JEPPIAAR
ENGINEERING COLLEGE

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

OEE351 – RENWABLE ENERGY SYSTEM

(Regulation 2021)

QUESTION BANK

Batch: (2022 – 2026)

Year/ Semester: III/VI

JEPPIAAR ENGINEERING COLLEGE

Vision of the Institute	To build Jeppiaar Engineering College as an institution of academic excellence in technological and management education to become a world class University	
Mission of the Institute	**M1**	To excel in teaching and learning, research and innovation by promoting the principles of scientific analysis and creative thinking
	M2	To participate in the production, development and dissemination of knowledge and interact with national and international communities.
	M3	To equip students with values, ethics and life skills needed to enrich their lives and enable them to meaningfully contribute to the progress of society
	M4	To prepare students for higher studies and lifelong learning, enrich them with the practical and entrepreneurial skills necessary to excel as future professionals and contribute to Nation's economy

DEPARTMENT: ELECTRONICS AND COMMUNICATION ENGINEERING

Vision of the Department	To become a centre of excellence to provide quality education and produce creative engineers in the field of Electronics and Communication Engineering to excel at international level.	
Mission of the Department	**M1**	Inculcate creative thinking and zeal for research to excel in teaching-learning process
	M2	Create and disseminate technical knowledge in collaboration with industries
	M3	Provide ethical and value based education by promoting activities for the betterment of the society
	M4	Encourage higher studies, employability skills, entrepreneurship and research to produce efficient professionals thereby adding value to the nation's economy

	PO 1	**Engineering knowledge**: **Apply** the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

	PROGRAM OUTCOMES (PO)	**PO 2**	**Problem analysis**: **Identify, formulate, review** research literature, and **analyze** complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
		PO 3	**Design/development of solutions**: **Design solutions** for complex engineering problems and **design** system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
		PO 4	**Conduct investigations of complex problems**: **Use** research-based knowledge and research methods including **design** of experiments, **analysis** and **interpretation** of data, and **synthesis** of the information to provide valid conclusions.
		PO 5	**Modern tool usage**: **Create**, **select**, and **apply** appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
		PO 6	**The engineer and society**: **Apply** reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
		PO 7	**Environment and sustainability**: **Understand** the impact of the professional engineering solutions in societal and environmental contexts, and **demonstrate** the knowledge of, and need for sustainable development.
		PO 8	**Ethics**: **Apply** ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
		PO 9	**Individual and team work**: **Function effectively** as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
		PO 10	**Communication**: **Communicate effectively** on complex engineering activities with the engineering community and with society at large, such as, being able **to comprehend** and **write** effective reports and **design** documentation, **make** effective presentations, and **give** and **receive** clear instructions.
		PO 11	**Project management and finance**: **Demonstrate** knowledge and understanding of the engineering and management principles and **apply** these to one's own work, as a member and leader in a team, to **manage** projects and in multidisciplinary environments.
		PO 12	**Life-long learning**: **Recognize** the need for, and have the preparation and ability to **engage** in independent and life-long learning in the broadest context of technological change.
		PEO I	Produce technically competent graduates with a solid foundation in the field of Electronics and Communication Engineering with the ability to analyze, design, develop, and implement electronic

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)		systems.
	PEO II	Motivate the students for choosing the successful career choices in both public and private sectors by imparting professional development activities.
	PEO III	Inculcate the ethical values, effective communication skills and develop the ability to integrate engineering skills to broader social needs to the students.
	PEO IV	Impart professional competence, desire for lifelong learning and leadership skills in the field of Electronics and Communication Engineering.
PROGRAM SPECIFIC OUTCOMES (PSOs)	**PSO 1**	Design, develop and analyze electronic systems through application of relevant electronics, mathematics and engineering principles.
	PSO 2	Design, develop and analyze communication systems through application of fundamentals from communication principles, signal processing, and RF System Design & Electromagnetics.
	PSO 3	Adapt to emerging electronics and communication technologies and develop innovative solutions for existing and newer problems.

OEE351 RENEWABLE ENERGY SYSTEMS L T P C 3 0 0 3

COURSE OBJECTIVES:

- To Provide knowledge about various renewable energy technologies
- To enable students to understand and design a PV system.
- To provide knowledge about wind energy system.
- To Provide knowledge about various possible hybrid energy systems
- To gain knowledge about application of various renewable energy technologies

UNIT I INTRODUCTION

Primary energy sources, renewable vs. non-renewable primary energy sources, renewable energy resources in India, Current usage of renewable energy sources in India, future potential of renewable energy in power production and development of renewable energy technologies.

UNIT II SOLAR ENERGY

Solar Radiation and its measurements, Solar Thermal Energy Conversion from plate Solar Collectors, Concentrating Collectors and its Types, Efficiency and performance of collectors,. Direct Solar Electricity Conversion from Photovoltaic, types of solar cells and its application of battery charger, domestic lighting, street lighting, and water pumping, power generation schemes. Recent Advances in PV Applications: Building Integrated PV, Grid Connected PV Systems,

UNIT III WIND ENERGY

Wind energy principles, wind site and its resource assessment, wind assessment, Factors influencing wind, wind turbine components, wind energy conversion systems (WECS), Classification of WECS devices, wind electric generating and control systems, characteristics and applications.

UNIT IV BIO - ENERGY

Energy from biomass, Principle of biomass conversion technologies/process and their classification, Bio gas generation, types of biogas plants, selection of site for biogas plant, classification of biogas plants, Advantage and disadvantages of biogas generation, thermal gasification of biomass, biomass gasifies, Application of biomass and biogas plants and their economics

UNIT V OTHER TYPES OF ENERGY:

Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, minihydel power plants and their economics. **TOTAL : 45 PERIODSOUTCOMES:**

At the end of the course students will be able to:

CO1: Attained knowledge about various renewable energy technologies
CO2: Ability to understand and design a PV system.
CO3: Understand the concept of various wind energy system.
CO4: Gained knowledge about various possible hybrid energy systems
CO5: Attained knowledge about various application of renewable energy technologies

REFERENCES:

1. Twidell & Wier,'Renewable Energy Resources' CRC Press(Taylor & Francis).
2. Tiwari and Ghosal/ Narosa,'Renewable energy resources'.
3. D.P.Kothari, K.C.Singhal,'Renewable energy sources and emerging technologies', P.H.I.
4. D.S.Chauhan, S.K. Srivastava, 'Non – Conventional Energy Resources', New Age Publishers, 2006.
5. 5. B.H.Khan, 'Non – Conventional Energy Resources', Tata Mc Graw Hill, 2006.

UNIT I INTRODUCTION

Primary energy sources, renewable vs. non-renewable primary energy sources, renewable energy resources in India, Current usage of renewable energy sources in India, future potential of renewable energy in power production and development of renewable energy technologies.

PART A

1**. Definition of a renewable energy source?(Nov/Dec2024)C311.1 PO5,7 BTL 1**

A **renewable energy source** is a natural resource that replenishes itself over time and can be used continuously without depletion. Examples include solar, wind, hydro, biomass, and geothermal energy

2..**Why Ocean, Wave, and Tidal Energies Are Not Considered Main Renewable Sources? Nov/Dec2024)C311.1 PO5,7 BTL 1**

•High Cost of Technology:**.**

•Limited Deployment:**.**

•Geographical Constraints:.

Environmental Impact: Large-scale tidal barrages can affect marine ecosystems and alter water flow patterns

3. W**hat are the three methods of conversion of solar energy into other useful forms of energy?(April May 2024) C311.1 PO5,7 BTL1**

Photovoltaic Conversion: Converts solar energy directly into electricity using solar cells.
Solar Thermal Conversion: Uses solar energy to heat fluids, which can be used for power generation or direct heating applications.

Photosynthesis (Biological Conversion): Plants convert solar energy into chemical energy, which can be harnessed for biofuels.

4. What is the status of non-conventional energy sources in India? (April May 2024) C311.1 PO 7 BTL1

India has been actively promoting renewable energy sources, including solar, wind, biomass, and small hydro power. As of recent years India is one of the top producers of solar and wind energy. The government has launched initiatives like the **National Solar Mission** to boost solar power generation. The target for renewable energy capacity is set at **500 GW by 2030**, contributing significantly to the country's energy mix. Policies and subsidies encourage investment in non-conventional energy sources to reduce dependence on fossil fuels.

