Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NPED504	Unconventional Hydrocarbon Resources	3	0	0	3

Course Objective
• Introducing students to newer hydrocarbon resources including coalbed methane, gas hydrates, and shale oil/gas • Teaching exploitation strategies for these emerging energy resources
Learning Outcomes
• Familiar with newer resources for fossil fuel • Exposure to contemporary energy recovery processes

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction to unconventional hydrocarbon resources - global and Indian scenarios.	4	Updating the share of unconventional resources in energy basket
2	Coalbed methane: formation and properties of coalbed methane, generation of coalbed methane and its properties, properties of coal as reservoir rock. Reserve estimation. Thermodynamics of coalbed methane and isotherm studies. Overview of drilling and production systems of coalbed methane wells.	5	students will know how the generation of CBM, identification of sweet spot, finding out volume of gas, and processes of exploitation of CBM
3	Hydro-fracturing of coal seams; Testing of coalbed methane wells; treating and disposal of produced water.	5	How to enhance CBM production through fracturing and assessment of reservoir properties and extent of reservoir. To understand, what to do with the huge volume of produced water.
4	Natural gas hydrates: formation, accumulation and properties of gas hydrates.Thermodynamics, kinetics and phase behavior of gas hydrates. Drilling and production systemsfor gas hydrate wells.	6	Knowledge about (i) the gas hydrate formation and dissociation through thermodynamic point of view (ii) what are kinds of special precaution need to be taken during drilling and production compared to that of conventional hydrocarbon production
5	Extraction technologies from gas hydrates. Uses and applications of gas hydrates.	6	Overview about the special technologies adopted for gas hydrate exploitation and its application in transportation and energy consumptions.
6	Shale gas and oil: nature, origin and distribution of shale gas and oil, and characterization of shale for production of shale gas and oil.	5	Understanding about the shale as reservoir, its characteristics to restore oil/gas, finding sweet spot.
7	Extraction methods of shale gas and oil: development of current practices, location and size of production areas. Estimated reserves and economics.	6	Developing knowledge about the required characteristics and volume of oil/gas for economic production through available techniques
8	Environmental issues in shale gas exploration, markets and global impact on energy scenario, and economic factors controlling shale gas and oil production.	5	What are facts involved in productions and whether they cause environmental issues during production of shale oil/gas, with special emphasis on the HF job and its impact. Students shall have understanding whether gas from shale can change the energy scenario of country with example of USA shale gas production.
	Total	**42**	

Text Books:

1. Unconventional Oil and Gas Resources – Exploitation and Development, Y. Zee Ma and Stephen Holdich, CRC Press, 2016.
2. Advanced Reservoir and Production Engineering for Coalbed Methane, Pramod Thakur, Gulf Publishing, 2016.
3. A Guide to Coalbed Methane (i) Operations & (ii) Reservoir Engineering: Gas Research Institute,Chicago, Illinois, U.S.A.
4. Natural Gas Hydrates, John Carroll, Elsevier, 2014