

ME424 Sustainable Energy Technologies										
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	-

Objective: The key objective of this course is to understand the basics of sustainable energy, solar energy system and wind energy systems.

Syllabus		Contact Hours
Unit-1	Introduction to Sustainable Energy. Global energy challenges and the need for sustainable energy technologies; Principles of sustainability and carbon-neutral strategies; Overview of renewable energy sources and their potential; Energy efficiency and demand-side management	6
Unit-2	Solar Energy Systems. Solar energy: Photovoltaic systems, solar thermal applications, and concentrated solar power (CSP)	6
Unit-3	Wind Energy Systems Wind energy: Aerodynamics, wind turbines, wind resource assessment, and offshore wind farms. Integration of solar and wind energy into power grid.	8
Unit-4	Bioenergy and Waste-to-Energy Technologies. Biomass conversion technologies: Combustion, gasification, and anaerobic digestion. Production of biofuels: Biogas, biodiesel, and bioethanol. Energy recovery from municipal solid waste and industrial waste. Environmental impact and economic feasibility of bioenergy systems	8
Unit-5	Energy Storage and Hybrid Energy Systems. Energy storage technologies: Batteries, thermal energy storage, compressed air energy storage (CAES), and hydrogen storage. Role of energy storage in renewable energy integration. Design and optimization of hybrid energy systems. Case studies: Hybrid systems for rural and urban applications	8
Unit-6	Emerging Non-Conventional Energy Technologies. Smart grids and digitalization in energy systems. Role of artificial intelligence and IoT in energy optimization. Innovations in tidal, wave, and geothermal energy technologies. Global and national energy policies for promoting sustainable energy. Future challenges and opportunities in sustainable energy	6
	Total	42

Reference Book:	
1	"Non-Conventional Energy Resources" by B.H. Khan, McGraw-Hill.
2	"Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle, Oxford University Press.
3	"Energy and the Environment" by James A. Fay and Dan S. Golomb, Oxford University Press.
4	"Solar Energy: Principles of Thermal Collection and Storage" by S.P. Sukhatme and J.K. Nayak, Tata McGraw-Hill.
5	"Sustainable Energy: Choosing Among Options" by Jefferson W. Tester et al., MIT Press.
6	"Handbook of Renewable Energy Technology" by Ahmad Hemami, Wiley.
7	"Biomass to Renewable Energy Processes" by Jay Cheng, CRC Press.
8	"Energy Storage: Systems and Components" by Alfred Rufer, CRC Press.
9	"Smart Grid: Fundamentals of Design and Analysis" by James Momoh, Wiley-IEEE Press.

Course Outcomes

CO1	Understand the global energy scenario, the need for sustainability, and the role of sustainable energy technologies.
CO2	Analyze the principles and applications of renewable energy systems, including solar, wind, and biomass.
CO3	Evaluate advanced energy storage solutions for enhancing renewable energy integration.
CO4	Design hybrid energy systems and assess their technical, economic, and environmental viability.
CO5	Explore emerging trends in smart grids, AI-based energy management, and energy policy frameworks for sustainability.
CO6	Applications of Sustainable Energy Technologies

CO-PO/PSO Matrix

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