5. What are the limitations of Renewable Energy source? (April may 2023)

•The energy available in dilute form from these sources.

•Though available freely in nature, the cost of harnessing energy from a non conventionalsource is generally high.outlet is called anon-commercial sources .E.g., wood, animal dung cake, crop residue, etc.,

6.What is meant by non-renewable energy source? (April May 2023)

Non-Renewable energy resource which are finite and do not get replenished after their consumption are called non-renewable. E.g., fossil fuels, uranium, etc.

7.What is meant by supplementary sources? (Nov/Dec 2022)

Supplementary sources are defined as those whose net energy yield iszero and those requiring highest investment in terms of energy insulation(thermal) is an example for this source.

8. How the energy resources are classified? (April /May 2022)

Based on usability of energy(

•Primary resources

•Intermediate resources

•Secondary resources Based on traditional use

•Conventional energy

•Non-conventional energy Based on long term availability

•Non-renewable

•Renewable Based on commercial application

•Commercial energy source

•Non-commercial energy source Based on origin

•Fossil fuels Energy

•Nuclear Energy

9. What are the factors causing winds?

Winds are caused from two main factors:

•Heating and cooling of the atmosphere which generates convection currents. Heating is caused by the absorption of solar energy on the earth's surface and in the atmosphere.
•The rotation of the earth with respect to atmosphere, and its motion around the sun.

10. What are the features of wind energy?

The characteristics of wind energy are:

•It is renewable source of energy

•Like all forms of solar energy, wind power systems are non-polluting ,so it has no adverse influence on the environment.
•Wind energy systems avoid fuel provision and transport.

•On a small scale, up to a few kilowatt system, is less costly.

11..What are the problems associated with wind energy?

The problems associated with wind energy are:
•Wind energy available is dilute and fluctuating in nature. Because of thedilute form, conversion machines have to be necessarily large.
•Unlike water energy, wind energy need storage means because of itsirregularity.

•Wind energy systems are noisy in operation; a large unit can be heardmany kilometers away.

•Large areas are needed to install wind farms for electrical powergeneration.

12.Name the three categories of Biomass resources.

Bio mass resources fall into three categories:

•Biomass in its traditional solid mass (wood and agricultural residue),and

•Biomass in non-traditional form (converted into liquid fuels).The first category is to burn the biomass directly and get the energy. In the second category, the biomass is converted into ethanol and methanol to be used as liquid fuels in engines. The third category is to ferment the biomassan aerobically to obtain a gaseous fuel called biogas..

13.Define heliostats.

In solar tower concentration system (tower power concept)the incomingsolar radiation is focused to a central receiver or a boiler mounted on a talltower using thousands of plane reflectors which are steerable about two axesare called heliostats.

14. Define energy yield ratio.

The energy yields ratio of an energy extraction process is defined asfollows:Energy yield ratio =Energy received from raw energy sourceEnergy spent to obtain raw energy source

15.State the importance of non-conventional energy source.

•The demand of energy is increasing by leaps and bounds due to rapidindustrialization and population growth, and hence the conventionalsources of energy will not be sufficient to meet the growing demand.

•Conventional sources (except hydro) are non-renewable and are boundto finish up one day.

•Conventional sources (fossil fuels, nuclear) also cause pollution; therebytheir use degrades the environment.

•Large hydro resources affect wildlife, cause deforestation and posevarious social problems.

•In addition to supplying energy, fossil fuels are also used extensively asfeed stock materials for the manufacture of organic chemicals. Asreserve deplete, the need for using fossil fuels exclusively for suchpurpose may become greater.

16.What is meant by Energy Conservation?

Energy Conservation means reduction in energy consumption butwithout making any sacrifice in the quality or quantity of production. In otherwords, it means increasing the production from a given amount of energyinput by reducing losses/wastage and maximizingthe efficiency.

17.What are the applications of solar energy?

•Heating and cooling residential building

•Solar water heating

•Solar distillation

18. State three incentives in Energy Conservation.

The three major incentives in energy conservation are:
Decreasing the energy requirement
Conserving the limited conventional assets of energy
Saving the environment

19. List the general principles of Energy Conservation

The general principles of Energy Conservation are:

•Recycling of waste

•Modernization of technology

20. List the necessity of energy storage.

•The effective utilization of intermittent and variable energy source suchas sunlight, wind, etc., often requires energy storage

•Storing the energy and transporting it economically to a load centre.

•The vehicle must carry its energy supply, the storage system must bereadily transportable

21. Define Energy Utility Factor.

The relation between useful thermal energy and the available chemicalenergy in the fuel is expressed by means of the energy utility
factor.Energy Utility Factor= Useful Thermal Energy/ Available Energy in Fuel

22.What are the applications of solar energy?

•Heating and cooling residential building

•Solar water heating

•Solar distillation

23.Comparison of Conventional and non-conventional sources.Feature Conventional(nonrenewable)Non conventional(renewable)
Technologies Established Under development

Plant size Large(mw range) Small (kw range)Main power plants Suitable Not sufficientEnergy density ofsourceHigh
LowPollution problems More LessEnergy conserves Limited will getexhausted soonWill continue to renewCost of generation Low High

24. What are the needs of energy conservation?

•Energy conservation is necessary to reduce the wastage of energy.

•It helps to keep the domestic change payment constant even when theproduction cost of electricity increase.
•It helps to maintain the profit in industries uniform even if theelectricity change increases.

25. What are the different types of renewable energy sources?

Solar energy Wind energyHydro power Geo thermalBiomass Tidal &Wave energy

26. What are the applications of solar energy?

•Heating and cooling residential building

•Solar water heating

•Solar distillation

•Solar engines for water pumping

•Food refrigeration

27. What are the types of wind mills?

•Multi blade type

•Sail blade type

•Propeller type

•Savonius type and

•Darrieus type

28. Write the characteristics of wind energy.

•It is a renewable source of energy

•Non polluting

•Wind energy systems avoid fuel provision and transport

•On a small scale up to a few KW system is less costly

29. State the causes of problems in wind mill

•Wind energy available is dilute and fluctuating in nature. Because of the dilute form, conversion machines have to e necessarily large.
•Wind energy systems are noisy in operation a large unit can be heard many kilometers away.

•Large areas are needed to install wind forms for electrical power generation

31. What is energy plantation?

Selected species of trees would be planted and harvested over regular time period near the power plant.Eg: Eucalyptus, casuarinas and babool.

32. What are the draw backs on bio gas?

•Biomass combustion produces air pollution

•Large scale production of biomass and its harvesting accelerate soil erosionand nutrient.

•Domestic use of biomass in rural areas creates air pollution

33. What are the applications of bio mass?

•Cooking

•Lightning

•Mechanical power

•Generation of small electricity

34. What are the environmental concerns of geo thermal energy?

•Gases containing H2S are oxidized to SO2 and H2So4 and drops down as acidrain.

•Chemicals like sulphates, Chlorides and Carbonates of lead, boron andarsenic pollute soiand water

•Discharge of waste hot water infects rivers and affect drinking water, farmingand fisheries

•Noise pollution caused by exhausts is a health hazard and is controlled byusing silencers

35. What are the adverse effects produced by geo thermal energy source?

•Ammonia is used as working fluid in closed cycle OTEC system. Its leakagemay cause great damage to the ocean eco system.

•An OTEC plant displaces 4 cumec water/ MW generation. Massive flowdisturbs thermal balance, changes salinity gradient and turbidity. It createsadverse impact on marine environment.

•Mining of warm & cold water near the surface develops convection of sinkingcold water. It creates a temporary variation at 40 ^{o}C forcing mortality amongcoral and fines.

36. What is meant by Solar Energy?

The energy received in the form of radiation, can be converted directly or indirectly into other forms of energy, such as heat and electricity, which can be utilized by man.

37. List the drawbacks of Solar Energy.

- The intermittent and variable manner in which it arrives at the earth's surface and

- The large area required to collect the energy at a useful rate.

