

Unit 7

1) What is meant by renewable energy?

Renewable energy is energy obtained from sources that are essentially inexhaustible. Ex: wind power, solar power, geothermal energy, tidal power and hydroelectric power

2) What is the greenhouse effect?

Carbon dioxide (CO₂) envelope present around the globe in the atmosphere behaves similar to a glass pane and forms a big global greenhouse. This tends to prevent the escape of heat from earth, which leads to global warming. This phenomenon is known as the greenhouse effect.

3) What is meant by global warming?

Global warming is the continuing rise in the average temperature of the earth's atmosphere and ocean's surface due to the greenhouse effect.

4) What is green power?

The green power is used to describe the sources of energy which are environmental friendly, non-polluting, and having a remedy to the effects of pollution and global warming. These sources are called renewable energy sources such as sun, wind, water, biomass and waste.

5) List the greenhouse gases emitted due to the combustion of fossil fuels.

Carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O)

6) Explain the principle of power generation using tides?

Tide or wave is the periodic rise and fall of the water level of the sea. Tides occur due to the attraction of sea water by the moon. Tides contain a large amount of potential energy which is used for power generation. When the water is above the mean sea level, it is called a flood tide. When the water level is below the mean level, it is called an ebb tide.

7) Discriminate between spring and neap tides?

The difference between spring and neap tides is that spring tides are much higher than normal and neap tides are lower than normal. Spring tides occur because of the combined effects of the sun and moon, whereas neap tides happen when the sun and the moon are at a right angle.

8) What are the advantages and disadvantages of non renewable system

Advantages:

They are abundant and affordable. For example, oil and diesel are still good choices for powering vehicles.

Non-renewable energy is cost effective and easier to product and use. **Disadvantages:**

Once sources of non-renewable energies are gone, they can't be replaced.

Mining of non-renewable energy and the by-products they leave damage to the environment.

9) List out the major factors influencing the amount of GHG emissions.

Fluorinated gases such as hydro fluorocarbon, per fluorocarbon, sulfur hexafluoride

UNIT II

1) What are the factors determine the output from a wind converter:

i. The wind speed,

ii. The cross-section of wind swept by rotor, and

iii. The overall conversion efficiency of the rotor, transmission system generator or pump.

2) Define Power Co-efficient.

The fraction of the free-flow wind power that can be extracted by a rotor is called the power co-efficient. Thus

Power Coefficient = Power of wind rotor / Power available in the wind

Where, power available is calculated from the air density, rotor diameter and free wind speed as discussed earlier. The maximum theoretical power coefficient is equal to $16/27$ or 0.593 . This value cannot be exceeded by a rotor in free-flow wind-stream.

3) What are the mechanisms for producing forces from wind?

There are two primary mechanism for producing forces from the winds. They are i. Lift force, and ii. Drag force

4) Define Magnus Effect

Magnus Effect, caused by spinning a cylinder in an air stream at a high-speed of rotation. The spinning slows down the air speed on the side where the cylinder is moving into wind and increases it on the other side; the result is similar to an airfoil. This principle has been put to practical use in one or two cases but is not generally employed.

5) What are the major broad classification of WECS?

There are two broad classification of WECS. They are

- i. Horizontal Axis machines and
- ii. Vertical Axis machines

6) What are the different types of vertical axis wind turbines.

- i. Savonius Rotor type machines
- ii. Darrieus type machines

7) Define Stalling.

When lift decreases and the drag increases quite substantially; this phenomenon is known as Stalling. For efficient operation, a wind turbine blade needs to function with as much lift and as little drag as possible because drag dissipates energy.

8) Give some important factor consider for site selection of WECS

High annual average wind speed:

Availability of anemometry data:

Availability of wind $V(t)$ Curve at the proposed site:

Wind structure at the proposed site:

Altitude of the proposed site:

Terrain and its aerodynamic:

Local Ecology

Distance to road or railways:

Nearness of site to local centre/users:

Nature of ground:

Favourable land cost:

9) What is the function of back-up in small producers?

For small producers, back-up can take the form of

- a) Battery storage b) Connection with the local electricity distribution systems, or c) A stand by generator powered by liquid or gaseous fuels
Drag force

10) What are the different types of forces acting on propeller type wind turbine.

There are two types of forces which are acting on the blades. They are

1. Circumferential force acting in the direction of wheel rotation that provides the torque, and
2. Axial force acting in the wind stream that provides an axial thrust that must be countered by proper mechanical design.

Unit III

1) Define Fill Factor.

It is a measure of squareness of the I-V characteristics of the solar cell and is defined as

$$FF = \text{Maximum output power} / (\text{open-circuit voltage} \times \text{short-circuit current})$$

2) List some of the applications of Solar system.

Power Generation, Water Pumping, Solar Vehicles, Solar aircraft and Rural electrification.

