Course Type	Course Code	Name of the course	L	T	P	Credits
DC	NFMC525	Energy Technology	3	1	0	4

Course Objective

- To understand the processing and limitations of fossil fuels (coal, petroleum and natural gas)
- Necessity of harnessing alternate energy resources such as solar, wind, nuclear, geothermal, tidal and biomass.
- To understand and practice various characterization techniques for fuels.

Learning Outcomes

At the end of this course, students will be able to

- Know about conventional energy resources and their effective utilization
- Knowledge of modern energy conversion technologies, identify available non-conventional (renewable) energy resources and
- Techniques to utilize the conventional and non-conventional resources effectively

Unit No.	Topics to be Covered	Lecture Hours	Tutorial hours	Learning Outcome
1.	**Basics of Energy Systems:** Zeroth & First law of Thermodynamics, Entropy & Exergy analysis: case study, Enthalpy of reaction, Maximum temperature in combustion. Analytical models of coal combustion.	4	1	Basics of energy systems
2.	**Energy from coal combustion:** Fluidized Bed Combustion; pressurizedpulverized coal combustion, pressurized oxy-fuel combustion, Calcium and Chemical looping combustion, Co-firing technologies; Supercritical/Ultra-supercritical CO2 power cycles	8	3	Understanding about different coal combustion systems
3.	**Advanced Combustion methods:** Dry low NOx (DLN) systems; External Combustion cycles- Gas turbine & Stirling cycles; gas turbine cogeneration systems; IC engines cogeneration systems; Binary Cycle. Geological CO_2 sequestering	8	3	Understanding advanced combustion in IC engines
4.	**Energy from coal gasification:** Coal Gasifier for Power and Chemical Production; Integrated Gasification Combined Cycle (IGCC); Direct and indirect energy conversion in thermochemical, electrochemical, thermomechanical and other processes. Underground coal gasification, Carbon capture utilization and storage.	9	3	Understanding about coal gasification systems, other thermomechanical systems
5.	**Derived Fuels:** Production and utilization of secondary fuels from coal gasification like Ammonia, Methanol, Ethanol, Urea, DME, etc. Biochar, Syngas DRI.	4	1	Understanding the utilization of fuels derived from coal gasification

6.	**Introduction of Hydrogen Energy Systems:** Hydrogen pathways introduction – current uses, General introduction to infrastructure requirement for hydrogen production, storage, dispensing and utilization, and Hydrogen production in power plants. Fuel cell fundamentals, Alkaline fuel cell, Acidic fuel cells, SOFC, Emerging areas in Fuel cells. Battery vehicles, Electric vehicles. Case studies on techno economics of energy technologies.	9	3	Understanding about hydrogen production and application in different fuel cells, batteries etc.
	Total	**42**	**14**	

TextBooks:

1. Gupta, O. P. Energy Technology. Khanna Publishers, 2018.
2. S. Rao, B.B. Parulekar, Energy Technology, Khanna Publishers, 1994.

ReferenceBooks:

1. Zobaa, Ahmed F., and Ramesh C. Bansal, eds. Handbook of renewable energy technology. World Scientific, 2011.
2. Kishore, V. V. N., ed. Renewable energy engineering and technology: principles and practice. The Energy and Resources Institute (TERI), 2010.