38. Define solar constant.

Solar constant is defined as the amount of energy received in unit time on a unit area perpendicular to the sun's direction at the mean distance of the earth from the sun.

39. What is meant by solar collector? Mention its types.

A solar collector is a device for collecting solar radiation and transfers the energy to a fluid passing in contact with it. There are two types of collectors:

- Non- concentrating or flat plate type solar collector.
- Concentrating (focusing) type solar collector.

40. Mention the ways of solar energy can be utilized.

Solar energy can be utilized directly in two ways:

- By collecting the radiant heat and using it in a thermal system
- By collecting and converting it directly to electrical energy using a photovoltaic system

41. What are the indirect forms of solar Energy?

- Wind energy
- Biomass energy
- Tidal energy
- Ocean wave energy
- Ocean thermal energy
- Fossil fuels and other organic chemicals
- Hydro energy

42. What are the performance indices of a solar collector?

The performance indices of a solar collector are

Collector Efficiency is defined as the ratio of the energy actually absorbed and transferred to the heat transport fluid by the collector (useful energy) to the energy incident on the collector

Concentration Ratio is defined as the ratio of the area of aperture of the system to the area of the receiver. The aperture of the system is the projected area of the collector facing (normal) the beam.

Temperature Range is the range of temperature to which the heat transport fluid is heated up by the collector.

43. Name the basic design of solar cookers

The four basic designs of the solar cookers are:

Box type solar cooker

Dish type solar cooker

Community solar cooker

Advanced solar cooker

44. List out the advantages and disadvantages of air flat plate collector Advantages of flat plate air heating collector are

- It is compact, simple in construction and requires little maintenance.
- The need to transfer thermal energy from the working fluid to another
- Fluid is eliminated as air is used directly as the working fluid.

Corrosion is completely eliminated.

- Leakage of air from the duct is less severe.
- Possibility of freezing of working fluid is also eliminated.

Disadvantages of air collector are

- A large amount of fluid is to be handled due to low density. As a result, the electrical power required to blow the air through the system can be significant if the pressure drop is not kept within prescribed limits.
- Heat transfer between the absorber plate and air is poor.
- There is less storage of thermal energy due to low heat capacity.

45. List any four disadvantages of solar energy

- It is available only by day and not when the sky is cloudy, thereby reducing the chances of it being totally reliable and requiring storage facilities
- It needs back up power plant to be kept hot and not to replace solar power stations they stop producing energy
- Keeping back up plants hot includes an energy cost which includes coal burning
- Places located at high altitudes or those that are often cloudy are not targets for solar power use

46. List the five advantages of solar energy

- It is free from pollution
- The plant requires little maintenance or help after set up
- It is economical
- They collect solar energy optically and transfer it to a single receiver thus minimizing thermal energy transport requirement
- Concentration ration is 300 to 1500 and are highly efficient both in collecting energy

and in converting energy

47. Mention the advantages of vertical axis wind turbine over horizontal axis

They will react to wind from any direction and therefore do not need yawing equipment to turn the rotor into the wind.

They can require less structural support because heavy components can be located at ground level. This configuration also eases installation and maintenance.

Since the blades do not turn end over end, the rotor is not subjected to continue cyclic gravity loads..

48. What are the factors consider for the electrical generators and control method?

The choice of an electrical generator and control method can be considered by following three methods:

- The basis of operation i.e., either constant tip speed or constant tip speed ratio
- The wind power rating of the turbine
- The type of load demand e.g. battery connection.

49. What are the main Environmental aspects due to wind turbines?

The main environmental aspects are:

- Indirect energy use and emissions
- Bird life
- Noise
- Visual impact
- Telecommunication interference
- Safety
- Effects on ecosyste

50. What are the types of rotors for HAWT?

The different types of rotor for HAWT are:

- Single blade rotor
- Two blade rotor
- Three blade rotor
- Sailing rotor

PART-B

1.**What are the prospects of non-conventional energy sources in India? Explain.(Nov/Dec2024)**

Refer page no.35-46, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

2.**Compare the energy consumption pattern in various sections in India. Discuss the growthrate of energy requirements and power generation in India.(April/May 2024)**

Refer page no.37-46, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

3.**a) Name and explain briefly the various sources of Non-conventional Energy**

b) Briefly describe about energy conservation act 2003.

Refer page no.50, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

4. Explain the solar energy option?

Refer page no.47, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

5. Analyze the availability and efficiency of Role and potential of new and renewable source.

Refer page no.4, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

6.Briefly discuss about the primary and commercial energy resources. Also discuss about the energy consumption pattern and growth rate in India.

Refer page no.55, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

7.Discuss briefly Environmental impact of solar power?

Refer page no.60, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

8.Describe the Physics of the sun, the solar constant and Explain.

Refer page no.72, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

9.What are the Extra terrestrial and terrestrial solar radiation? Describe them.

Refer page no.52, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

10.Write briefly on Solar radiation on titled surface and Instruments for measuring solar radiation and sun shine?

Refer page no.71, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

11.Explain the Solar radiation data?

Refer page no.64, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

UNIT II - SOLAR ENERGY
Solar Radiation and its measurements, Solar Thermal Energy Conversion from plate Solar Collectors, Concentrating Collectors and its Types, Efficiency and performance of collectors,. Direct Solar Electricity Conversion from Photovoltaic, types of solar cells and its application of battery charger, domestic lighting, street lighting, and water pumping, power generation schemes. Recent Advances in PV Applications: Building Integrated PV, Grid Connected PV Systems,

PART A

1. Classification the Photovoltaic (PV) Modules ?(Nov/Dec / 2024)BTL1 CO 311.1PO1

- **Crystalline Silicon Modules**

- **Monocrystalline Silicon (Mono-Si):** High efficiency, expensive, better performance in low light.
- **Polycrystalline Silicon (Poly-Si):** Lower efficiency than monocrystalline but more affordable..

2. What is Meant by Concentration Ratio? (Nov/Dec / 2024)BTL1 CO 311.1 PO1

The **concentration ratio (CR)** in solar photovoltaic or thermal systems refers to the ratio of the area of sunlight collected to the area of the solar cell or receiver. It is given by:

$$CR = \frac{\text{Collector Area}}{\text{Receiver Area}}$$

- **Low Concentration Systems:** CR < 10
- **Medium Concentration Systems:** CR = 10 to 100
- **High Concentration Systems:** CR > 100

3. What is the average range of solar radiation received on the earth's surface during the day?(April /May 2024)BTL1 PO1

The average solar radiation received on Earth's surface varies based on location, time of year, and atmospheric conditions. However, it typically falls within the range of **100 to 1000 W/m²**. On a clear day, solar irradiance can reach around **1000 W/m² at noon** in direct sunlight.

4. Draw the equivalent circuit of a practical solar cell.usage? (April /May 2024)BTL1 PO1

Need for pumping occurs during the summer when solar radiation is greatest.

During periods of low radiation when pumping reduce evaporation losses from crops also low.

5. What is the need for solar crop drying?

High moisture crops are prone to fungus infection, attack by insects and rests. Solar dryers remove moisture with no ingress at just and the product can be preserved for a longer period at time.

6. State the use of solar kilns?

For large scale drying ie seasoning of timber, corn drying, tea processing, fish and fruit drying, solar kilns are in use.

7. List the different modes of solar cooling

- Evaporative cooling
- Absorption cooling and
- Passive desiccant cooling

8. What are the 4 units of absorption type solar cooler?

- Generator
- Condenser
- Evaporator

9. What are the two types of flat plate collectors?

- Liquid heating collectors
- Solar air heaters

10. What Essential subsystems in a solar energy plant:

1. Solar collector or concentrator: It receives solar rays and collects the energy. It may be of following types:

a) Flat plate type without focusing

b) Parabolic trough type with line focusing

c) Paraboloid dish with central focusing

d) Fresnel lens with centre focusing

e) Heliostats with centre receiver focusing

10. What is meant by Solar Energy?

The energy received in the form of radiation, can be converted directlyor indirectly into other forms of energy, such as heat and electricity, which can be utilized by man.

11. List the drawbacks of Solar Energy.

The intermittent and variable manner in which it arrives at the earth'surface and

The large area required to collect the energy at a useful rate.

