COURSE MODULE: Renewable Energy Power Plants

Course Coordinator:				Academic Year: **2024-25**	
Department: **Mechanical Engineering**					
Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours L:T: P:S	Total Hrs/ Sessions
BME654B	**Renewable Energy Power Plants**	**Open Elective**	**Basic Physics**	**3:0:0**	**40**

Course Learning Objective:

The course will enable the students to:

CLO1: To explore society's present needs and future energy demands.

CLO2: To introduce the concepts of solar energy

CLO3: To introduce the concepts and applications of Wind energy, Biomass energy, geothermal energy and Ocean energy as alternative energy sources.

CLO4: To get exposed to energy conservation methods.

Pedagogy (General Instruction):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Use pie chart showing distribution of renewable energy sources
2. Use wind turbine models
3. Use sun path diagrams

Module-1

Introduction to Renewable Energy: Overview of global energy demand and the need for renewable energy, Comparison of renewable and nonrenewable energy sources, Environmental benefits and challenges of renewable energy. Solar Radiation: Extra Terrestrial radiation, spectral distribution of extraterrestrial radiation, solar constant, solar radiation at the earth's surface, beam, diffuse and global radiation

Module-2

Solar Power Plants: Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working. Solar Thermal Conversion: Collection and storage, thermal collection devices. Fundamentals of solar energy and photovoltaic (PV) technology, Types of solar power plants: gridtied, offgrid, and hybrid systems, Design considerations for solar power plants: site selection, orientation, and shading analysis, PV system components and their functionalities, Operation, maintenance, and performance monitoring of solar power plants.

Module-3

Wind Power Plants: Basics of wind energy and wind turbine technology, Types of wind turbines: horizontal axis and vertical axis; Wind resource assessment and site selection for wind power plants, Wind farm layout optimization and wake effects, Grid integration and power system considerations for wind power plants

Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, geothermal plants in the world, problems associated with geothermal conversion, scope of geothermal energy.

Module-4

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations.

Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC.

Module-5

Biomass Power Plants: Biomass as a renewable energy source: types and characteristics, Conversion technologies: combustion, gasification, and anaerobic digestion, biomass feedstock selection and availability, Environmental impacts and sustainability of biomass power plants, Integration of biomass power plants with other energy systems
Hydrogen Energy: Properties of Hydrogen with respected to its utilization as a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermos Chemical production biochemical production

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. **Understand the need of renewable energy resources, historical and latest developments.**
2. **Describe the use of solar energy and the various components used in the energy production**
3. **Appreciate the need of Wind Energy and the various components used in energy generation and the classifications.**
4. **Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and Applications.**
5. **Understand the concept of Biomass energy resources and their classification, types of biogas Plants applications**

List of Text Books

1. **Computer Aided Engineering Drawing** by Dr. M H Annaiah, Dr C N Chandrappa and Dr B Sudheer Premkumar Fifth edition, New Age International Publishers.
2. Luzadder Warren J., Duff John M., **Fundamentals of Engineering Drawing: with an Introduction to Interactive Computer Graphics for Design and Production**, Prentice-Hall of India Pvt. Ltd.,New Delhi, Eastern Economy Edition, 2005.
3. Dhawan R. K., **A Textbook of Engineering Drawing**, 3/e, S. Chand Publishing, 2019.
4. Venugopal K., **Engineering Drawing and Graphics**, New Age International publishers, 2014.
5. Parthasarathy N. S., Vela Murali, **Engineering Drawing**, Oxford University Press, 2015.Bhattacharya S. K., Electrical Engineering Drawing, New Age International publishers, second edition 1998, reprint 2005.
6. Chris Schroder, **Printed Circuit Board Design using AutoCAD**, Newnes, 1997.

List of URLs, Text Books, Notes, Multimedia Content, etc

1. Nonconventional Energy sources, G D Rai, Khanna Publication, Fourth Edition,

2. Energy Technology, S.Rao and Dr. B.B. Parulekar, Khanna Publication. Solar energy, Subhas P Sukhatme, TataMcGrawHill, 2ndEdition,1996

3. Principles of Energy conversion, A.W.Culp Jr. McGraw Hill, 1996 4. 4. NonConvention Energy Resources, ShobhNath Singh, Pearson, 2018.

https://www.investopedia.com/terms/i/internetenergy

Ebook URL: https://www.pdfdrive.com/nonconventionalenergysourcese10086374.html

Ebook URL: https://www.pdfdrive.com/nonconventionalenergysystemsnpteld17376903.html

Ebook URL: https://www.pdfdrive.com/renewableenergysourcesandtheirapplicationse33423592.html

Ebook URL: https://www.pdfdrive.com/lecturenotesonrenewableenergysourcese34339149.

html https://onlinecourses.nptel.ac.in/noc18_ge09/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Visit nearest power plants and know the principles of power production
Seminar/poster presentation of all Renewable power plants
Assignments
quiz

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- The CIE is the sum of Average of Two Internal Assessment Tests each of 25 marks and Any two Assessment methods for 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assessment methods mentioned in the 22OB4.2 if an assignment is project based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled down sum of two tests and other methods of assessment for a total of 50 marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 subquestions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Subject Code: BME654B				**TITLE: Renewable Energy Power Plants**				Course Coordinator:			
List of Course Outcomes	**Program Outcomes**										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO-1	2	2	-	-	-	-	2	-	-	-	-	2
CO-2	2	2	2	-	-	-	-	-	-	-	-	2
CO-3	2	2	-	-	-	-	-	-	-	-	-	2
CO-4	2	2	-	-	-	-	-	-	-	-	-	2
CO-5	2	2	-	-	-	-	2	-	-	-	-	2
Ave.CO	**2**	**2**					**2**					**2**

Note: 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution - = No Contribution