



Course: Sustainable Energy Technology 1
12150310

Title: Renewable Energy Technologies- L1

Dr. Mahmoud Ismail

Renewable Energy Technologies

Course Syllabus: General

College	Engineering and Technology		
Department	Electrical Engineering		
Program			
Course Title	Sustainable Energy Technology 1	Course Number:	12150310
Year	2022-2023	Semester:	Second
Prerequisite(s)	Thermodynamics and Power Applications & Power Electronics		
Instructor	Dr. Mahmoud Ismail		
Instructor's e-mail	m.ismail@ptuk.edu.ps ; mahmoud_kafa@yahoo.com		
Office Hours	10:00-11:00 SUN,TUS,THU		
Class Time	09:30-11:MON,WED	Class Room:	H216
Course description	<p>Introduction to energy systems : conventional and renewable energy resources ; Solar Spectrum, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram; Shadow angle protractor; Solar Radiation ; Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces; Measurement of solar radiation; Solar radiation calculations.</p> <p>Photovoltaic fundamentals; Solar Cell Physics; The Photovoltaic Effect, Dark and illumination characteristics; Figure of merits of solar cell; Efficiency limits; Variation of efficiency with band-gap and temperature; Efficiency measurements; High efficiency cells.</p> <p>Equivalent Circuit of the Solar Cell, Analysis of PV Cells: Types of Solar cells. Solar Cell Fabrication Technology. Solar Photovoltaic System Design; Maximum tracking; Centralized and decentralized SPV systems; Stand alone, hybrid and, grid connected system.</p> <p>The Recent developments in Solar cells, Role of nano-technology in Solar cells.</p> <p>Wind speed analysis; Wind turbine energy, power, torque and speed characteristics.</p> <p>Solar heater systems: Design, amount of heat.</p>		

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Course Syllabus: Topics covered and Calendar

No.	Topics	Number of hours
	Introduction <ol style="list-style-type: none"><li data-bbox="297 376 1122 411">1. Palestine & World energy consumption & Demand<li data-bbox="297 454 890 488">2. Renewable vs fossil energy sources<li data-bbox="297 531 581 565">3. Future outlook	3
	Overview of renewable energy technologies <ol style="list-style-type: none"><li data-bbox="297 648 755 682">1. Renewable energy sources<li data-bbox="297 725 726 759">2. Advantages and benefits<li data-bbox="297 802 929 836">3. Available technologies and challenges	3
	Load analysis and Tariff Systems <ol style="list-style-type: none"><li data-bbox="297 919 1020 953">1. Load Curve Terminologies and Calculations<li data-bbox="297 962 1058 996">2. Tariff Systems in conventional power systems<li data-bbox="297 1011 1025 1045">3. Tariff systems in Renewable Energy systems	3
	Solar energy <ol style="list-style-type: none"><li data-bbox="297 1113 1006 1148">1. Sun and its Energy: Basics of Solar Energy<li data-bbox="297 1190 765 1225">2. Solar angles and Radiation<li data-bbox="297 1268 774 1302">3. Radiation on tilted surfaces.<li data-bbox="297 1345 614 1379">4. Radiation Meters	6

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Course Syllabus: Topics covered and Calendar

	<p>Photovoltaic Systems</p> <ol style="list-style-type: none">1. Solar Photovoltaic Definition , features , and applications2. Solar cell physics and technology3. Photovoltaic Panels4. Related Equipment (Batteries; Inverters; Charge controllers; Peak-power trackers)5. Photovoltaic Applications (Direct-coupled PV system; Stand-alone applications; Grid-connected system; Hybrid connected system)6. Design of PV systems (Electrical loads; Absorbed solar radiation; Cell temperature; Sizing of PV systems; Tilt angle and yield; Concentrating PV)7. Degradation in PV Systems8. Solar Tracking Systems.9. Distance between rows10. Losses Analysis of PV Systems11. Bypass and Blocking Diodes12. Recent Developments in Solar cells, Role of Nano-technology in Solar Cells	18
	<p>Solar Thermal Energy</p> <ol style="list-style-type: none">1. Solar Thermal Energy (Solar energy collectors; Thermal analysis of Solar Collectors; Performance of Solar Collectors).2. Solar Thermal Power Systems (Parabolic trough collector systems; Power tower systems; Dish systems)	6
	<p>Wind Energy Systems</p> <ol style="list-style-type: none">1. Introduction (How the sun produces wind; Capturing and using the wind's energy)2. Today's Wind Energy Systems (Sizes; Designs; Benefits; Challenges)3. Wind characteristics (Wind speed profiles; Wind speed variation with time; Wind resources)	6

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Course Syllabus: Student Assessment Methods

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Introduction

The sun is the only star of our solar system located at its center.

The earth and other planets orbit the sun.

Energy from the sun in the form of solar radiation supports almost all life on earth via photosynthesis and drives the earth's climate and weather.

The sun generates its energy by nuclear fusion of hydrogen nuclei to helium.

Sunlight is the main source of energy to the surface of the earth that can be harnessed via a variety of natural and synthetic processes.

Plants capture the energy of solar radiation and convert it to chemical form.

Nearly all life on earth depends on photosynthesis.

The photosynthesis equation is as follows:



Carbon dioxide + water + energy from light produces glucose and oxygen.

Renewable Energy Technologies

Introduction

Basically all the forms of energy in the world as we know it are solar in origin.

Oil, coal, natural gas, and wood were originally produced by photosynthetic processes.

Even the energy of the wind and tide has a solar origin, since they are caused by differences in temperature in various regions of the earth.

The greatest advantage of solar energy compared with other forms of energy is that it is clean and can be supplied without environmental pollution.

Over the past century, fossil fuels provided most of our energy, because these were much cheaper and more convenient than energy from alternative energy sources, and until recently, environmental pollution has been of little concern.