12. Define solar constant.

Solar constant is defined as the amount of energy received in unit time on a unit area

perpendicular to the sun's direction at the mean distance of the earth from the sun.

13. Define solar time.

Solar time (Local Apparent Time) is measured with reference to solarnoon, which is the time when the sun is crossing the observer's meridian.Solar time = Standard time ±4 (L st-Lloc) +E

Where

Lst = standard longitude L

Loc = longitude of the observer's location E = Equation of Time diffused radiation is known as global radiation.

14. What is meant by solar collector? Mention its types.

A solar collector is a device for collecting solar radiation and transfers theenergy to a fluid passing in contact with it. There are two types of collectors:

Non- concentrating or flat plate type solar collector.

Concentrating (focusing) type solar collector.

15. Mention the ways of solar energy can be utilized.

Solar energy can be utilized directly in two ways:

By collecting the radiant heat and using it in a thermal system

By collecting and converting it directly to electrical energy using a photovoltaic system

16. What are the indirect forms of solar Energy?

Wind energy Biomass energy Tidal energy Ocean wave energy Ocean thermal energy Fossil fuels and other organic chemicalsHydro energy

17.What are the performance indices of a solar collector?

The performance indices of a solar collector are

Collector Efficiency

is defined as the ratio of the energy actually absorbedand transferred to the heat transport fluid by the collector(useful energy) tothe energy incident on the collector

Concentration Ratio

is defined as the ratio of the area of aperture of thesystem to the area of the receiver. The aperture of the system is the projectedarea of the collector facing (normal) the beam.

Temperature Range

is the range of temperature to which the heat transportfluid is heated up by the collector.

18.**Name the basic design of solar cookers**

The four basic designs of the solar cookers are:Box type solar cookerDish type solar cookerCommunity solar cookerAdvanced solar cooker

19. List out the advantages and disadvantages of air flat plate collectorAdvantages of flat plate air heating collector are

It is compact, simple in construction and requires little maintenance.

The need to transfer thermal energy from the working fluid to anotherfluid is eliminated as air is used directly as the working fluid.

Corrosion is completely eliminated.

Leakage of air from the duct is less severe.

Possibility of freezing of working fluid is also eliminated.

The pressure inside the collector does not become very high.

Disadvantages of air collector are

A large amount of fluid is to be handled due to low density. As aresult, the electrical power required to blow the air through the systemcan be significant if the pressure drop is not kept within prescribedlimits.

Heat transfer between the absorber plate and air is poor.

There is less storage of thermal energy due to low heat capacity.

20. What is meant by solar pond?

A natural or artificial body of water for collecting and absorbing solarradiation energy and storing it as heat. Thus a solar pond combines solarenergy collection and sensible heat storage.

21. What is meant by solar photo voltaic?

The direct conversion of solar energy into electrical energy by means of thephotovoltaic effect, that is, the conversion of light (or other electromagneticradiation) into electricity. The photovoltaic effect is defined as the generation of anelectromotive force as a result of the absorption of ionizing radiation.

22. List the application of solar PV system.

Water pumping sets for micro irrigation and drinking water supplyRadio beacons for ship navigation at portsCommunity radio and television setsCathodic protection of oil pipe linesWeather monitoringRailway signaling equipmentBattery chargingStreet lighting

23.**What are the advantages & disadvantages of PV solar energy conversionsystem?**

Advantages

Direct room temperature conversion of light to electricitythrough a simple solid state device.Absence of moving partsMaintenance cost is low s they are easy to operateDo not create pollutionLong effective lifeHighly reliable

Disadvantages

High costIn many applications energy storage is required because ofno insolation at night.

24. What are the advantages & disadvantages of concentrating collectors overflat plate type collectors?

Advantages:

Reflecting surfaces required less material and are structurally simplerthan flat plate collectors. For a concentrator system the cost per unitarea of solar collecting surface is therefore potentially less than that forflat plate collectors

The absorber area of a concentrator system is smaller than that of a flatplate system for same solar energy collection and therefore theinsulation intensity is greater.

Little or no anti-freeze is required to protect the absorber in aconcentrator system whereas the entire solar energy collection surfacerequires anti-freeze protection in a flat plate collector.

Disadvantages:

Out of the beam and diffuse solar radiation components, only beamcomponent is collected in case of focusing collectors because diffusecomponent can not be reflected and is thus lost.

Additional requirements of maintenance particular to retain the qualityof reflecting surface against dirt, weather, oxidation etc.,

Non-uniform flux on the absorber whereas flux in flat plate collectorsis uniform

Additional optical losses such as reflectance loss and the intercept loss,so they introduce additional factors in energy balances

High initial cost

25. Name the types of concentrating collectors.

The main types of concentrating collectors are:Parabolic trough collectorMirror strip reflectorFresnel lens collectorFlat plate collector with adjustable mirrors compoundparabolic concentrator(CPC)

26. What are the zones in solar pond?

Surface convective zone or upper convective zone (0.3-0.5m)

Non-convective zone (1-1.5m) salinity increases with depth.

Storage zone or lower convective zone (1.5-2m) salinity =20%

27. What are the merits of solar cooker?

No attention needed while cooking

No fuse required

Negligible maintenance cost

No pollution

Vitamins of food are not destroyed

No overflowing

28. **What are the limitations of solar cooker?**

According to sunshine menu should be prepared

Short time cooking not possible

Cooking at night or cloudy days is difficult

Takes long time for cooking

Chapaties are not cooked because of high temperature requirement and needsmanipulation at the time of baking

29. What are the reasons for solar pumping usage?

Need for pumping occurs during the summer when solar radiation isgreatest.

During periods of low radiation when pumping reduce evaporation lossesfrom crops also low.

30. What is the need for solar crop drying?

High moisture crops are prone to fungus infection, attack by insects andrests. Solar dryers remove moisture with no ingress at just and the product can bepreserved for a longer period at time.

31. State the use of solar kilns?

For large scale drying ie seasoning of timber, corn drying, tea processing, fishand fruit drying, solar kilns are in use.

32. List the different modes of solar cooling

Evaporative cooling

Absorption cooling and

Passive desiccant cooling

33. What are the 4 units of absorption type solar cooler?

Generator

Condenser

Evaporator

34. What are the advantages of solar cells?

They need little maintenance

They have longer life

They do not create pollution problem

Their energy source is unlimited

Easy to fabricate

They can be made from raw materials which are easily available inlarger quantities

35. What are the disadvantages of solar cell?

Compares with other sources of energy solar cells produce electricpower at very high cost

Solar cell output is not constant and it varies with the time of day andweather

They can be used to generate small amount of electric power.

36. What are the components of basic solar pumping system?

The solar collector

The heat transfer system

Boiler or heat exchanger

Heat engine

Condenser

Pump

37. List the types of heat engines used in solar system

Rankine engine

Reciprocating engine

Vapor engine

Stirling hot gas engine

Brayton cycle gas turbine

Rotary piston engine

38. Write the equation for over all efficiency of solar pump?

$\eta o = \eta e \eta c$

Over all efficiency= Efficiency of the engine* Efficiency of the collectors

39. List the working fluids used in solar pumps

Foluene

Monochloro benzene

Frifuluroethanol

Hexa flura benzene

40. What are the two types of flat plate collectors?

Liquid heating collectors

Solarairheaters

41. What is Green house effect?

The energy we receive from sun in the form of light is a shortwave radiation(not visible to human eye). When this radiation strikes a solid or liquid it isabsorbed and transformed in to heat, the material becomes heat and conducts it tosurrounding materials (air, water or liquids) or reradiates in to other materials oflow temperature as long wave radiation.

42. What is concentration ratio?

Concentration ratio is the ratio between the aperture area and receiver /absorber area of the collector.

43. List the five advantages of solar energy

It is free from pollution

The plant requires little maintenance or help after set up

It is economical

They collect solar energy optically and transfer it to a single receiver thus minimizing thermal energy transport requirement

Concentration ration is 300 to 1500 and are highly efficient both in collecting energy and in converting energy

44. List any four disadvantages of solar energy

It is available only by day and not when the sky is cloudy, there by reducing the chances of it being totally reliable and requiring storage facilities

It needs back up power plant to be kept hot and not to replace solar power stations they stop producing energy

Keeping back up plants hot includes an energy cost which includes coal burning

Places located at high altitudes or those that are often cloudy are not targets for solar power use.

