

INSTITUTE	FACULTY OF TECHNOLOGY
PROGRAM	MASTER OF TECHNOLOGY in ELECTRICAL ENGINEERING
SEMESTER	1
COURSE TITLE	SUSTAINABLE ENERGY
COURSE CODE	01OE9002
COURSE CREDITS	3

Objective:

- 1 The course introduces various sustainable energy sources including solar, wind, and biomass energy as a potential source of energy for present and future needs.

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

- 1 Differentiate between various types of energy sources.
- 2 Identify challenges and strength of various energy convention technologies
- 3 Analyse solar and wind energy technologies from system perspective.
- 4 Understand the various route to generate energy from biomass and other renewable resources
- 5 Articulate various challenges associated with use of renewable energy sources.

Pre-requisite of course:None

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	Introduction to Sustainable energy Introduction; sustainability principle, classification of energy resources, factors affecting energy resource development, environmental aspects of energy, Needs of renewable energy, advantages and limitations of renewable energy, energy strategy for the future, scenario in India	7
2	Solar Energy and Thermal applications Energy available from the sun, spectral distribution, solar radiation outside the earth's atmosphere and at the earth's surface, Instruments for solar radiation measurements- pyranometer, pyrliometer, sunshine recorder, measurement of solar radiation, solar energy conversion into heat, types of solar collectors, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air conditioning, solar pond	8

Contents : Unit	Topics	Contact Hours
3	Solar Photovoltaic System Introduction, solar cell fundamentals, photovoltaic effect, solar cell, module, panel and array, solar cell characteristics and equivalent circuit, classification and types of solar cell, series and parallel arrays, solar PV system: standalone, grid connected & hybrid systems, Solar Water Pumps, Solar street lights	10
4	Wind Energy Energy available from wind, basics of lift and drag, basics of wind energy conversion system, effect of density, angle of attack and wind speed, types of wind mill: horizontal and vertical axes rotors, drag, lift, torque, and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential, and site selection, basics of wind farm, wind energy potential and installation in India	12
5	Hydro Energy Schematic arrangement, advantages and disadvantages,, site selection of hydro power plant, Environmental aspects for selecting the sites and locations of hydro power stations	4
6	Bio Energy Introduction, energy plantation, biomass conversion technologies,, photosynthesis, biogas generation, factors affecting biogas generation,, classification of biogas plants & their comparisons, types of biogas plants.	3
Total Hours		44

Textbook :

- 1 Non-Conventional Energy Resources, G.S. SAWHNEY, Prentice Hall of India, 2012
- 2 Non-Conventional Energy Resources, Shobh Nath Singh, Pearson Education India, 2016
- 3 Non-Conventional Energy Resources, B. H. Khan, McGraw Hill Education India (P) Ltd, 2017

References:

- 1 Renewable Energy Resources, Renewable Energy Resources, John Twidell and Tony Weir, Routledge, 2015
- 2 Sustainable Energy: Choosing Among Options, Sustainable Energy: Choosing Among Options, Tester, J. W., Drake, E. M., Driscoll, M. J., Golay, M. W., & Peters, W. A., MIT Press, 2012
- 3 Renewable and Efficient Electric Power Systems, Renewable and Efficient Electric Power Systems, Gilbert M. Masters, John Wiley & Sons, 2004
- 4 Alternative Energy Systems and Applications, Alternative Energy Systems and Applications, B. K. Hodge, Wiley, 2017
- 5 Renewable Energy Technologies, Renewable Energy Technologies, J. C. Sabonnadiere, John Wiley & Sons, 2009

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	30.00	25.00	15.00	10.00	0.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The trainer shall train students through interactions, demonstration, brainstorming, group tasks etc
- 2 Teacher will use supplementary resources such as online videos from NPTEL/SWAYAM, Coursera or edX platforms for flipped classrooms
- 3 Students will ensure academic integrity by avoiding plagiarism and giving proper credit to all sources used.
- 4 Students must use reliable and accurate information, citing credible sources, and critically evaluating the validity of the data.

Supplementary Resources:

- 1 <https://www.coursera.org/learn/solar-energy-basics>
- 2 <https://www.coursera.org/learn/wind-energy>
- 3 <https://www.coursera.org/learn/solar-energy-system-design>
- 4 <https://www.coursera.org/learn/future-of-energy>
- 5 <https://www.coursera.org/learn/sustainable-development>
- 6 <https://www.edx.org/micromasters/uqx-sustainable-energy>
- 7 <https://www.edx.org/micromasters/delftx-solar-energy-engineering>
- 8 <https://www.edx.org/professional-certificate/imperialx-clean-power>
- 9 <https://www.edx.org/professional-certificate/delftx-buildings-as-sustainable-energy-systems>
- 10 <https://www.edx.org/course/solar-energy-integration-of-photovoltaic-systems-i>
- 11 <https://solarenergytraining.org/>