

ME407 Carbon Capture and Climate Change

L	T	P	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC/GEC		15/25	25	20/25	40/50	-

Objectives: To enable the students to understand the Science of climate change, Greenhouse effect and Carbon Emissions Mitigation Strategies. To understand Fundamentals Carbon Capture Technologies and Carbon Storage and Utilization.

Syllabus		Contact Hours
Unit-1	Fundamentals of Climate Change. Science of climate change: Greenhouse effect and global warming Sources of greenhouse gases (GHGs) and their environmental impacts Climate change impacts on ecosystems, agriculture, and water resources Global climate models and predictions	6
Unit-2	Carbon Emissions Mitigation Strategies , Global carbon cycle and anthropogenic emissions	6
Unit-3	Mitigation Strategies: Carbon mitigation strategies: Renewable energy, energy efficiency, and sustainable land use. Role of carbon pricing, carbon markets, and carbon credits. Case studies on mitigation strategies	6
Unit-4	Carbon Capture Technologies. Introduction to carbon capture, utilization, and storage (CCUS). Carbon capture methods: Pre-combustion, post-combustion, and oxy-fuel combustion. Technologies for CO ₂ capture: Chemical absorption, adsorption, membranes, and cryogenic separation. Challenges and opportunities in CCUS	8
Unit-5	Carbon Storage and Utilization. Geological storage of CO ₂ : Deep saline aquifers, depleted oil and gas reservoirs. Mineral carbonation and ocean sequestration. Utilization of captured CO ₂ : Enhanced oil recovery, synthetic fuels, and chemicals Environmental risks and monitoring of carbon storage	8
Unit-6	Policies, Economics, and Innovations. International climate agreements: Paris Agreement, Kyoto Protocol, and IPCC guidelines. National policies for carbon management and climate change mitigation. Socio-economic aspects of carbon capture and climate change. Emerging technologies and innovations for carbon neutrality. Future directions and global efforts for sustainable development.	8
Total		42

Reference Book:

1	"Introduction to Modern Climate Change" by Andrew Dessler, Cambridge University Press.
2	"Carbon Capture and Storage" by Stephen A. Rackley, Butterworth-Heinemann.
3	"Global Warming: Understanding the Forecast" by David Archer, Wiley.
4	"Carbon Capture" by Jennifer Wilcox, Springer.
5	"Handbook of Climate Change Mitigation and Adaptation" by Wei-Yin Chen, Springer.
6	"Climate Change: The Science of Global Warming and Our Energy Future" by Edmond A. Mathez, Columbia University Press.
7	"Carbon Sequestration and Sustainable Development" by K. Lal and B. Singh, Springer.

Course Outcomes

CO1	Understand the science of climate change, its causes, and its impacts on the environment and society.
CO2	Analyze the principles, methods, and technologies used for carbon capture, utilization, and storage (CCUS).
CO3	Evaluate carbon mitigation strategies and their effectiveness in reducing greenhouse gas emissions.
CO4	Explore the socio-economic, policy, and legal aspects of climate change and carbon management.
CO5	Develop innovative and sustainable solutions to address climate challenges and promote carbon neutrality.
CO6	Applications of Carbon Capture and Climate Change

CO-PO/PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	2	3	2	1	2	2	2	1	2	3	2	3
CO2	3	3	2	2	3	3	2	2	1	2	1	1	3	3	3
CO3	3	1	1	3	2	2	3	2	2	3	2	2	3	2	2
CO4	1	2	2	1	2	3	1	2	3	1	3	3	1	3	2
CO5	2	2	1	3	1	3	2	2	3	3	2	1	2	3	1
CO6	3	3	3	3	3	2	2	2	1	1	1	2	3	2	3