

**Department of Petroleum Technology  
Dibrugarh University**

**Add-on Course:**

**Geo-Sequestration of Anthropogenic CO<sub>2</sub> with Enhanced Oil Recovery**

Duration: 3 months

Date of Commencement: 5<sup>th</sup> August 2024

Credits: 2

**By Dr. Ranjan Phukan**

**Overview of the course:**

*One of the best practices for reducing anthropogenic CO<sub>2</sub> levels in the atmosphere is the long-term storage of CO<sub>2</sub> in geological formations, including depleted oil/gas reservoirs, deep saline aquifers, and coalbeds. In particular, CO<sub>2</sub> storage in depleted oil/gas reservoirs has several advantages, including reduced exploration costs, proven traps for holding liquids/gases for millions of years, known reservoir properties, and existence of basic injection-production infrastructures. In addition, the injection of CO<sub>2</sub> into depleted oil reservoirs has special significance owing to the storage of CO<sub>2</sub> as part of the enhanced oil recovery (EOR) process. In this regard, reservoir rock-fluid interactions are key mechanisms influencing the recovery of trapped oil and promoting the trapping of injected gas for long-term CO<sub>2</sub> sequestration. Hence, this 3-month course will provide hands-on activity with reservoir rock, crude oil, formation water, and their interactions with CO<sub>2</sub> gas.*

*This add-on course is specially designed for those wishing to gain a comprehensive understanding of the various aspects of the anthropogenic CO<sub>2</sub> injection process for EOR and storage. Starting with an overview of different oil recovery methods, the course will present the global warming and climate change aspects associated with anthropogenic CO<sub>2</sub> emissions. Additionally, the anthropogenic CO<sub>2</sub> capture technology, transport options, and utilization or sequestration disposition will be illustrated. Furthermore, the course will provide a detailed understanding of the mechanisms responsible for CO<sub>2</sub>-EOR and geo-sequestration. Further, the latest information available on global anthropogenic CO<sub>2</sub> injection projects will be illustrated and the lessons learned. In addition, technologies promoting the efficient utilization of anthropogenic CO<sub>2</sub> for EOR and storage will be presented.*

### Course Contents:

Units	Contents	Contact hours			
		Lecture	Tutorial	Practical	Total
1	<i>Oil recovery methods.</i>	2			2
2	<i>CO<sub>2</sub> injection as an enhanced oil recovery method.</i>	3			3
3	<i>Effect of anthropogenic CO<sub>2</sub> emissions on global warming and climate change.</i>	3			3
4	<i>CO<sub>2</sub>Capture Methods and Technologies</i>	3			3
5	<i>CO<sub>2</sub>Transport and Utilization for Industrial Processes.</i>	3	1		3
6	<i>Anthropogenic CO<sub>2</sub>Storage and enhanced Oil recovery</i>	2	2		4
7	<i>CO<sub>2</sub>-reservoir rock-fluid Interactions.</i>	2	1	3	6
8	<i>Case Studies: Global CCUS Projects and Lessons Learned</i>	2	1		3
9	<i>At-scale deployment of anthropogenic CO<sub>2</sub> injection as CCUS Technology</i>	2	1	2	5
				<i>Total</i>	32

### Assessment Plan

Type	Description	Weightage	Marks
<i>End-course Exam</i>	<i>Written exam</i>	<i>60%</i>	<i>60</i>
<i>In-course Exam</i>	<i>Written test</i>	<i>15%</i>	<i>15</i>
	<i>Assignment- written report</i>	<i>15%</i>	<i>15</i>
	<i>Objective type test</i>	<i>10%</i>	<i>10</i>
<i>Total marks</i>			<i>100</i>

### Learning Outcome

*On completion of the course, participants are expected to be able to:*

- 1. Understand the different oil recovery methods, especially CO<sub>2</sub>-EOR.*
- 2. Perceive the importance of abating anthropogenic CO<sub>2</sub> emissions for climate change mitigation.*
- 3. Understand the different methods of carbon capture.*
- 4. Describe the mechanisms of CO<sub>2</sub>-EOR and geo-sequestration.*
- 5. Understand the CO<sub>2</sub>-rock-fluid interactions that promote EOR and CO<sub>2</sub>-storage.*

6. Gain knowledge about the different operational CCUS projects of the world.
7. Evaluate the feasibility of CCUS deployment in any regional scale.

**Books and References:**

1. Gerhard, Lee C., William E. Harrison, and Bernold M. Hanson, eds. *Geological perspectives of global climate change: AAPG Studies in Geology 47*. No. 47. AAPG, 2001.
2. Ampomah, William, Brian McPherson, Robert Balch, Reid Grigg, and Martha Cather. "Forecasting CO<sub>2</sub> sequestration with enhanced oil recovery." *Energies* 15, no. 16 (2022): 5930.
3. Divison, AAPG Energy Minerals. "Carbon Dioxide Sequestration in Geological Media: State of the Science, AAPG Studies in Geology 59." (2010).
4. Maroto-Valer, M. Mercedes, ed. *Developments and innovation in carbon dioxide (CO<sub>2</sub>) capture and storage technology: carbon dioxide (CO<sub>2</sub>) storage and utilisation*. Elsevier, 2010.
5. Rackley, Steve A. *Carbon capture and storage*. Butterworth-Heinemann, 2017.
6. Ganguli, Shib Sankar. *Integrated reservoir studies for CO<sub>2</sub>-enhanced oil recovery and sequestration: Application to an Indian mature oil field*. Springer, 2017.
7. Saini, Dayanand. *Engineering aspects of geologic CO<sub>2</sub> storage: synergy between enhanced oil recovery and storage*. Springer, 2017.
8. Bandyopadhyay, Amitava, ed. *Carbon capture and storage: CO<sub>2</sub> management technologies*. CRC Press, 2014.
9. Wilcox, Jennifer. *Carbon capture*. Springer Science & Business Media, 2012.
10. *Papers and Journals of Society of Petroleum Engineers (SPE)*.

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