46. What is meant by biomass energy and biomass energy resource?

Organic matters derived from biological organisms are called Biomass. The energy obtained from biomass is called biomass energy.

The raw organic matter obtained from nature for extracting secondary energy is called biomass energy resource.

47. Classify the biomass resources.

Biomass resources are broadly classified into two categories:

- Biomass from cultivated fields, crop, forest and harvested periodically.

- Biomass derived from waste e.g., municipal waste, animal excreta/dung, forest waste, agricultural waste, bioprocess waste,butcharry waste, fishery waste/processing waste etc.,

48. What do you mean by fossil fuels?

Fossil fuels (coal, petroleum oil and natural gases) are produced from dead, buried biomass under pressure and in absence of air during several millions of years. However; they are considered separately as fossils and are not included in the category of biomass.

49. What are the categories of scope of biomass energy?

The scope of biomass energy is of three categories. They are

- Rural application of biomass energy
- Urban and industrial applications of biomass energy
- Biomass as a primary source for large scale electrical power generation.

50. List the secondary energy forms of biomass.

The biomass can be converted to useful secondary energy forms such as

- Heat
- Gaseous fuels
- Solid fuels
- Organic chemical
- Liquid fuels

PART-B

1.Explain in detail Flat plate and concentrating collectors.

Refer page no.76, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

2.Draw illustrative diagram showing all the important components of solar heating and solar cooling unit. Explain the working principles of these devices.

Refer page no.87, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

3.Explain with necessary diagram Classification of concentrating collectors

Refer page no.87, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

4.Explain with neat diagram solar space cooling and solar pond electric power plant.

Refer page no.94, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

5.Write short notes on:

a) Solar pumping

b) Solar desalination

Refer page no.94, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

6.Describe the photovoltaic principles of solar power generation. Compare the different types of solar cells with respect to power output andefficiency.

Refer page no.94, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

7.Write briefly about Orientation and thermal analysis?.

Refer page no.94, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

8.Draw and explain different types of solar cooker

Refer page no.102, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

9.Explain with neat diagram about solar pond and its characteristics.

Refer page no.88, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

10. Discuss briefly about

a) Solar drying

b) solar cells

Refer page no.94, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

11.Draw schematic diagram of solar thermal power plant used for power production and explain the operation of this system in detail.

Refer page no.102, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

12.a) Give merits and demerits on solar energy.

b) State some important the applications of PV.

Refer page no.102, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

UNIT III – WIND ENERGY
Wind energy principles, wind site and its resource assessment, wind assessment, Factors influencing wind, wind turbine components, wind energy conversion systems (WECS), Classification of WECS devices, wind electric generating and control systems, characteristics and applications.

PART A

1.What Classify wind turbines by the orientation of their axis of rotation and by the mechanism that provides torque to the rotating shaft.?(Nov/Dec 2024)BTL1 CO311.1 PO1

- Wind turbines can be classified based on:
- **A. Orientation of Axis of Rotation**
- **Horizontal Axis Wind Turbines (HAWTs)**
  - Most common type
  - Higher efficiency
  - Requires yaw mechanism to face wind
- **Vertical Axis Wind Turbines (VAWTs)**
  - Can capture wind from any direction
  - Lower efficiency but simpler design

2.The power potential of a wind turbine at a wind speed of 5 m/s is 50 kW. Find the power potential of the same turbine at a velocity of 8 m/s? (Nov/Dec 2024)BTL1 CO311.1 PO1

The power output of a wind turbine is proportional to the **cube of wind speed**:

$$P \propto V^3$$

Given:

- $P_1 = 50$ kW at $V_1 = 5$ m/s
- $V_2 = 8$ m/s

Using the proportionality equation:

$$\frac{P_2}{P_1} = \left(\frac{V_2}{V_1}\right)^3$$

$$P_2 = 50 \times \left(\frac{8}{5}\right)^3$$

$$P_2 = 50 \times \left(\frac{512}{125}\right)$$

$$P_2 = 50 \times 4.096 = 204.8 \text{ kW}$$

Final Answer: The power potential at 8 m/s is **204.8 kW**

3.What are the disadvantages of solar cell?

- Compares with other sources of energy solar cells produce electric power at very high cost
- Solar cell output is not constant and it varies with the time of day and weather

- They can be used to generate small amount of electric power.

4. What are the components of basic solar pumping system?

- The solar collector
- The heat transfer system
- Boiler or heat exchanger
- Heat engine
- Condenser
- Pump

5. List the types of heat engines used in solar system

- Rankine engine
- Reciprocating engine
- Vapor engine
- Stirling hot gas engine
- Brayton cycle gas turbine
- Rotary piston engine

6. Write the equation for over all efficiency of solar pump?

$$\eta o = \eta e \eta c$$

Over all efficiency= Efficiency of the engine* Efficiency of the collectors

7. List the working fluids used in solar pumps

- Foluene
- Monochloro benzene
- Frifuluroethanol
- Hexa flura benzene

8. List out the factor led to accelerated development of wind power.

Availability of high strength fibre composites for constructing large low cost rotor blades Falling prices of power electronics Variable speed operation of electrical generators to capture maximum energy Improved plant operation, pushing the availability upto 95%.Economy of scale, as the turbines and plants are getting larger in size. Accumulated

field experience improving the capacity factor Short energy payback period of about one year

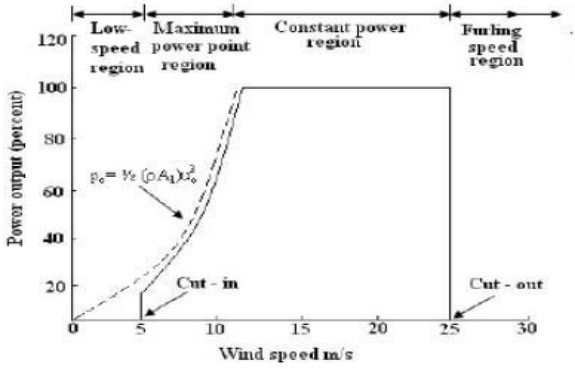
8.**What are the features prefer for the wind turbine site?**

No tall obstructions for some distance in the upwind direction and also a low a roughness as possible in the same direction A wide and open view i.e., opens plain, open shore line or offshore locations. Top of smooth well-rounded hill with gentle slopes on a flat plain An island in a lake or the sea narrow mountain gap through which wind is channelled Site reasonably close to power grid Soil conditions must be such that building of foundations of the turbines and transport of road- construction materials loaded in heavy trucks is feasible. Production results of existing wind turbines in the area to act as a guide to local wind conditions.

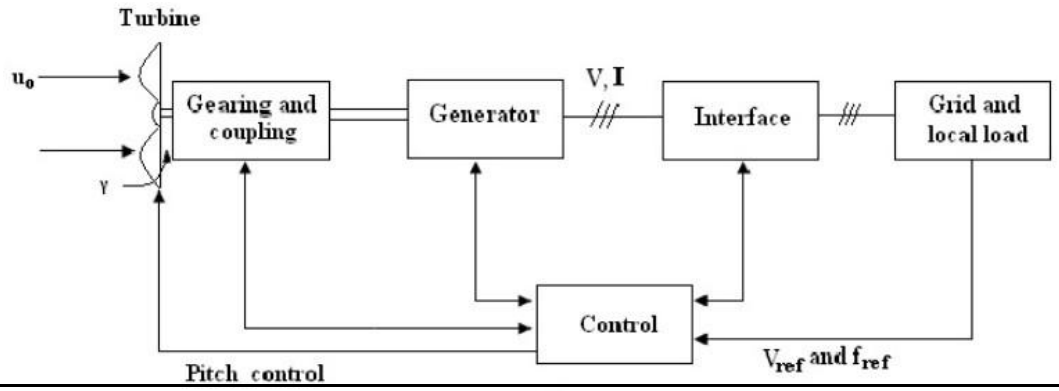
9. What are the merits and demerits of three blade rotor over two blade rotors?

