



QUESTION BANK

Name of the Department : Electrical and Electronics Engineering

Subject Code & Name : EE8703 & Renewable Energy System

Year & Semester : IV & VII

UNIT I -RENEWABLE ENERGY (RE) SOURCES

PART-A

1. List the non –conventional energy sources?

The various non-conventional energy sources are as follows:

- Solar energy
- Wind energy
- Energy from biomass and biogas
- Ocean thermal energy conversion
- Tidal energy
- Geothermal energy
- Hydrogen energy
- Fuel cells
- Magneto-hydrodynamics generator
- Thermionic converter
- Thermo-electric power.

2. Write the advantages of non –conventional Energy sources?

The leading advantages of non-conventional energy sources are:

1. They do not pollute the atmosphere
2. They are available in large quantities.
3. They are well suited for decentralized use.

3. What are the Important of renewable energy?

Renewable energy technologies have several **benefits** such as **sustainability** and security of **energy** supply, increased employment, and long lifetime of **energy** systems. ... **Solar Energy** Systems can be applied in a very harmonic way on buildings to cover the heating, cooling, **electricity** and lighting needs.



Accredited by NAAC

4. What are the most popular renewable energy sources?

1. Solar energy
2. Wind energy
3. Hydro energy
4. Tidal energy
5. Geothermal energy
6. Biomass energy

2

5. What isn't a renewable energy source?

Fossil fuels are not a renewable source of energy because they are not infinite. Plus, they release carbon dioxide into our atmosphere which contributes to climate change and global warming.

6. What is the Limitation of renewable energy sources?

- Higher upfront **cost**. While you can save money by using renewable energy, the technologies are typically more expensive upfront than traditional energy generators.
- Intermittency. ...
- **Storage** capabilities. ...
- Geographic limitations.

7. Explain the prospects on non-conventional energy sources in India.

In the rural sector, cooking and lighting mechanical power for generation of small electricity.

The gas can be used with advantage to improve sanitary conditions and also to check environmental pollutions.

12 lakhs families in india are installed bio gas plants.

Maradnagar (U.P.), Rishikesh (U.P.), Sanganer (Raj), Sihar (Raj) Pondicheri, bhopal etc.

8. Explain the significance of energy consumption as prosperity? (July 2013)

Energy consumption as a measure of prosperity

1. Energy is important in all sectors.
2. Standard of living \propto per capita energy consumption.
3. Energy Crisis is due to the two reasons
 - i. Population.
 - ii. Standard of living
4. Per capita energy consumption is a measure of the per capita income or the per capita energy consumption is a measure of the prosperity of the nation.

Country	Electricity consumption per capita in (Kwhr)
World's average	2970
China	2480



Accredited by NAAC

Germany	7530	3
USA	14600	
Canada	19100	
India	630	

9. What are the different sources of energy.

Energy source can be divided into 3-types

1. Primary energy sources – Net supply of energy (Ex: Coal, natural gas, oil, nuclear)
2. Secondary energy – Partial net energy (Solar, wind, water, geothermal and ocean etc.)
3. Supplementary Energy source – Net energy yield is zero.

10. What is the difference between a pyr heliometer and pyranometer?

Thermoelectric Pyranometer

- Measures solar irradiance from 300-4000 nm
- Sensor: Blackened copper constantan thermopile covered with two concentric glass domes which are transparent to radiation from 300-4000 nm.
- Generated emf by thermopile is proportional to incident radiation. The typical value is approximately 5 micro Volts/watt/sq. metre
- Used for instantaneous measurement and continuous recording of Global, Diffused, Reflected Solar irradiance.

Thermoelectric pyr heliometer on solar tracker

- Measures direct solar irradiance from 300-4000 nm at normal incidence.
- Sensor: Blackened copper constantan thermopile.
- Sensor mounted in a long metallic tube to collimate the incident beam.
- Solar tracker maintains the pyr heliometer always directed towards the sun.
- Generated emf by the thermopile is proportional to incident irradiance. (Approx. 5 micro volts/watt/sq. metre)
- Used for instantaneous measurements and continuous recording of direct solar irradiance.

