COURSE MODULES OF THE SUBJECT TAUGHT FOR THE EVEN SEMESTER 2025-26

Course Syllabi with CO's

Faculty Name: Dr. Raghavendra L				**Academic Year:** 2025-2026			
Department: Electrical and Electronics Engineering							
Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BEE654B	**Technologies of Renewable Energy Sources**	**Core**	Basic Electrical and Engineering Physics.	**3**	**0**	**0**	**40**
Course Objectives	1. To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy. 2. To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications. 3. To discuss benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages. 4. To discuss wind turbines, wind resources, site selection for wind turbine. 5. To discuss geothermal systems, their classification and geothermal based electric power generation. 6. To discuss biomass composition, production, types of biomass gasifiers, properties of producer gas benefits. 7. To discuss tidal energy resources, energy availability, power generation.						

Topics Covered as per Syllabus

Module-1

Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.

Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth's Surface, Solar Thermal Energy Applications. **8 Hours**

Teaching-Learning Process : Chalk and Board, Power Point Presentation.

Bloom's Taxonomy Level	L1 – Remembering, L2 – Understanding

Module-2

Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooling, Solar Cookers, Solar pond.

Solar Cells: Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic panels (series and parallel arrays). **8 Hours**

Teaching-Learning Process : Chalk and Board, Power Point Presentation.

Bloom's Taxonomy Level	L1 – Remembering, L2 – Understanding, L3 – Applying

Module-3

Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.

Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.

Geothermal Energy: Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.

Solid waste and Agricultural Refuse: Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics. **8 Hours**

Teaching-Learning Process : Chalk and Board, Power Point Presentation.

Bloom's Taxonomy Level	L1 – Remembering, L2 – Understanding, L3 – Applying

Module-4

Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.

Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.

Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy. **8 Hours**

Teaching-Learning Process : Chalk and Board, Power Point Presentation.

Bloom's Taxonomy Level	L1 – Remembering, L2 – Understanding, L3 – Applying

Module-5

Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.

Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. **8 Hours**

Teaching-Learning Process : Chalk and Board, Power Point Presentation.

Bloom's Taxonomy Level	L1 – Remembering, L2 – Understanding

List of Text Books

1. Nonconventional Energy Resources, Shobh Nath Singh, Pearson, 1st Edition, 2015.

List of Reference Books

1. Nonconventional Energy Resources, B.H. Khan, McGraw Hill, 3rd Edition.
2. Renewable Energy; Power for a sustainable Future, Godfrey Boyle, Oxford, 3rd Edition, 2012.
3. Renewable Energy Sources: Their Impact on global Warming and Pollution, Tasneem Abbasi S.A. Abbasi, PHI,1st Edition, 2011.

List of URLs, Textbooks, Notes, Multimedia Content, etc

http://digimat.in/nptel/courses/video/109101171/L20.html
http://kcl.digimat.in/nptel/courses/video/103103206/L02.html

Course Outcomes	**At the end of the course, the student will be able to:** **CO-1: Interpret** the causes of energy scarcity and its solution, energy resources and availability of renewable energy. **Outline** energy from the sun, energy reaching the Earth's surface and solar thermal energy applications. **(L2)** **CO-2: Interpret** types of solar collectors, their configurations, solar cell system, their characteristics and applications. **(L2)** **CO-3: Explain** the generation of energy from hydrogen, wind, geothermal systems, solid waste and agriculture refuse. **(L2)** **CO-4: Discuss** the production of energy from biomass and biogas. **(L2)** **CO-5: Summarize** tidal energy resources, sea wave energy, and ocean thermal energy. **(L2)**
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Engineers and Society and Life-Long Learning.	
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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and 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.	
Semester-End Examination: The question paper will have ten questions. Each question is set for 20 marks. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one full question from each module.	

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

Course Code:	**BEE654B**	**TITLE: Technologies of Renewable Energy Sources**					**Faculty Name:**		**Dr. Raghavendra L**		
List of Course Outcomes	**Program Outcomes**										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO-1	3	2	-	-	-	2	2	-	-	-	-	2
CO-2	3	2	-	-	-	2	2	-	-	-	-	2
CO-3	3	2	-	-	-	2	2	-	-	-	-	2
CO-4	3	2	-	-	-	2	2	-	-	-	-	2
CO-5	3	2	-	-	-	2	2	-	-	-	-	2

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

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

Course Code: BEE654B	TITLE: Technologies of Renewable Energy Sources	Faculty Name: Dr. Raghavendra L
List of Course Outcomes	Program Specific Outcome	
	PSO1	PSO2
CO-1	2	2
CO-2	2	2
CO-3	2	2
CO-4	2	2
CO-5	2	2

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