Compared to the two blade design, the three blade machine has smoother power output and balanced gyroscopic force. There is no need to teeter the rotor, allowing the use of a simple rigid hub. The blades may be cross-linked for greater rigidity. Adding a third blade increases the power output by about 5%only, while the weight and cost of a rotor increases by 50%,thus giving a diminished rate of return for additional 50%weight and cost. The two blade rotor is also simpler to erect, since it can be assembled on the ground and lifted to the shaft without complicated manoeuvres during the lift.

10. Draw the power Vs wind speed characteristics.



11. Draw the block diagram of WECS.



12. What are the types of generator drive for the operation of WECS?

The types of generator are suitable for the wind generations are: DC generator Synchronous Generator Induction generator

13. Define gusts

.Rapid fluctuations in the wind velocity over a wide range of frequencies and amplitudes, due to turbulence caused by mechanical mixing of lower layers of atmosphere by surface roughness,are commonly known as gusts.

14. What are the features of VAWT?

The features of VAWT:

It can accept wind from any direction, eliminating the need of yaw control.

The gearbox, generator, etc., are located at the ground, thus eliminating the heavy nacelle at the top of the tower, thus simplifying the design and installation of the whole structure, including the tower.

The inspection and maintenance also gets easier

It also reduces the overall cost

15. Define power coefficient

The fraction of the free flow wind power that can be extracted by a rotor is called the power-coefficient.Power coefficient = Power of wind turbine/Power available in the wind

16. List out the merits of WECS

It is a renewable source of energy Like all forms of solar energy, wind power systems are non-polluting, so it has no adverse influence on the environment.Wind energy systems avoidfuel provision and transport.On a small scale upto a few kilowatt system is less costly. On alarge-scale costs can be competitive with conventionalelectricity and lower coats can be competitive with conventionalelectricity and lower costs could be achieved by massproduction.

17. List out the demerits of WECS

Wind energy available in dilute and fluctuating in nature.Unlike water energy wind energy needs storage capacitybecause of its irregularityWind energy systems are noisy in operation; a large unit can beheard many kilometers away.Large areas are needed, typically, propellers 1 to 3 m indiameter, deliver power in the 30 to 300W range.

18. What are the components of wind turbine generator units?

A wind turbine unit consists of the following major assemblies:A wind turbine with vertical axis or horizontal axis.Gear chainAn electrical generator(synchronous or asynchronous(induction))Associated civil works, electrical and mechanical auxiliaries,control panels etc.,

19. Classify the schemes available for electric generation.

The schemes are available for electric generation is of three categories.Constant-speed

constant frequency systems(CSCF)Variable speed constant frequency systems(VSCF)Variable speed variable frequency systems(VSVF)

20. Define wind turbine.

A wind turbine which converts wind power into rotary mechanical power. A wind turbine has aerofoil blades mounted on the rotor. The wind drives the rotor and produces rotary mechanical energy.

21. What is cut in speed and cut-out wind speeds for turbine? CUT IN SPEED

Wind speed at which wind turbine starts delivering shaft power.Cut in speed: While operating - 7m/while stopping - 5m/s

CUT OUT SPEED

At high velocities during storms, it is necessary to cut out the powerconversion of wind turbine by furling the wind turbine blades. The speed atwhich power conversion is cut out is called cut out wind speed or furling windspeed.Cut out speed:

While operating - 20m/sWhile stopping - 17m/sRated speed - 14m/s

22. Name the two natural phenomena in the atmosphere of different origins.

Winds are natural phenomena in the atmosphere and have twodifferent origins.

Planetary Winds

are caused by daily rotation of earth around itspolar axis and unequal temperatures between polar regions andequatorial region.

Local Winds

are caused by unequal heating and cooling ofground surfaces and ocean/lake surfaces during day and night.

23. Name the characteristics in which the speed of a wind turbine rotordepends.

The speed of a wind turbine rotor depends principally onWind speedPitch of the turbine bladesMechanical and electrical load i.e., shaft load,friction,breakingforce etc.,Orientation of yaw with reference to the wind.

24. Mention the advantages of vertical axis wind turbine over horizontal axis

They will react to wind from any direction and therefore do not need yawing equipment to turn the rotor into the wind. They can require less structural support because heavy components can be located at ground level. This configuration also eases installation and maintenance. Since the blades do not turn end over end, the rotor is not subjected to continue cyclic gravity loads.

25. **What are the factors consider for the electrical generators and controlmethod?**

The choice of an electrical generator and control method can be considered by following three methods:

The basis of operation i.e., either constant tip speed or constant tip speed ratio

The wind power rating of the turbine

The type of load demand e.g. battery connection.

26. What are the main Environmental aspects due to wind turbines?

The main environmental aspects are: Indirect energy use and emissions Bird life

Noise Visual impact Telecommunication interferenceSafetyEffects on ecosystem.

27.**What are the types of rotors for HAWT?**

The different types of rotor for HAWT are: Single blade rotor Two blade rotor Three blade rotor Sailing rotor Chalk multiband rotor American multiplied rotor Dutch type rotor

28.**What are the types of rotors for VAWT?**

The different types of rotor for HAWT are: Cup type rotorSavonious rotorDarrieus rotor Musgrove rotor Evans rotor

29. What are the characteristics of good wind power site?

A site should have a high annual wind speed

There should not be any obstructions for a radius of 3Km

An open plain or an open line may be a good location

The top of a smooth.

30. List the components of wind energy systems

A rotor

A gear box

An enclosure

A tail vane

31. Explain the principles of wind energy conversion

There are two primary physical principles by which energy can be extracted from the wind; these are through the creation of either lift or drag force (or combination of two)

32. What are the features of lift and drag?

Drag in the direction of air flow

Lift perpendicular to the direction of air flow

Generation of lift always causes certain amount of drag to be developed

Lift devices are more efficient than drag devices

33. List wind speed types.

Start up wind speed

Cut in wind speed

Rated wind speed

Furling wind speed

Maximum design wind speed

34. What are basic designs of wind turbines?

Vertical axis or egg beater style

Horizontal axis (propeller style)

35. What are the types of wind power plants?

Remote

Hybrid

Grid connected system

36. What are the advantages of wind energy systems?

Inexhaustible fuel source

No pollution

Often an excellent supplement to other renewable sources

Reduces fossil fuel consumption

Wind power plant create may jobs

Increases local tax revenues

Least reliance on foreign oil

It's free

37. What are the disadvantages of wind energy systems?

Large areas are needed

Suitable for wind power generation

Relatively expensive to maintain

Large numbers of wind generators are required to produce useful amount ofheat or electricity

38. What are the safety systems in wind energy system?

The computer

Emergency stop

Revolution counters

Lightning

39. What are the environmental impacts of wind energy systems?

Electromagnetic interference

Noise

Visual effect

40. List the classification of wind mills according to size.

Small scale (up to 2Kw)

Medium size machines

41. List classification according to output power

DC output

AC outputa)

Variable frequency variable or constant voltage ACb)

Constant frequency, variable or constant voltage AC

42. What are the types of horizontal axis machines?

Single bladed

Multi bladed

By cycle multi blade type

43. What are the vertical axis machines?

Savonius or S type rotor mill

Davieus type rotor mill

44. Point out the cultivated biomass.

- The cultivated biomass (biomass from energy farms) includes:
- Sugar cane crops, sweet sorghum crops, sugar beets.
- Herbaceous crops which are non-woody plants which can be converted into biogas or biochemical fuels.
- Cereals, potatoes and other carbohydrate fruit crops, etc.grown for producing in feeds to the fermentation plants.
- Forests crops of fast growing energy intensive trees specially grown as
- source of energy.
- Aquatic crops grown in fresh water, sea water, muddy water etc., and these crops include submerged plants, surface plants and include sea
- weeds, marine algae, water hyacinth, floating kelp etc.algae is considered to be a promising aquatic biomass.

45. List out the biomass energy resources from waste.

The waste to energy processes convert organic wastes to intermediate or secondary energy forms such as heat, biogas, alcohol, fuels, chemicals, etc.The waste is classified as

- Urban (municipal) waste
- Industrial organic waste, process waste

- Agricultural farm waste
- Rural animal waste
- Forest waste
- Fishery,poultry,butcharry waste
- Animal and human excreta

46. **What is meant by biogas plant?**

The plant which converts biomass to biogas (methane plus carbon dioxide) by the process of anaerobic digestion is generally called a biogas plant.