PART-B

1. Analyze the environmental consequences fossil fuel usage with case study.
2. Evaluate the important role of Conventional and non-conventional energy sources
3. Compose the Necessity of sustainable design and Development for the Prosper growth of human life in the world



Accredited by NAAC

4. Generalize the present Indian and international energy scenario of conventional and RE sources.
5. Summarize in details about different types of hydro Electric Energy systems with neat diagram. (13)
6. Briefly explain the Limitations of Renewable Energy (RE) sources(13)
7. Explain in details about the Geothermal Energy sources (13)
8. Explain about the various types of Ocean Thermal Energy Conversion (OTEC) systems (13)
9. Examine the impact of environmental consequences of fossil fuel usage (13)
10. Demonstrate the importance of renewable sources of energy (13)
11. (i) Explain about the different types of Energy sources. (7)
(ii) Discuss about the non-Conventional Energy Sources (6)
12. Summarize about the various types of Non-Conventional energy sources (13)
13. Explain in detail the Sustainable Design and development. (13)
14. Explain about the different types of Renewable energy (RE) sources.(13)

4

UNIT II -WIND ENERGY

PART-A

1. Write the characteristic's of wind energy?

Wind-power systems do not pollute the atmosphere.

2. What are the types of wind mills?

1. Multiple blade type
2. Savonius type
3. Darrieus type

3. Write the types of wind machines?

1. Horizontal axis wind machines
2. Vertical axis wind machines

4. List the various components of wind energy system.

1. Rotor
2. Gearbox
3. Enclosure
4. Tailvane

5. Write down the various types of wind power plants.

- Remote
- Hybrid
- Grid connected

6. List any four advantages of wind turbine.

- Inexhaustible fuel source
- No pollution
- Excellent supplement to other renewable source
- Its free



7. **List the disadvantages of wind power generation.**

1. Low energy production
2. Expensive maintenance

8. **What is the principle of wind power generation?**

Kinetic energy in moving air (wind) is converted into electrical energy. If mechanical energy is directly used it is called a wind mill. e.g.Pump. If mechanical energy is used to generate electrical energy and then used it is a wind energy converter. Cluster of wind mills is called a wind farm. Winds are essentially caused by the solar heating of the atmosphere. They carry enormous quantity of energy.

Wind as a source of power is very attractive because it is plentiful, inexhaustible, renewable and non-polluting. There is no depletion of scarce resources. In large portion of the world, wind blows for 320 days in a year and this gives them an advantage over sunlight in direct conversion programmes, operating cost of a wind mill is negligible.

9. **What are the types of wind mills?**

Wind energy conversion system are classified into two types, i) Horizontal axis wind mills
The axis of rotation is horizontal and in the aero turbine, plane is vertical facing the wind. ii)
Vertical axis wind mills
The axis of rotation is vertical, the blades also be vertical.

10. **Define a distributed generation system?**

It is a system of modular power generators at are near the customers sites and loads It potentially provide an economic value to the consumers as well as the power grid.

11. **What are the application of Wind energy?**

- Energy conversion
- Water pumping.
- Driving ship

PART-B

1. What is Wind power and derive the equation of power in wind(13)
2. (i)Define Tip speed ratio and write the necessary equation(6)
(ii)What are the advantages of windpowersystems? (7)
3. Explain in detail about the pitch control and Yaw control(13)
4. Explain the construction and working of Vertical Axis Wind Turbine (VAWT).(13)
5. Explain about the various Types of Wind Power Plant (WPPs). (13)
6. Explain about the Components of WPPswith necessary diagram(13)
7. Describe With a neat sketch about Horizontal axis windmills. (13)
8. Summarizethe working principle of Wind Energy Conversion System (WECS) (13)
9. Distinguish the difference between vertical Axis Wind Turbine and Horizontal Axis Wind Turbine. (13)



Accredited by NAAC

10. Explain in details about the various components present in the wind power plant with neat sketch.(13)
11. Classify the various types of rotor used in the wind turbine(13)
12. Generalize the factors to be consider for the site selection to install the wind power plant. (13)
13. Summarize the Grid integration issues of WPPs(13)
14. Sketch the diagram of a HAWT and explain the functions of its main components(15)
15. With the help of a diagram, discuss the power versus wind speed characteristics of a wind turbine(15)
16. Generalize the most favorable sites for installing of wind turbines.(15)

6

UNIT III -SOLAR PV AND THERMAL SYSTEMS

PART-A

1.What are the advantages and disadvantages of solar energy system?

