SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Bachelor of Technology

Mechanical Engineering Department

B. Tech. Semester VI

Course Name: **Renewable Energy Engineering** **Course Code: BTME14611**

Type of course: **Professional Elective Course**

Prerequisite: Fundamental knowledge of fluid mechanics and heat transfer.

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	100
3	0	0	3	60	25	15	0	0	

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.	2	5%
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.	14	30%

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.	**14**	**30%**
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, wind energy potential and site selection, basics of wind farm, Safety and environmental aspects, wind energy potential and installation in India.	**8**	**18%**
5.	**Other Energy Sources**: Biomass energy – modern energy carrier, energy plantation, gasification, types and applications of gasifiers, types of biogas plants Ocean and wave thermal energy conversion principle, open, closed and hybrid cycle OTEC system Geothermal energy introduction, vapor and liquid dominated systems, binary cycle.	**7**	**17%**

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	PS O 1	PS O 2	PS O 3
CO-1	3	3	1	0	1	3	2	0	1	0	2	1	2	1	1
CO-2	3	2	3	2	2	2	1	0	1	0	2	1	3	2	2
CO-3	1	1	1	0	0	1	2	0	0	0	0	2	1	1	1
CO-4	1	1	1	0	1	2	1	0	0	0	0	2	1	0	0
Rationale*	**8**	**7**	**6**	**2**	**4**	**8**	**6**	**0**	**2**	**0**	**4**	**6**	**7**	**4**	**4**

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 and Program Specific Outcomes 1. 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 and finally it will lead to, convert conceptual knowledge of mechanical engineering to real life application.

Assignments to be given as per the requirement of the course.

List of open learning website:

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