	National Institute of Technology Meghalaya An Institute of National Importance	**CURRICULUM**

Programme	**Master of Technology**	Year of Regulation	**2025**
Department	**Civil Engineering**	Semester	**I**

Course Code	Course Name	Pre-requisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
CE 537	**Sustainable Energy Generation and its Use**	**NIL**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	Course Outcomes		
1. To understand the principles and technologies of sustainable energy generation. 2. To explore the environmental, economic, and social implications of different renewable energy systems. 3. To analyze energy conversion efficiency, resource potential, and sustainability of renewable energy systems. 4. To evaluate the integration of sustainable energy into existing infrastructure and policies. 5. To develop skills to design and assess sustainable energy systems for environmental applications.		CO1	Able to identify and explain various sources of sustainable and renewable energy..
		CO2	Able to Analyze the environmental impacts and benefits of sustainable energy generation.
		CO3	Able to evaluate the efficiency and feasibility of different renewable energy technologies.
		CO4	Able to design energy systems considering sustainability, local resources, and technological options.
		CO5	Able to assess policies, regulations, and incentives related to renewable energy development.

SYLLABUS

No.	Content	Hours	COs
I	**Introduction to Sustainable Energy:** Overview of global and Indian energy demand and supply; Concept of sustainability and clean energy; Classification of energy sources: renewable vs non-renewable; Climate change, carbon emissions, and energy challenges.	6	CO1, CO2
II	**Solar Energy:** Solar radiation and its measurement; Photovoltaic systems: working, components, and performance; Solar thermal systems: collectors, applications; Grid-connected and off-grid systems.	6	CO2, CO3, CO4
III	**Wind and Hydro Power:** Wind energy fundamentals, wind turbine types, power curve; Wind farm design and energy generation; Small hydro and micro-hydro power plants; Site selection and environmental impact.	5	CO2, CO3, CO4
IV	**Bioenergy and Waste-to-Energy:** Biomass resources and classification; Biogas generation and applications; Biofuels: biodiesel, ethanol, algae-based fuels; Waste-to-energy technologies: incineration, gasification, anaerobic digestion	7	CO2, CO3, CO4
V	**Energy Efficiency and Smart Systems:** Energy conservation principles and audit techniques; Energy efficiency in buildings and industries; Smart grids, net metering, and demand-side management; Energy storage technologies (battery, pumped hydro, etc.).	9	CO4, CO5
VI	**Policy, Economics, and Life Cycle Assessment:** National Renewable Energy Mission and MNRE initiatives; Renewable Energy Service Companies (RESCOs) and financing models; Life Cycle Assessment (LCA) of energy systems; Case studies: solar parks, wind farms, bioenergy projects in India.	9	CO4, CO5
	Total Hours	**42**	

Essential Readings

1. **Boyle, G.** – *Renewable Energy: Power for a Sustainable Future*, Oxford University Press, 2012
2. **Twidell, J. & Weir, T.** – *Renewable Energy Resources*, Routledge, 2019.
3. **Kothari, D.P., Singal, K.C., & Ranjan, R.** – *Renewable Energy Sources and Emerging Technologies*, PHI Learning, 2011

Supplementary Readings

1. MNRE and IREDA Guidelines and Reports (Government of India), 2022.