Advantages

1. Sun is essentially an infinite source of energy. Therefore solar energy is a very large inexhaustible and renewable source of energy and is freely available all over the world.
2. It is environmentally very clean and is hence pollution-free.
3. It is a dependable energy source without new requirements of a highly technical and specialized nature for its wide spread utilization.
4. It is the best alternative for the rapid depletion of fossil fuels.

Disadvantages

1. It is available in a dilute and is at low potential. The intensity of solar energy on a sunny day in India is about 1.1 kW/square meter area. Hence very large collecting areas are required.
2. Also the dilute and diffused nature of the solar energy needs large land area for the power plant for instance, about 30 square kilometers area is required for a solar power station to replace a nuclear plant on a 1 square kilometer site. Hence capital cost is more for the solar plant.
3. Solar energy is not available at night or during cloudy or rainy days.

2.What are the applications of Solar Energy?

Applications of solar energy enjoying most success today are:

1. Solar engines for pumping.
2. Solar water heaters.
3. Solar cookers.
4. Solar driers.
5. Solar furnaces.
6. Photo-voltaic conversion (solar cells)
7. Solar power generation.



3. What are the main components of a flat plate collector ? Explain the function of each.

7

Basic Components of Flat plate collectors:

1. A transparent cover which may be one or more sheets of glass or radiation transmitting plastic film or sheets.

Tubes, fins, passages or channels are integrated with the collector absorber plate or connected to it, which carry the water, air or other fluids.

The absorber plate, normally metallic or with a black surface although a wide variety of other materials can be used with air heaters.

2. Insulation, Which should be provided at the back and sides to minimize the heat losses.

(fiber glass or styro-foam)

3. The casing or container which enclose the other components and protects them from the weather.

4. Classify solar energy storage systems. Describe in brief any one of the different storage systems. Dec 2012, June 2014

Concentrating Collector:

1. Focusing Collector is a device to collect solar energy with high intensity of solar radiation on the energy absorbing surface. Optical system in the form of reflectors or refractors are used.

2. A focusing collector is a special form of flat plate collector modified by introducing a reflecting surface between the solar radiators and absorber.

3. Radiation increases from low value of 1.5-2 to high values of the order of 10,000.

4. Radiation falling on a relatively large area, is focused on to a receiver (or absorber) of considerably smaller area.

5. Fluid can be heated to temperature of 500°C or more.

Types of Concentrating Collectors:

1. Depending on concentrating, collectors may be classified as 1. Line focusing and Point focusing

As per the no. of concentrating collector geometries, the main types of concentrating collector are

1. Parabolic trough

collector

2. Mirror

strip reflector

3. Fresnel lens

collector

4. Flat plate collector with adjustable

mirrors

5. Compound parabolic concentrator (C.P.C)



5. Explain the principle of conversion of solar energy into heat energy.

Physical principles of the conversion of solar radiation into heat

8

1. Green houses are useful for growing and propagating plants because they both allow sunlight to enter and prevent heat from escaping.

2. The transparent covering of the greenhouse allows visible light to enter unhindered, where it warms the interior as it is absorbed by the material within. The transparent covering also prevents the heat from leaving by reflecting the energy back into the interior and preventing outside winds from carrying it away.

6. With a neat diagram explain the working of a solar cooker.

Solar Cooker:

1. The solar rays penetrate through the glass covers and absorbed by a blackened metal tray kept inside the solar box.

2. The solar radiation entering the box are of short wave length.

3. The higher wave length radiation is not able to pass through the glass cover i.e reradiation from absorber plate to outside the box is minimized to gain minimize the heat loss.

4. Rubber strips are used to reduce the loss.

5. Insulation material like glass wool, paddy husk, saw dust are used.

6. A solar box cooks because the interior of the box is heated by the energy of the sun.

7. Sunlight, both direct and reflected, enters the solar box through the glass or plastic top. It turns to heat energy when it is absorbed by the dark absorber plate and cooking pots. This heat input causes the temperature inside of the solar box cooker to rise until the heat loss of the cooker is equal to the solar heat gain.

