

# **Maulana Abul Kalam Azad University of Technology, West Bengal**

(Formerly West Bengal University of Technology)

## **Syllabus for B. Tech in Electrical Engineering**

(Applicable from the academic session 2018-2019)

<b>Name of the course</b>		<b>RENEWABLE &amp; NON CONVENTIONAL ENERGY</b>	
<b>Course Code:</b> PE-EE-501C		<b>Semester:</b> 5 <sup>th</sup>	
<b>Duration:</b> 6 months		<b>Maximum Marks:</b> 100	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
<b>Objective:</b>			
1.	To understand the difference between Renewable and non-renewable energy sources		
2.	To understand methods of conversion of solar energy and wind energy to other form of energy.		
3.	To understand methods harnessing energy from Biomass, Geothermal and ocean		
4.	To understand the principle of operation of Magneto Hydrodynamic power generation:		
5.	To understand the principle and operation of fuel cell.		
6.	To solve numerical problems of Renewable and non-renewable energy sources		
<b>Pre-Requisite</b>			
1.	Electric Circuit Theory (PC-EE-301)		
2.	Electromagnetic field theory (PC-EE-303)		
3.	Electric Machine-I (PC-EE-401)		
4.	Electrical and Electronics measurement (PC-EE-403)		
<b>Unit</b>	<b>Content</b>	<b>Hrs</b>	<b>Marks</b>
1	<b>Introduction to Energy sources:</b> Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.	03	
2	<b>Solar Energy:</b> Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond, solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems	08	
3	<b>Wind Energy:</b> Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations	05	
	<b>Energy from Biomass:</b>		

4	Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas	05	
5	<b>Geothermal Energy:</b> Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.	05	
6	<b>Energy from Ocean:</b> Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.	05	
7	<b>Magneto Hydrodynamic power generation:</b> Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.	05	
8	<b>Hydrogen Energy:</b> Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.	03	
9	<b>Fuel cell:</b> Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells	03	

#### Text books:

1. Renewable energy sources and conversion technology, Bansal Keemann, Meliss, Tata Mc Graw Hill.
2. Renewable energy resources and emerging technologies, D.P. Kothari, PHI.
3. Non-conventional Energy sources, G.D. Rai, Khanna Publishers.

#### Reference books

1. Non-conventional Energy, Ashok V. Desai, New Age International Publishers Ltd.

#### Course Outcome:

After completion of this course, the learners will be able to

1. explain the principle of conversion of solar energy, wind energy, biomass, Geothermal energy, Ocean energy and Hydrogen energy to other form of energy.
2. explain the principle of operation of magneto hydrodynamic power generation.
3. use Solar energy, Wind energy, Biomass, Geothermal energy, Ocean energy, Hydrogen energy and fuel cell for different applications.
4. suggest location to set up wind mill and biogas generation plant
5. estimate conversion efficiency of fuel cell.

6. solve numerical problems relating to conversion of Solar energy, Wind energy , Biomass, Ocean energy and Hydrogen energy to heat and electric energy.

**Special Remarks (if any)**

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.