SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B.Tech. Semester VI

Subject Name: Renewable Power Generation Systems **Subject Code: BTEL14624**

Type of course: **Professional Elective Courses**

Prerequisite: **Fundamental knowledge of electrical machines and power electronics**

Rationale: Renewable energies are sources of clean, inexhaustible and increasingly competitive energy**.** They differ from fossil fuels principally in their diversity, abundance and potential for use anywhere on the planet, but above all in that they produce neither greenhouse gases – which cause climate change – nor polluting emissions**.** Their costs are also falling and at a sustainable rate, whereas the general cost trend for fossil fuels is in the opposite direction in spite of their present volatility. This subject deal with various renewable energy resources available in the country, their potential, exploitation/achievements Also the subject Illustrate the concept about the various types of energy technology and power generation system.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	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

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**INTRODUCTION** Conventional energy sources and their limitations, present status of renewable energy sources, most popular renewable energy sources, installed across the globe and scenario of India, potential of renewable energy sources for power generation.	3	6
2.	**WIND ENERGY CONVERSION** Introduction, History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions. Types of wind turbines and their characteristics, wind data and	13	31

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	energy estimation, basic components of wind electric conversion system, types of electrical machines suitable for wind energy conversion,		
3.	**SOLAR ENERGY CONVERSION** Introduction, solar irradiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability, solar tracking mechanism Solar thermal energy and solar thermal power plant, efficiency, Basics of solar cell and its physics and working principle, photovoltaic cell/module characteristics and effects of insolation and temperature variations, operating efficiency, maximum power point tracking, power electronic interface for solar PV system, Solar PV applications (domestic loads, battery storage, and irrigation), grid connected PV systems.	**14**	**31**
4	**BIOMASS ENERGY** Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass **GEOTHERMAL ENERGY** Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: **THER ENERGY SOURCES** Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell: Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.	**08**	**16**
5	**HYBRID ENERGY SYSTEMS** Need of hybrid energy system, types of hybrid systems and sources (PV-diesel-battery, wind-PV, fuel cell-PV), advantages and limitations of hybrid systems.	**07**	**16**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**20**	**20**	**20**	**20**	**00**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

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

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Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Recognize the limitations of the conventional energy sources and examine potential of wind and solar energy conversion.	6
CO-2	Explain and demonstrate the working principle of wind energy conversion.	31
CO-3	Explain and demonstrate the working principle of solar energy conversion, maximum power tracking algorithms and power electronics interface.	31
CO-4	Explain and demonstrate the working principle of Biomass, Tidal and other renewable energy conversion.	16
CO-5	Identify and select the suitable energy sources for hybrid energy system	16

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO-1	3	1	2	1		2	3					3			3
CO-2	3	3	3	3		1	3						3	3	
CO-3	3	3	3	3		1	3						3	3	
CO-4	3	3	3	3	3	1	3				2		3	3	
CO-5	3	1	2	3	3	1	3				2		3	3	
Rationale*															

Rationale*: Explaining why it is matching this particular program outcome

LIST OF PRACTICALS:

1. Generation of wind speed sequence using wind model.
2. Development of Wind Turbine Model
3. FOC based active and reactive power control of wind energy conversion system
4. DTC based active and reactive power control of wind energy conversion system
5. DPC based active and reactive power control of wind energy conversion system

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6. Study of I-V Characteristic of a solar cell illuminated by an incandescent lamp, at different frequencies
7. Practical Performance Evaluation of Maximum Power Point Tracking Algorithms of a Photovoltaic System.
8. To study and simulate Grid-connected PV system with boost converter and inverter
9. To study and simulate PV–wind hybrid system
10. To study the biogas plant
11. Simulate hybrid system of renewable energy sources.

Reference Text Books:

Sr. No	Title of book / Article	Authors(s)	Publishers and details like ISBN	Year of publication	Publication Edition
1	Solar Energy - Principles of Thermal Collection and Storage	J. K. Nayak and S. P. Sukhatme	978-0-07-026064-1 Tata Mcgraw Hill	2017	**2nd and 3rd edition**
2	Solar Photovoltaics: Fundamental, Technologies and Applications	Chetan Singh Solanki	978-81-203-5111-0 PHI Learning Pvt. Limited	2011	**2nd edition**
3	Wind Energy Systems	Gary L. Johnson	978-0139577543 Prentice Hall	1985	**1st edition**
4	Solar Energy: Fundamentals, Technology and Systems, Delft University of Technology	Olindo Isabella, Klaus Jager, Arno Smets	9781906860325 UIT Cambridge Ltd.	2016	
5	Wind Power in Power Systems	Thomas Ackermann	0-470-85508-8 John Wiley & Sons Ltd.	2005	
6	A few IEEE review papers and industrial application notes.				

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