8. Temperatures sufficient for cooking food and pasteurizing water are easily achieved.

7. What are the Merits of Solar cooker?

1. No attention is needed during

cooking 2. No fuel is required.

3. Negligible maintenance

cost 4. No pollution

5. Vitamins of the food are not destroyed

6. No problem of charring of food and no over flowing

Limitations:

1. One has to cook according to the sun shine, menu has to be preplanned.

2. One cannot cook at short notice and food cannot be cooked in the night or during cloudy days. 3. It takes comparatively more time.

4. Chapaties are not cooked because high temperature is required and also needs manipulation at the time of baking



PART-B

1. summarize in detail about the construction and working principle of Solar Thermal Power Plant.(15)
2. With a neat sketch explain the construction and the principle operation of solar photovoltaic system (15)
3. Evaluate the series and parallel connection of Solar Photovoltaic system with neat sketch. (15)
4. summarize the maximum power point tracking in the Solar Photo voltaic system and discuss the advantages and disadvantages.
5. Explain in detail about the solar radiation Phenomena(13)
6. Explain and derive expression for beam and diffuse radiation(13)
7. Tabulate the different types of solar energy measuring instruments.(13)
8. What are the reasons for variation in the amount of solar energy reaching earth surface.(13)
9. Discuss the construction and working principle of Central Receiver Power Plants(13)
10. Examine the Environmental impact of solar power generation.(13)
11. Explain the working of Thermal Energy storage system with PCM(13)
12. Discuss in detail about the principle of Solar Photo Voltaic (SPV) conversion. (13)
13. Explain the various types of Photo Voltaic (PV) Systems. (13)
14. Explain in detail about the construction of solar cell ,solar module and solar array. (13)

UNIT IV BIOMASS ENERGY

PART-A

1. Define biomass. Give a descriptive classification of biomass resource.

Biomass is biological material from living, or recently living organisms, most often referring to plants or plant-derived materials. As a renewable energy source, biomass can either be used directly, or indirectly -- once or converted into another type of energy product such as biofuel. Biomass can be converted to energy in three ways: thermal conversion, chemical conversion, and biochemical conversion.

They are classified as i. Biofuel ii. Bio alcohols iii. Bio gas

2. With a suitable diagram, Explain the working of Janata model.

A fixed-dome plant consists of an enclosed digester with a fixed, non-movable gas space. The gas is stored in the upper part of the digester. When gas production commences, the slurry is displaced into the compensating tank. Gas pressure increases with the volume of gas stored; therefore the volume of the digester should not exceed 20 m³. If there is little gas in the holder, the gas pressure is low.

3. Discuss the process of biogas generation, List the factors affecting the generation of biogas.

10

Organic substances exist in wide variety from living beings to dead organisms . Organic matters are composed of Carbon (C), combined with elements such as Hydrogen (H), Oxygen (O), Nitrogen (N), Sulphur (S) to form variety of organic compounds such as carbohydrates, proteins & lipids. In nature MOs (microorganisms), through digestion process breaks the complex carbon into smaller substances.

There are 2 types of digestion process :

Aerobic digestion.

Anaerobic digestion.

The digestion process occurring in presence of Oxygen is called Aerobic digestion and produces mixtures of gases having carbon dioxide (CO₂), one of the main –green houses responsible for global warming.

The digestion process occurring without (absence) oxygen is called Anaerobic digestion which generates mixtures of gases. The gas produced which is mainly methane produces 5200-5800 KJ/m³ which when burned at normal room temperature and presents a viable environmentally friendly energy source to replace fossil fuels (non-renewable

OBJECTIVES:

Optimization of gas
production Comparison with
conventional plants

4. What are the factors affecting biogas generation?

Factors affecting Biogas production:

1. Substrate temperature
2. pH level
3. Mixing Ratio
4. Loading Rate
5. Hydraulic Retention time
6. Nitrogen inhibition
7. C/N ratio
8. Agitation
9. Toxicity
10. Solid concentration

5. What are the different models of biogas plants in India?

Main types of simple biogas plants :

- balloon plants,
- fixed-dome plants,
- floating-drum plants.



