

25MEET302	SUSTAINABLE ENERGY SOURCES	Category	L	T	P	R	Credit	Year of Introduction
		VAC	4	0	0	0	4	2025

Preamble: This course introduces current and emerging energy systems, their extraction, conversion, and applications, with emphasis on meeting regional and global energy needs sustainably and enhancing awareness of sustainability issues.

Prerequisite: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Explain the concept and need of sustainability.	K2 Understand
CO2	Apply the working principles of solar photovoltaic and wind energy systems to generate electrical energy.	K3 Apply
CO3	Explain the concept of energy production from ocean, geothermal and hydropower	K2 Understand
CO4	Apply the principles of biomass energy conversion to produce energy for practical applications.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	2	3	2	-	-	1	2	-
CO2	3	2	1	-	-	2	3	-	-	-	1	2	1
CO3	3	2	1	-	-	2	3	-	-	-	1	2	1
CO4	3	2	1	-	-	2	3	-	-	-	1	2	1
Avg	3	2	1	-	-	2	3	2	-	-	1	2	1

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*	-	*	-	*
CO2	*	*	*	*	*	-	*	-	*
CO3	*	*	*	*	*	-	*	-	*
CO4	*	*	*	*	*	-	*	-	*

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*	-	*	-	*

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
00	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance	: 5 marks
Continuous Assessment Test	: 20 marks
Continuous Assessment Assignment	: 15 marks

SYLLABUS

Module 1 (13 Hours)

Introduction and Energy Fundamentals- Sustainability, Need and concept of sustainability, Social, environmental and economic sustainability concepts, Sustainable development, Challenges for sustainable development-Increasing energy demand and climate change

General classification of energy- Conventional and non-conventional, Global and Indian energy sources, Environmental aspects of energy utilization, Energy planning, Renewable energy sources, potentials, achievements and applications

Module 2 (13 Hours)

Solar Energy- Solar radiation, Solar thermal systems-Flat plate and concentrating collectors, Solar desalination, Solar Pond, Solar dryers, Solar cookers, Solar thermal electric power plant, Solar photovoltaic conversion, Merits, and limitations of solar energy

Wind Energy – Availability of wind energy, Site characteristics, Wind turbine types, Wind power plants, Merits and limitations of wind energy Carbon footprint, global uptake, and future possibilities for solar and wind energy

Module 3 (15 Hours)

Production of ocean, geothermal and hydro energy-Ocean thermal electrical conversion, Tidal energy conversion Geothermal energy conversion -Hydropower-Global and Indian scenario - Positive and negative attributes of hydropower-Electricity from hydropower - Small hydro plants.
Carbon footprint, global uptake and future possibilities for ocean, geothermal and hydropower.

Module 4 (15 Hours)

Energy production from biomass and wastes-Biomass resources, Biomass conversion technologies- direct combustion, pyrolysis, biomass gasification, Biogas production, Bioethanol, Biodiesel, Hydrogen as fuel, Biohydrogen production, Storage of hydrogen, Carbon footprint, global uptake and future possibilities for bioenergy.

Fuel cells-types and applications.

Case Studies – Sustainability assessment of conventional energy systems, Sustainability assessment of alternative energy systems.

Text Books:

1. Boyle, G. (2012). *Renewable energy* (3rd ed.). Oxford University Press.
2. Bansal, N. K., Kleemann, M., & Meliss, M. (1990). *Renewable energy sources and conversion technology*. Tata McGraw-Hill.
3. Rai, G. D. (2011). *Non-conventional energy sources*. Khanna Publishers.

Reference Books:

1. Johnson, G. L. (1995). *Wind energy system*. Prentice Hall Inc.
2. Earnest, J., & Wizelius, T. (2015). *Wind power plants and project development* (2nd ed.). PHI Learning Pvt. Ltd.
3. Rai, G. D. (1995). *Solar energy utilization*. Khanna Publishers.
4. Sayigh, A. A. M. (1977). *Solar energy engineering*. Academic Press.
5. Abbasi, S. A., & Abbasi, N. (2001). *Renewable energy sources and their environmental impact*. Prentice Hall of India.
6. Khan, B. H. (2009). *Non-conventional energy resources*. Tata McGraw-Hill.
7. Sawhney, G. S. (2012). *Non-conventional energy resources*. PHI Learning

END SEMESTER EXAMINATION – MODEL QUESTION PAPER (STC 2025 SCHEME)

Course Code	25MEET302
Course Name	SUSTAINABLE ENERGY SOURCES

Max. Marks: 60	Duration: 2.5 Hours
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Part A <i>(Answer all questions. Each question carries 3 marks)</i>				
Qn No.	Question	Marks	CO	BL
1	Classify energy sources into conventional and non-conventional categories with examples.	3	1	L2
2	Summarize the role of energy planning in sustainable development.	3	1	L2
3	Apply the principle of solar desalination for freshwater production.	3	2	L3
4	Demonstrate the operation of a flat plate collector used in solar thermal applications.	3	2	L3
5	Explain the principle of geothermal energy conversion.	3	3	L2
6	Describe the features of small hydro power plants.	3	3	L2
7	Apply the principle of biomass gasification to produce useful energy.	3	4	L3
8	Demonstrate the application of flywheel energy storage in power systems.	3	4	L3
Part B <i>(Answer any one full question from each Module. Each carry 9 marks)</i>				
Module I				
9	Explain the environmental impacts associated with energy utilization and discuss measures for sustainable energy use.	9	1	L2
OR				
10	Interpret the relationship between sustainability, energy utilization, climate change, and renewable energy development.	9	1	2
Module II				
11	Apply the operating principles of various wind turbine types to evaluate their performance in wind energy conversion.	9	2	L3
OR				

12	Demonstrate the significance of carbon footprint, global uptake, and future possibilities of solar and wind energy technologies for sustainable development.	9	2	L3
Module III				
13	Describe the working of tidal energy conversion systems and discuss their advantages and limitations.	9	3	L2
OR				
14	Explain the working principles of OTEC, tidal energy conversion, and geothermal energy conversion systems.	9	3	L2
Module IV				
15	Execute the selection of flywheel, compressed air, battery, and pumped hydro energy storage systems based on their characteristics and applications.	9	4	L3
OR				
16	Implement the production processes of biogas, bioethanol, and biodiesel for renewable energy applications.	9	4	L3
