united-states/ https://www.climate.gov/news-features/department/climate-case-studies Journals 1. Atmospheric Environment 2. Climate Dynamics 3. Coal 4. Combustion Technologies 5. Energy Policy 6. Global Environmental Change 7. Renewable Energy 8. Review of environmental economics and policy 9. Solar Energy 10. Sustainable and Renewable Energy reviews
Additional information (if any): Students will we encouraged to read important reports related to subject published by 1. UNFCCC: http://unfccc.int/focus/mitigation/items/7171.php 2. World bank: https://openknowledge.worldbank.org/bitstream/handle/10986/24451/K8860.pdf?sequence=2 3. ADB:https://www.climateinvestmentfunds.org/sites/default/files/knowledge-documents/adb-climate-investment-funds_0.pdf
Advanced Reading Material
Additional information (if any)
Student responsibilities The students are expected to submit assignments in time and come prepared with readings when provided.

Course Reviewers

1. Dr Umesh Kulshrestha, Professor, School of Environmental Sciences Jawaharlal Nehru University.
2. Dr. Y.P Abbi- Senior Fellow, Energoindia Limited, Delhi.
3. Mr. Prabhat Upadhayay-Centre for Global Environment Research Group, TERI, Delhi.