Addis Ababa Institute of Technology (AAIT-AAU)
School of Mechanical and Industrial Engineering
Graduate Program in Thermal Engineering

Course Title : ***Renewable Energy Conversion***
Course No. : ***MEng 6304***
Credit Hours : ***3 (ECTS 6)***
Instructor : ***Abdulkadir A. Hassen (PhD)***

Module Title:	Renewable Energy Conversion
Module Code:	MEng 6304
Module Credit:	Credit Hours : 3 ESTC : 6
Pre-requisite Module:	Undergraduate level courses – Thermodynamics I & II, Fluid Mechanics I & II, and Heat Transfer
Co-requisite Module:	Non
Barred Combination Modules:	Non
Module Description:	Solar Radiation; Solar water heaters; Solar Driers; Solar Stills (Desalinators); Solar Photovoltaic; Hydropower generation; Wind energy power generation; Biomass power generation; Economic evaluation of renewable energy technologies.
Learning Outcome:	After completion of this module the student will be able to comprehend: • The basic principles involved in the Sun-Earth angles relations. • The methods of estimation of extraterrestrial-, terrestrial-, beam- and diffuse radiation on inclined and horizontal surfaces. • The techniques involved in thermal analysis and component optimization solar water heaters, solar driers, solar stills (desalinators), solar steam generators, etc. • The basic principles involved in photovoltaic conversion and their applications. • The basic principles applied in hydropower generation analysis and energy calculations. • The basics of wind energy systems and analysis of wind energy generation. • The methods applied in the economic evaluation of renewable energy technologies.
Content:	1. **Introduction** 2. **Solar Radiation:** The Sun as the Source of Radiation; Solar Radiation on Horizontal Surfaces; Solar Radiation on Inclined Surfaces; Estimation of Solar Radiation 3. **Solar Heaters and Driers:**1 Flat Plate Collectors; Solar Concentrators; Solar Air Heaters; Solar Driers; Solar Distillation 4. **Solar Photovoltaics:** Fundamentals of Photovoltaic Conversion ; Efficiency of Solar Cells; PV Systems performance; Photovoltaic Applications

5. **Hydropower : h**ydropower Reservoir Capacity Estimation; Hydraulic Turbine Selection; Hydropower economics
6. **Wind Power:** Wind Data and power availability: Wind Power Generation and Wind turbine types; Performance Determination and Selection of Wind Turbines
7. **Biomass Energy:** Wood Fuel ; Gasification of Wood; Biogas Digesters
8. **Economic Evaluation of Renewable Energy Technologies:** Introduction ; Net Present Value Concept; Life-Cycle Cost Method; Cost-Benefit Comparison Method; Pay-back Period Method

Teaching Strategy/Methods:

Lecture:
Exercises:
Projects:

Assessment Strategy:

Assignments	20%
Projects and Presentations	30%
Final examination	50%

Teaching Support and Inputs:

- Lectures supported by tutorials
- Assignments, and
- Projects

Module Requirements:

- Minimum of 75% attendance during lecture hours

Text Books:

References:

1. Bansal and Kleemann , *Renewable Energy Sources and Conversion Technology*, McGraw-Hill Education, Mar 1, 1989
2. Bent Sorensen ,***Renewable Energy Conversion, Transmission, and Storage***, Academic Press, Nov 1, 2007
3. C.G. Granqvist , ***Materials Science for Solar Energy Conversion Systems (Renewable Energy)***, Pergamon; 1st ed edition, Aug 1, 1991
4. Charles C. Sorrell, Sunao Sugihara, and Janusz Nowotny , ***Materials for energy conversion devices***, CRC, Nov 16, 2005
5. F. Kreith and J.F. Kreider, *Principles of Solar Engineering*, McGraw-Hill Inc., 1989.
6. J.F. Duffie and W.A. Beckman, *Solar Energy Thermal Processes*, John Wiley & Sons, 1991.
7. J.F. Kreider and F. Kreith, *Solar Energy Handbook*, McGraw-Hill, New York, 1991.
8. J.P. Holman, *Heat Transfer*, 7th Edition, McGraw-Hill Inc., UK Ltd., 1992.
9. J.R. Simonson, *Computing Methods in Solar Heating Design*, Macmillan Press, London, 1984.
10. Martin A. Green ,***Third Generation Photovoltaics: Advanced Solar Energy Conversion (Springer Series in Photonics)***, Springer; 1 edition, Aug 13, 2003

Peter Gevorkian , ***Solar Power in Building Design***, McGraw-Hill Professional; 1edition, Sep 14, 2007