47. Mention advantages of biomass energy

- It is a renewable source.
- The energy storage is an in-built feature of it.
- It is an indigenous source requiring little or no foreign exchange.
- The forestry and agricultural industries that supply feed stocks also provide substantial economic development opportunities in rural areas.
- The pollutant emissions from combustion of biomass are usually lower than those from fossil fuels.

48. Mention disadvantages of biomass energy

- It is a dispersed and land intensive source.
- It is often of low energy density.
- It is also labour intensive and the cost of collecting large quantities for commercial application is significant. Most current commercial large quantities for commercial application are significant. Most current commercial applications of biomass energy, use material that has been
- collected for other reasons, such as timber and food processing residues and urban waste.
- Capacity is determines by availability of biomass and not suitable for varying loads.
- Not feasible to set up at all locations.

49. What is meant by biomass gasification?

The word gasification (or thermal gasification) implies converting solid fuel into a gaseous fuel by thermo chemical method without leaving any solid carbonaceous residue.

50. Classify the biogas plant.

The biogas plant are classified into

- Continuous and batch types
- The dome and drum types

PART-B

1. Explain the Different methods solar energy storage?

Refer page no.125, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

2. Explain in detail about the Sensible solar energy?

Refer page no.138, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

3. Describe the Latent heat and stratified storage ?

Refer page no.810, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

4.a) What is the origin of Solar ponds and Explain.

Refer page no.146, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

5. Explain the Solar Applications?.

Refer page no.195, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

6. Explain the working of a Solar heating/cooling technique ?

Refer page no.202, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

7. Explain the principle of Solar distillation and drying?

Refer page no.208, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

8. Explain the principle of operation of Photovoltaic energy conversion?

Refer page no.577, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

9. Discuss briefly about

a) Performance of wind mills

b) Wind power generation in India

Refer page no.202, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

10. Describe the saronious type of rotor in wind mill.

Refer page no.207, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

11. Compare the performance of horizontal and vertical axis wind mills.

Refer page no.206, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

12. How wind energy conversion systems are classified? Discuss in brief. Whatare its advantages and disadvantages?

Refer page no.210, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

UNIT IV BIO ENERGY
Energy from biomass, Principle of biomass conversion technologies/process and their classification, Bio gas generation, types of biogas plants, selection of site for biogas plant, classification of biogas plants, Advantage and disadvantages of biogas generation, thermal gasification of biomass, biomass gasifies, Application of biomass and biogas plants and their economics

PART A

1. What is meant by biomass energy and biomass energy resource?(Nov/Dec 2024)BTL1,CO 311.4,PO1

Biomass refers to organic material derived from plants and animals that can be used as a renewable energy source.

2. Distinguish between combustion and pyrolysis. Nov/Dec 2024)BTL4,CO 311.4 ,PO1

Parameter	Combustion	Pyrolysis
Oxygen presence	Requires oxygen	Occurs in absence of oxygen
Temperature	High	Moderate
Products	CO_2, H_2O, heat	Charcoal, bio-oil, gases
Example	Burning wood	Making charcoal

3.resources.

Biomass resources are broadly classified into two categories:Biomass from cultivated fields, crop, forest and harvestedperiodically.Biomass derived from waste e.g., municipal waste, animalexcreta/dung, forest waste, agricultural waste, bioprocesswaste,butcharry waste, fishery waste/processing waste etc.,

4.What do you mean by fossil fuels?

Fossil fuels (coal, petroleum oil and natural gases) are produced fromdead, buried biomass under pressure and in absence of air during severalmillions of years. However; they are considered separately as fossils and arenot included in the category of biomass.

5.What are the categories of scope of biomass energy?

The scope of biomass energy is of three categories. They areRural application of biomass energyUrban and industrial applications of biomass energyBiomass as a primary source for large scale electrical powergeneration.

6.List the secondary energy forms of biomass.

The biomass can be converted to useful secondary energy forms suchasHeatGaseous fuelsSolid fuelsOrganic chemicalLiquid fuels

7.Point out the cultivated biomass.

The cultivated biomass (biomass from energy farms) includes:

Sugar cane crops, sweet sorghum crops, sugar beets.

Herbaceous crops which are non-woody plants which can be convertedinto biogas or biochemical fuels. Cereals, potatoes and other carbohydrate fruit crops, etc.grown forproducing in feeds to thefermentation plants.

Forests crops of fast growing energy intensive trees specially grown assource of energy.

Aquatic crops grown in fresh water, sea water, muddy water etc., andthese crops include submerged plants, surface plants and include seaweeds, marine algae, water hyacinth, floating kelp etc.algae isconsidered to be a promising aquatic biomass.

8.List out the biomass energy resources from waste.

The waste to energy processes convert organic wastes to intermediate orsecondary energy forms such as heat, biogas, alcohol, fuels, chemicals, etc.Thewaste is classified asUrban (municipal) wasteIndustrial organic waste, process wasteAgricultural farm wasteRural animal wasteForest wasteFishery,poultry,butcharry wasteAnimal and human excreta

9.What is meant by biogas plant?

The plant which converts biomass to biogas (methane plus carbondioxide) by the process of anaerobic digestion is generally called a biogasplant.

10. Mention advantages of biomass energy

It is a renewable source.The energy storage is an in-built feature of it.It is an indigenous source requiring little or no foreign exchange.The forestry and agricultural industries that supply feed stocks alsoprovide substantial economic development opportunities in ruralareas.The pollutant emissions from combustion of biomass are usuallylower than those from fossil fuels.

11.Mention disadvantages of biomass energy

It is a dispersed and land intensive source.It is often of low energy density.It is also labour intensive and the cost of collecting large quantities forcommercial application is significant. Most current commercial largequantities for commercial application are significant. Most currentcommercial applications of biomass energy, use material that has beencollected for other reasons, such as timber and food processingresidues and urban waste.Capacity is determines by availability of biomass and not suitable forvarying loads.Not feasible to set up at all locations.

12.What is meant by biomass gasification?

The word gasification (or thermal gasification) implies converting solidfuel into a gaseous fuel by thermo chemical method without leaving any solidcarbonaceous residue.

13.Classify the biogas plant.

The biogas plant are classified intoContinuous and batch typesThe dome and drum types

13.**List the factors affecting biodigestion or generation of gas.**

The factors affecting biodigestion or generation of gas are:pH or the hydrogen- ion concentrationTemperatureTotal sold content of the feed materialLoading rateSeedingUniform feedingN utrientsType of feed stocksToxicity due end productPressureAcid accumulation inside the digester

14. Why the biogases are mainly utilized?

Biogases are mainly utilized.The biogas can be utilized effectively forHousehold cooking,Lighting,Operating small engines,Utilizing power for pumping water,Chaffing fodder andGrinding flour.

15. List the Feature of continuous plant

It will produce gas continuously.It requires small digestion chambers.It needs lesser period for digestion.It has less problems compared to batch type and it is easier inoperation.

16. List the Features of batch plant.

The gas production in it is intermittent, depending upon the clearingof the digester.

It needs several digesters or chambers for continuous gas production,these are fed alternatively.

Batch plants are good for long fibrous materials

This plant needs addition of fementated slurry to start the digestionprocess.

This plant is expensive and has problems comparatively; thecontinuous plant will have less problems and will be easy foroperation.

17. Write the advantages of floating drum plant.

It has scum troubles because solids are constantly submerged.In it, the danger of mixing oxygen with the gas to form anexplosive mixture is minimized

No problem of gas leakageConstant gas pressure

18. Write the disadvantages of floating drum plant.

It has higher cost, as cost is dependent on steel and cement.Heat is lost through the metal gas holder, hence it troubles incolder regions and periodsGas holder requires painting once or twice a year, depending onthe humidity of the location.Flexible pipe joining the gas holder to the main gas piperequires maintenance, as it is damaged by ultraviolet rays in thesun. It may be twisted also, with the rotation of the drum formixing or scum removal.