3) Define the efficiency of solar cell

Energy conversion efficiency is defined as the ratio of power output of cell (in watts) at its maximum power point (P_{MAX}) and the product of input light power (E, in W/m²) and the surface area of the solar cell (S in m²) under standard conditions

$$\eta = \text{maximum output power} / (\text{irradiance} \times \text{area}) = P_{MAX} / (E \times S)$$

4) Mention the Types of solar cells.

- (1) single crystal silicon solar cell,
- (2) polycrystalline and amorphous silicon cell,
- (3) cadmium sulphide-cadmium telluride cell,

(4) copper indium diselenide cell

(5) gallium arsenide cell.

5) Disadvantages of Solar Pond.

Relatively low temperatures achieved in these ponds.

Solar-to-electricity conversion is fairly inefficient - generally less than 2%.

As well, large amounts of fresh water are necessary to maintain the right salt concentrations all through the pond. This is an issue in places where fresh water is hard to come by, especially in desert environments.

6) What is solar pond?

A solar pond is a solar energy collector, generally large in size, that looks like a pond. This type of energy collector uses a large, salty lake as a kind of flat plate collector that absorbs and stores energy from the Sun in the warm, lower layers of the pond. These ponds can be natural or man-made, but generally speaking the solar ponds that are in operation today are artificial.

7) List the types of receiver used in solar tower plant.

Water/steam receiver, Salt receiver, Open volumetric air receiver and Closed (pressurized) air receivers

8) List the components of Heliostats.

The reflector surface (e.g. mirrors, mirror facets, other sunlight-reflecting surfaces)

A sun-tracking system provided with drive motors foundations and control electronics.

9) Define solar Azimuth Angle.

It is the angle on a horizontal plane, between the due south and the projection of sun's ray on horizontal plane. It is taken as +ve when measured from south towards west.

10) Define Solar Irradiation

Solar radiation that reaches earth surface after passing through the earth's atmosphere is known as Terrestrial Radiation. The terrestrial radiation expressed as energy per unit time per unit area (i.e. W/m^2) is known as Solar Irradiation.

UNIT IV

1) List the different fuel sources for biomass plant.

Forests, Agricultural Residues, Energy Crops, Aquatic Plants and Urban Waste

2) Give the classifications of biomass energy
Direct and Indirect Methods

3) What is geothermal Energy?

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5) Give the disadvantages of geothermal energy.

The only disadvantage of geothermal energy is the release of hydrogen sulfide identified by the signature rotten egg smell.

6) Give the classifications of geothermal energy.

Vapour-dominated (dry steam) geothermal systems
Liquid-dominated (hot waters) geothermal systems

7) Give the types of geothermal conversion technology used electricity generation
Dry steam plants, Flashed Steam Plants, Binary and Hybrid power plants

8) List the applications of geothermal energy.
Aquaculture and horticulture, Industry agriculture, Food processing and providing residential use.

9) Discuss the advantages of hydropower.
Hydroelectric energy is non-polluting—no heat or noxious gases are released.
Hydroelectric energy has low operating and maintenance costs, it is essentially inflation proof.
Hydroelectric energy is a continuously renewable energy source.
It is a much more concentrated energy resource than either wind or solar power.

10) Mention classifications of hydropower Based on Capacity: micro (less than 100 kWe), mini (100 kWe-1 MWe) and small (1 MWe-25 MWe).
The small/mini/micro schemes are further operation: (i) Storage and (ii) run-of-the-river

UNIT V

1) Define tides.

Tides are periodic rises and falls of large bodies of water. Gravity is one major force that creates tides. Ocean tides result from the gravitational attraction of the sun and moon on the oceans of the earth.

2) Tell about neap tides.

Neap tides are especially weak tides. They occur when the gravitational forces of the moon and the sun are perpendicular to one another with respect to the earth. Neap tides occur during quarter moons.

3) Give the classification of tidal power basin.

Single basin system, and Two basin systems

4) Write any two advantages of Tidal energy system.

It is an inexhaustible source of energy.
It is an environment friendly energy and does not produce greenhouse effects.

5) Mention the devices that are used for wave energy generation.

Terminator devices, Attenuator devices, point absorber and overtopping devices.

6) List the disadvantages of wave energy.

High construction costs.
Marine life is disrupted and displaced.
Damage to the devices from strong storms and corrosion create problems.

7) Give the types of OTEC power plant.

Land based and floating power plant.

8) List the advantages of OTEC.

Ocean thermal energy is a renewable, clean natural resource available in abundance.
It is pollution-free and has no greenhouse effects.
It is a good source of freshwater and portable water.

9) What is fuel cell?

A fuel cell is a device that converts the chemical energy from a fuel into electricity through a chemical reaction with oxygen or another oxidizing agent. A fuel cell consists of two

electrodes, namely an anode and a cathode.

10) What is Mixed potential electrodes ?

Unavoidable parasitic reactions, such as the crossover of fuel through the electrolyte from anode to cathode or vice versa, that tend to lower the equilibrium electrode potential are the primary cause of mixed potential at electrodes.