SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Bachelor of Technology

Mechanical Engineering Department

B. Tech. Semester V

Course Name: **Non-conventional Energy Systems** **Course Code: BTME19553**

Type of course: **Minors - Alternate Energy Systems**

Prerequisite: Nil

Rationale of Course: The students will able to understand basic concepts of new evolving renewable energies such as solar energy, bio energy, wind energy, etc. They will be able to think a new solutions which provide alternates for conventional fuel consumption.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
4	0	2	5	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Current Energy Scenarios:** Present energy scenario of conventional and renewable sources, requirement of alternate energy sources, need of renewable energy sources, limitations of renewable energy.	4	6%
2.	**Basics of Solar Energy:** Solar radiation outside the earth's atmosphere and at the earth's surface, Instruments for measuring solar radiation and sunshine, energy available from the sun, spectral distribution, solar radiation geometry, empirical equations for prediction of availability of solar radiation on horizontal and tilted surface.	15	25%

Sr. No.	Topics	Teaching Hrs.	Module Weightage
3.	**Solar Energy Applications:** Construction and working of solar liquid flat plate collector, solar air heater, cylindrical parabolic collector, compound parabolic collector, paraboloid dish collector, central receiver collector, solar energy thermal storage, solar pond, solar cooker, solar still, solar drier, heliostat, solar furnace, photovoltaic system for power generation, photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and disadvantages.	**15**	**25%**
4.	**Wind Energy:** Energy available from wind, basics of lift and drag, basics of wind energy conversion system, wind mill rotors, horizontal and vertical axes rotors, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind farm, Safety and environmental aspects, wind energy potential and installation in India.	**10**	**18%**
5.	**Bio Energy**: Biomass energy – modern energy carrier, energy plantation, gasification, types and applications of gasifiers, types of biogas plants, factors affecting biogas generation, advantages and disadvantages.	**6**	**10%**
6.	**Other Energy Sources**: Ocean and wave thermal energy conversion principle, open, closed and hybrid cycle OTEC system, energy from tides, estimation of tidal power, tidal power plants, single and double basin plants, site requirements, advantages and limitations Geothermal energy introduction, vapor and liquid dominated systems, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications.	**10**	**16%**

Percentage Distribution of Marks as per Bloom's Taxonomy (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**15**	**25**	**25**	**15**	**10**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher	Publication year	Publication edition
1.	Solar Energy: Principles of Thermal Collection and Storage	S. P. Sukhatme and J. K. Nayak	McGraw Hill Publishing Company Ltd.	2016	4th
2.	Solar Engineering of Thermal Processes, Photovoltaics and Wind	John A. Duffie, William A. Beckman	John Wiley, New York	2020	5th
3.	Principles of Solar Engineering	D. Y. Goswami, F. Kreith and J. F. Kreider	CRC Press, Taylor and Francis.	2014	3rd
4.	Solar Energy: Fundamentals and Applications	H. P. Garg and Jai Prakash	McGraw Hill Publishing Company Ltd.	2017	2nd
5.	Engineering Thermodynamics of Thermal Radiation for Solar Power Utilization	R. Petela	McGraw Hill Publishing Company Ltd.	2010	1st

Course Outcomes (CO's):

CO. No.	CO Statements After learning this subject, students will be able to	Marks % weightage
CO-1	Identify and recognize the various renewable energy specifically solar energy	20
CO-2	Analyze and design the performance of various solar applications.	40
CO-3	Determine the potential of wind energy conversion systems.	20
CO-4	Illustrate Bio energy, Wave energy, Ocean energy and Geothermal Energy.	20

Mapping of (CO's) with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO-1	3	3	1	0	1	3	2	0	1	0	2	1			
CO-2	3	2	3	2	2	2	1	0	1	0	2	1			
CO-3	1	1	1	0	0	1	2	0	0	0	0	2			
CO-4	1	1	1	0	1	2	1	0	0	0	0	2			
Rationale*	**8**	**7**	**6**	**2**	**4**	**8**	**6**	**0**	**2**	**0**	**4**	**6**			

Rationale - Mapping of CO's with PO's and CO's with PSO's:
It states that the course will develop engineering knowledge, addresses societal, health and environmental issue with the aid of knowledge of renewable energy.

This course highly maps with Program outcomes 1,2,3,6,7,12. it states that the course will develop Engineering knowledge, Problem analysis, Design / development of solutions, The engineer and society, Environment and sustainability, Life-long learning.

List of Practical:

1. To study and measure the solar radiation on horizontal and tilted surface using solar radiation measuring instruments.
2. To evaluate the performance of solar liquid flat plate collector.
3. To study the performance of solar air heater.
4. To study the performance of concentrating collectors.
5. To evaluate the performance of solar still.
6. To evaluate the performance of box type solar cooker.
7. To study the various types of wind mill and evaluate the performance parameter of wind mill.
8. To study the various types of gasifier and biogas plant.
9. To study the ocean energy, wave energy, geothermal energy conversion systems.

Major Equipment:

1. Solar power meter
2. Solar liquid flat plate collector
3. Box type solar cooker
4. Solar still

List of open learning website:

1. **https://nptel.ac.in/courses/115103123**