



MUSTANSIRIYAH UNIVERSITY
COLLEGE OF SCIENCES
DEPARTMENT OF ATMOSPHERIC SCIENCES

DR.HAZIM H. HUSSAIN



Solar Energy



Pro. Dr. Hazim H. Hussain

3^{ed} level / 1st semester



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Solar Energy

Welcome Students

TO LECTURE ONE



Solar Energy

Module Objectives:

1. Learning the kind of renewable energy.
2. Understand the source of solar energy.
3. Learn the basic physics and laws of solar radiation.
4. Understanding the general concept of interaction solar radiation with atmosphere.
5. Understanding the basic of solar geometry.
6. Learn the fundamentals of solar energy applications.





Solar Energy

Course Intended Outcomes:

1. Developing the student's scientific knowledge in renewable energy, its types and importance, in general and solar energy in particular.
2. Improve the abilities of the students to understand the basic processes of producing solar energy in the core of the sun and the mechanism of its transmission and arrival outside the atmosphere.
3. Learn about the main physical laws governing the relationship between radiation and energy and their transfer out and within the atmosphere and to the Earth's surface.
4. Knowing the processes that solar radiation is exposed to within the atmosphere, from reflection, scattering, and absorption, and the results of these processes in the distribution of the amount of energy and its transfer within the atmosphere and the Earth's surface.
5. Understand and learn all the details of solar geometry, its importance and its relationship to solar energy applications.
6. Knowing the weather conditions and climatic factors that affect the amount of solar energy reaching the Earth's surface and the role of these conditions in influencing the operation of solar energy systems.
7. Get an overview of solar radiation and solar energy measuring devices.
8. Knowledge the types of solar energy systems and their applications and their classifications (active and passive systems).



Course Outline:

Introduction:

Week 1

- kind of renewable energy.
- Characteristics, advantages and disadvantages of each type.
- the deference between renewable energy and alternative energy.

The sun as the source of solar energy:

Week 2

- What is the sun
- The basic processes of producing solar energy in the core of the sun
- The mechanism of solar energy from the core to the surface of the sun
- The mechanism of transmission solar energy from the surface of the sun until outside the atmosphere. (Radiant Flux Emitted by the Sun)

Solar Radiation :

Week 3

- The physics of solar Radiation.
- Solar Constant
- Total Solar Radiant Flux Received by the Earth.

Solar Radiation & atmosphere :

Week 4

- The processes that solar radiation is exposed to within the atmosphere.
- 1. Reflection.
- 2. Scattering.
- 3. Absorption.
- Air mass and solar radiation path.

The fundamentals of Radiation Climatology:

Week 5

- Energy budget of the earth-atmosphere system.
- extraterrestrial radiation on a horizontal surface as function of season and latitude.

The basic of solar geometry I:

Week 6

- Relation between the Earth and the Sun.
- Solar Time and Position of the Sun
- Solar angle I :
 1. Declination δ .
 2. Hour Angle h .

Week 7

Midterm Exam



Course Outline:

Week 8	<p><u>The basic of solar geometry II:</u></p> <ul style="list-style-type: none"> Solar angle II : <ul style="list-style-type: none"> Solar Attitude Angle a. Solar Azimuth Angle z. Incidence Angle θ. <p><u>The basic of solar geometry III:</u></p> <p>Extraterrestrial radiation on a horizontal plane Total Radiation on Tilted Surfaces Beam radiation tilt factor Total radiation on a tilted surface</p>
Week 9	<p><u>Terrestrial radiations measurement:</u></p> <ul style="list-style-type: none"> Total, direct and diffuse solar radiation measuring devices. Terrestrial irradiation estimation. Satellite data.
Week 10	<p><u>Solar energy applications I:</u></p> <ul style="list-style-type: none"> Passive solar system I: <ol style="list-style-type: none"> Daylight. Space Heating. Water desalination. Drying Agricultural Products
Week 11	<p><u>Solar energy applications II:</u></p> <ul style="list-style-type: none"> Passive solar system II: <ul style="list-style-type: none"> Flat plate water heating Concentrating solar system (water heating)
Week 12	<p><u>Solar energy systems III:</u></p> <ul style="list-style-type: none"> Active solar system I: <ol style="list-style-type: none"> Concentrating solar system (Generating Electrical Power)
Week 13	<p><u>Solar energy systems IIII:</u></p> <ul style="list-style-type: none"> Active solar system II: <ul style="list-style-type: none"> Photovoltaic panels (Generating Electrical Power)
Week 14	Preparatory week before the final Exam
Week 15	Final exam