PART-B

1. List out the classification of biogas plants and explain any two with neat sketch. (13)
2. What is the meaning of biomass? Further, discuss its multipurpose utilization(13)
3. Describe in detail how does biomass conversion take place? (13)
4. Describe in detail the various factors affecting bio digestion of a gas? (13)
5. Differentiate between the following methods of biogas generation i. Pyrolysis (6) ii. Combustion (7)
6. Discuss the following methods of biogas generationi. Gasification (6)ii. Anaerobic Digestion
7. With a neat sketch explain the operation dry steam geothermal power plant. (13)
8. Describe in detail the operation dry binary cycle geothermal power plant. (13)
9. Explain the analysis of the energy content and its extraction for a hot dry rock type Geothermal resource.(13)
10. With a neat sketch explain the operation impoundment hydro power plant. (13)
11. Describe in detail the operation pumped storage hydro power plant.(13)
12. Demonstrate the following Impulse turbine:
 - (i)Pelton (6)ii. Turgo turbine (7)
7. Explain the operation of the following Reaction turbines:i. Francis (6)ii.Kaplan (7)
8. Discuss about selection of water turbine based on capacity of the power plan, head and water flow rate.

UNIT V OTHER ENERGY SOURCES

PART-A

1. Define Tide.

The periodic rise and fall of the water level of sea which are carried by the action of sun and moon on water of the earth is called the tide.

2. In which system the power is Intermittently generated?

In a single basin arrangement power can be generated only intermittently.

3. What are the consistencies 'Solar farm'ndolar'Stowaer'?

The solar farm consists of a whole field covered with parabolic trough concentrators and a 'solar tower'consists of a central receiver on a tower and a whole field of tracking.



4. Define Seebeck effect?

12

If two dissimilar materials are joined to form a loop and the two junctions maintained at different temperatures, an e.m.f. will be set up around the loop. This is called the Seebeck effect.

5. Write the classification of Tidal power plants?

Single Basin arrangement.

Double Basin arrangement.

6. What are the types of OCEAN THERMAL ENERGY CONVERSION (OTEC)?

- (1) Open cycle (or) Claude cycle.
- (2) Closed cycle (or) Anderson cycle.

7. What are the Advantages and Disadvantages of OTEC?

Advantages of OTEC

1. Ocean is an infinite heat reservoir which receives solar incidence throughout the year.
2. Energy is freely available.

Disadvantage of OTEC

1. Efficiency is very low, about 2.5%, as compared to 30-40% efficiency for conventional power plants.
2. Capital cost is very high

8. What are the advantages and limitation of Tidal power generation? Advantages:

1. Tidal power is completely independent of the precipitation (rain) and its uncertainty besides being inexhaustible.
2. Large area of valuable land is not required.
3. When a tidal power plant works in combination with thermal or hydro-electric system peak power demand can be effectively met with.
4. Tidal power generation is free from pollution.

Limitations:

1. Due to variation in tidal range the output is not uniform.
2. Since the turbines have to work on a wide range of head variation (due to variable tidal range) the plant efficiency is affected.



PART-B

13

1. Explain the different economic and environmental considerations of tidal power plant
 2. Describe in detail the operation of double basin type tidal power plant. (13)
 3. Discuss, what is the minimum tidal range required for the working of tidal plant.
Explain how much is the potential in tides. (13)
 4. Explain with a neat sketch the operation of OTEC plants. (13)
 5. Discuss the following:
i. Illustrate OTEC open cycle. (6)
ii. OTEC closed (Anderson) cycle-Discuss. (7)
 6. Explain the operation of hydrogen energy system with schematic diagram. (13)
 7. Describe the future fuel of the world that is hydrogen obtained by electrolysis of water with the energy. (13)
 8. Discuss in detail the various fuel cells and its applications. (13)
 9. Derive an expression for emf, free energy, potential, power output and efficiency of a fuel cell. (13)
 10. Describe working principle of fuel cell with neat sketch and draw the performance characteristics of hydrogen-oxygen fuel cell? (13)
 11. Describe the different methods of energy storage system. (13)
 12. With the help of neat diagram, explain the working of geo thermal-preheat Hybrid
-