GANPATUNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma in Petrochemical Technology / Chemical Engineering				
Semester	IV		Version	1.0.0.0	
Effective from Academic Year	2026-27		Effective for the batch Admitted in	JULY 2025	
Course code	1PCT4105	Course Name	Renewable Energy		

I.TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Type	Course Code	Learning Scheme						Assessment Scheme										
		Actual Contact Hrs./Week			SLH	NLH	Credits	Theory				Practical				Based on SL		Total Marks
								FA-TH	SA-TH	TOTAL		FA-PR	SA-PR	TOTAL		SLA		
		CL	TL	LL				MAX	MAX	MAX	MIN	MAX		MAX	MIN	MAX	MIN	
DSC	1PCT4105	2	-	0	2	4	2	40	60	100	40	-	-	-	-	20	8	120

Abbreviation :	**CL**- Classroom Learning	**TL** - Tutorial Learning	**LL** - Laboratory Learning
	SLH - Self Learning Hours	**NLH** - Notional Learning Hours	**SLA** - Self Learning Assessment
	FA - Formative Assessment (Term work +Mid Sem Exam +Attendance)		**SA** - Summative Assessment

II. PRE-REQUISITES

Basic knowledge of energy sources, environmental science, and elementary physics.

III. INDUSTRY /EMPLOYER EXPECTED OUTCOMES

Industry expects diploma engineers to understand renewable energy sources, basic system components, sustainability concepts, and the role of renewable energy in reducing dependence on fossil fuels.

IV. COURSE LEARNING OUTCOMES

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

CO1: Explain the need for renewable energy and global energy scenario
CO2: Describe solar energy systems and their applications
CO3: Explain biomass and wind energy technologies
CO4: Explain emerging renewable energy sources and energy storage systems

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Name of Unit	Theory Learning outcomes(TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes(TLO's)&CO's	Marks	Hours
Unit 1: Introduction to Renewable Energy	**TLO 1.1** Explain environmental impacts of fossil fuel–based energy **TLO 1.2** Define renewable energy and sustainability concepts **TLO 1.3** Classify various renewable energy sources **TLO 1.4** Explain the importance of renewable energy in sustainable development	**1.1** Environmental consequences of fossil fuels **1.2** Need and importance of renewable energy **1.3** Sustainable development concepts **1.4** Types of renewable energy sources **1.5** Limitations of renewable energy **1.6** Indian and global energy scenario	**12**	**06**

	TLO 1.5 Describe limitations and challenges of renewable energy sources **TLO 1.6** Explain present Indian energy scenario			
Unit 2: Solar PV and Solar Thermal Systems	**TLO 2.1** Explain solar radiation and its measurement **TLO 2.2** Describe solar thermal power generation methods **TLO 2.3** Explain central receiver power plants and solar ponds **TLO 2.4** Explain the principle of solar photovoltaic conversion **TLO 2.5** Classify different types of solar PV systems **TLO 2.6** Explain PV cell, module, and array concepts **TLO 2.7** Describe applications of solar energy systems	**2.1** Solar radiation and measurement **2.2** Solar thermal power plants **2.3** Central receiver systems and solar ponds **2.4** Thermal energy storage (PCM) Solar photovoltaic principle **2.5** Types of PV systems and solar cells **2.6** I–V characteristics, efficiency, MPPT, applications **2.7** applications of solar energy systems	**15**	**08**
Unit 3: Biomass and Wind Energy	**TLO 3.1** Define biomass energy and its sources **TLO 3.2** Explain biomass energy conversion processes **TLO 3.3** Describe biomass cogeneration systems **TLO 3.4** Explain environmental benefits of biomass energy **TLO 3.5** Explain the principle of wind energy conversion **TLO 3.6** Describe components and working of wind power plants	**3.1** Biomass resources and energy **3.2** Biomass conversion technologies **3.3** Biomass cogeneration **3.4** Environmental benefits **3.5** Wind energy basics **3.6** Wind power plant components and working	**16**	**08**
Unit 4: Other Renewable Energy Sources and Energy Storage	**TLO 4.1** Explain geothermal energy and its applications **TLO 4.2** Explain tidal energy and tidal power plants **TLO 4.3** Describe wave energy conversion systems **TLO 4.4** Explain ocean thermal energy conversion (OTEC) **TLO 4.5** Explain hydrogen production and storage methods **TLO 4.6** Explain fuel cell principle and types **TLO 4.7** Explain energy storage and hybrid energy systems	**4.1** Geothermal energy **4.2** Tidal energy (barrage and non-barrage) **4.3** Wave energy devices **4.4** OTEC **4.5** Hydrogen production and storage **4.6** Fuel cells: principle, types, applications **4.7** Energy storage systems and hybrid energy systems	**17**	**08**

VI. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

- Conduct a survey to identify the use of solar, wind, or biomass energy in nearby homes, industries, or institutions. Prepare a brief report highlighting benefits and challenges.
- Study a grid-connected or rooftop solar power plant. Prepare a report covering system components, capacity, advantages, and limitations.
- Prepare a comparative chart showing efficiency, cost, environmental impact, and sustainability of renewable vs. conventional energy sources.
- Identify locally available biomass resources and suggest possible methods for energy conversion.
- Prepare a PPT/poster on any emerging energy technology such as hydrogen energy, fuel cells, and tidal energy.

VII. LIST OF REFERENCE BOOKS

Sr. No.	Title	Author	Publication
1	Photovoltaic Systems: Analysis and Design	A.K.Mukerjee and Nivedita Thakur	PHI Learning Private Limited, New Delhi
2	Sustainable Energy	Richard A. Dunlap	Cengage Learning India Private Limited, Delhi
3	Renewable energy	Godfrey Boyle	Oxford University Press in association with the Open University, 2004
4	Non-conventional Energy resources	ShobhNath Singh	Pearson Education

VIII. LINK OF LEARNING WEB RESOURCE

1	https://nptel.ac.in
2	https://www.vlab.co.in
3	https://www.irena.org
4	https://www.eia.gov/energyexplained/renewable-sources

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Fundamentals of Industrial Sustainability	CO1	06	03	06	03	12
2	Resource Efficiency in Chemical and Petrochemical Industries	CO2	08	04	08	03	15
3	Industrial Waste Management and Circular Economy	CO3	08	03	09	04	16
4	Environmental Governance and Green Practices	CO4	08	03	09	05	17
	Grand Total		**30**	**13**	**32**	**15**	**60**

X. COs AND POs AND PSOs MAPPING

Course outcome (Cos)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	1	2	2	2	1
CO2	2	3	2	2	3	1	2	3	2	1
CO3	2	3	3	2	3	2	2	3	3	1
CO4	2	2	2	1	3	2	3	2	3	2

Legends: - *3- High 2-Moderate/Medium 1-Slight/Low 0-None*