CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Mechanical Engineering)**

Semester: **V**

Course Code: **202090505**

Course Title: **Alternate Energy Sources**

Course Group: **Professional Elective Course-I**

Course Objectives: The course is designed to provide knowledge of need and importance of Alternate Energy Sources and understanding of the future energy supply systems.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction:** World's Production and Reserves of Commercial Energy Sources, India's Production and Reserves of Energy Sources, The need for Alternate Energy Sources, Types of Alternate Energy Sources and their contribution in power production, Future Energy Scenario.	4
2	**Solar Energy Basics:** Energy Available in Sun, Solar Radiation and Sunshine Measuring Instrument, Solar Radiation Geometry, Predicting the Availability of Solar Radiation, Solar Radiation on Tilted Surface, Types of Solar Energy Collectors, Flat Plate Collectors, Thermal Analysis of Flat Plate Collectors, Types Concentrating Collectors and its working, Solar Thermal Energy Storage System.	9
3	**Applications of Solar Energy:** Solar PV-Systems – Solar Cell Working Principle, Components of Solar PV Power Generation Plant, Solar Cell Modules and Connections, ROI of PV Systems, Solar Thermal Power Plant, Solar Still, Solar heating and Cooling of Buildings, Solar Cooking, Solar Water Pump, Solar Green-House.	8

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4	**Bio-Energy:** Types of Biomass, Routes of Biomass Conversion, Thermo-chemical Conversion Processes, Types of Gasifiers, Bio-Chemical Conversion Processes, Types of Biogas Plants, Factors affecting Biogas Generation, Ethanol Production.	**9**
5	**Wind-Energy**: Wind Generation Principle, Types of Wind, Working Principle of Wind Energy Conversion System (WECS), Power Available in Wind, Wind Power Equation, Wind Power Coefficient, Classification of WECS, Working of Horizontal and Vertical Axis Wind Turbines, Forces acting of Wind Turbine, Site Selection.	**9**
6	**Other Alternate Energy Sources:** Geothermal Energy Source - Types of Geothermal Energy Sources, Working of Different Geothermal Energy Plant Ocean Energy Systems – Working Principle, Types of Tidal Power Plants MHD System -Working Principle of MHD Generator, Types of MHD Power Plants Fuel Cell - Working Principle of Fuel Cell, Types of Fuel Cell, Applications of Fuel Cells, Green Hydrogen Production Methods, Challenges in Utilizing Hydrogen as a Fuel.	**9**
	Total	**45**

List of Practicals / Tutorials:

1	To measure solar radiation using solar radiation measuring instruments.
2	To perform analysis of the solar liquid flat plate collector.
3	To analyze power generation using solar PV Systems.
4	To perform analysis of the solar still.
5	To evaluate the performance of box type solar cooker.
6	To perform analysis of the Biomass Gasification System.
7	To analyze power generation using wind mill.
8	To study power generation using geothermal, MHD and ocean energy.
9	To study different types of fuel cells and Challenges in Utilizing Hydrogen as a Fuel.
10	To study economic analysis of Renewable Energy Systems.

Reference Books:

1	Non-Conventional Energy Sources by G D Rai, Khanna Publishers.
2	Solar Energy Utilisation by G D Rai, Khanna Publishers.
3	Solar Energy by S P Sukhatme and J K Nayak, McGraw Hill Education India.
4	Biomass Gasification and Pyrolysis Practical Design and Theory by Prabir Basu, Academic Press, Elsevier.
5	Fuel Cells – Principles, Design and Analysis by Shripad Revankar and Pradip Majumdar, CRC Press

Supplementary learning Material:	
1	NPTEL resources
2	SWAYAM Portal
3	COURSERA

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Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Industrial/ Field visits

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20	20	15	15	25	5	

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 slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the need of Alternate Energy Sources.	**10**
CO-2	Knowledge of the Solar Radiation Power and its measurement.	**25**
CO-3	Applications of Solar Energy in different areas.	**25**
CO-4	Understand the methods of Biofuel Production and Wind Energy Utilization.	**20**
CO-5	Knowledge of Power Production from Fuel Cell, Geothermal, MHD, Hydrogen and Ocean Energy	**20**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025

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