19. Mention some advantages of fixed dome type plant

It has low cost compare to floating drum type, as it uses onlycement and no steel.It has no corrosion trouble.Heat insulation is better as construction is beneath the ground.Temperature will be constant.Cattle and human excreta and long fibrous stalks can be fed.No maintenance.

20. Mention some disadvantages of fixed dome type plant

This type of plant needs the service of skilled masons, who arerather scarce in rural areas.Gas production per cum of the digester volume is also less.Scum formation is a problem as no stirring arrangement.It has variable gas pressure.

21. What are the techniques or methods of maintaining biogas production?

The methods for maintaining biogas production areInsulating the gas plantCompostingHot water circulationUse of chemicalsSolar energy systems

22. What is meant by cogeneration?

A procedure for generating electric power and useful heat in a singleinstallation is known as cogeneration. Heat may be supplied in the form ofsteam, hot water or hot air. The net result is overall increase in the efficiencyof fuel utilization.

23. Mention the types and explain the cogeneration principles

.Types of cogeneration principles are:

The Topping Cycle:

primary heat is used to generate high pressure andtemperature steam for electrical energy generation. The discharged low gradeheat, which would otherwise be dispersed to the environment, is utilized inan industrial process or in other ways.

The Bottoming Cycle:

primary heat at high temperature is used directly forindustrial process requirements. The remaining low grade heat is then usedfor electrical power generation, e.g. high temperature cement kiln.

24. Three general types of cogeneration systems

The three general types of cogeneration principles systems are:Waste heat utilization

•space heating and cooling

•warm water in agriculture

•warm water in aquacultureTotal/Integrated energy system for residential complexTotal energy system (TES) for industry.

25. What is meant by incineration?

Organic matter can be burnt in presence of oxygen/air to produce heatand byproducts. This is the well known process called combustion. Completecombustion to ashes is called incineration.

26. What are the types of Gasifiers?

In down draft gasifier fuel and air move in a co current manner

In update gasifier fuel and air move in a counter current manner. But thebasic reaction zones remain the same.

27. What are the types of biomass resources?

Forests

Agricultural crops residues

Energy crops

Vegetable oil crops

A quatic crop

Animal waste

Urban waste

Industrial waste

28. What is Trans estarification?

Process where the raw vegetable oils are treated with alcohol(Methanol or ethanol with a catalyst) to form methyl or ethyl esters.

29 What are the advantages of bio-diesel as engine fuel?

Biodegradable produces 80% less and co2 100% less So2 emissions

Renewable

Higher octane number

Can be used as neat fuel or mixed in any ratio with petro diesel

Has a higher flash point making it safe to transport

30. What are the components of cogeneration system?

Prime mover

Generator

Heat recovery

Electrical interconnection

Configured in to an integrated whose

31. What are the types of prime movers?

Reciprocating engine

Combustion of gas functions

Steam turbines

Micro turbines

Fuel cells

32. Write any two benefits of cogeneration

Increased efficiency of energy conversion and use

Lower emission to the environment in particular of co2, the main greenhouse gas

Biomass fuels and some waste materials such as refinery gases,agricultural wastes are used. They serve as fuels for cogenerationschemes increases the cost effectiveness and reduces the need for wastedisposal

33. What are the types of cogeneration system?

Steam turbine cogeneration system

Gas turbine cogeneration system

Reciprocating engine cogeneration system

34. What are the types of steam turbine?

Back pressure turbine

Extraction condensing turbine

35.List out the factor led to accelerated development of wind power.

- Availability of high strength fibre composites for constructing large low cost rotor blades
- Falling prices of power electronics
- Variable speed operation of electrical generators to capture maximum energy
- Improved plant operation, pushing the availability upto 95%.
- Economy of scale, as the turbines and plants are getting larger in size.
- Accumulated field experience improving the capacity factor
- Short energy payback period of about one year

36.What are the features prefer for the wind turbine site?

- No tall obstructions for some distance in the upwind direction and also a low a roughness as possible in the same direction
- A wide and open view i.e., opens plain, open shore line or offshore locations.
- Top of smooth well-rounded hill with gentle slopes on a flat plain
- An island in a lake or the sea
- A narrow mountain gap through which wind is channeled
- Site reasonably close to power grid
- Soil conditions must be such that building of foundations of
- the turbines and transport of road- construction materials loaded in heavy trucks is feasible.

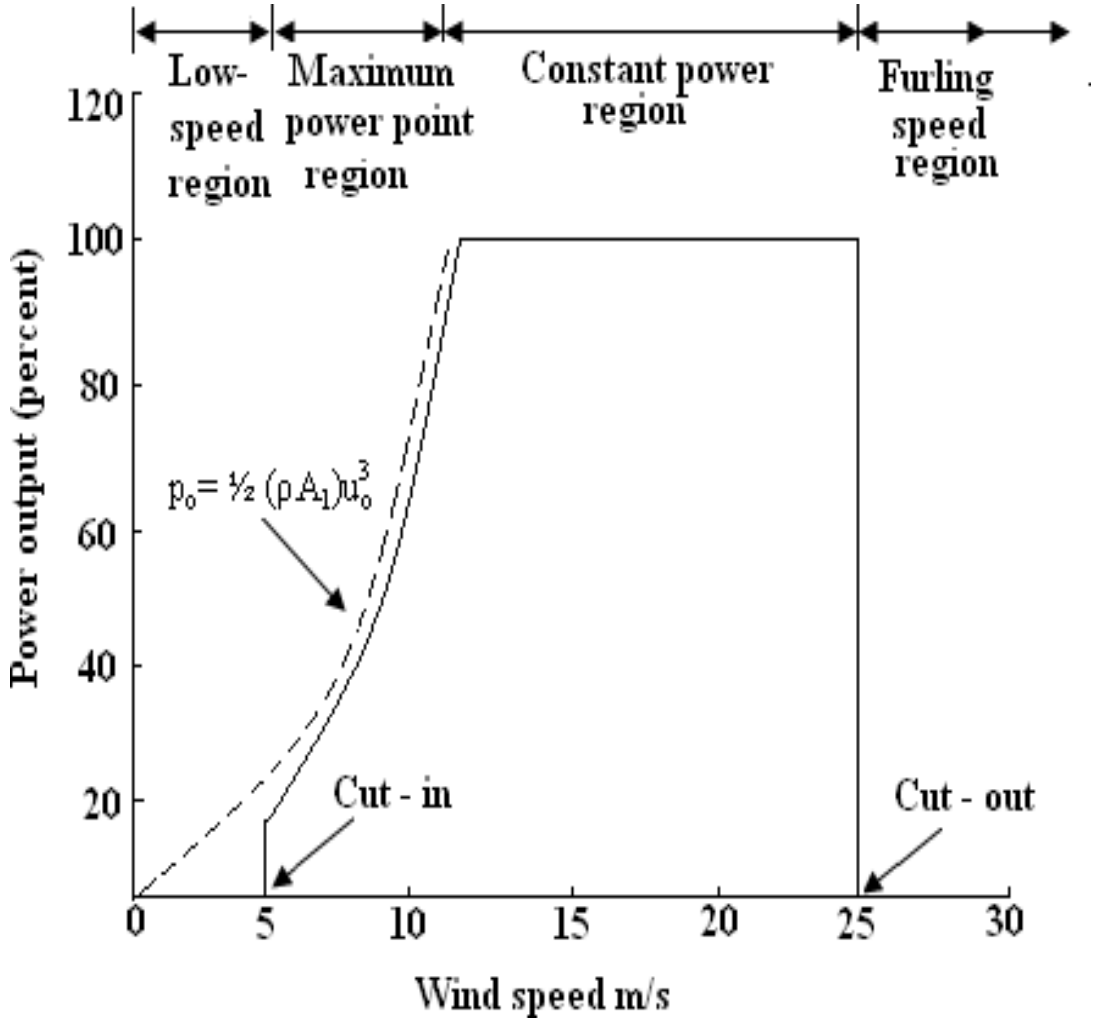
- Production results of existing wind turbines in the area to act as a guide to local wind conditions.

37.What are the merits and demerits of three blade rotor over two blade rotors?

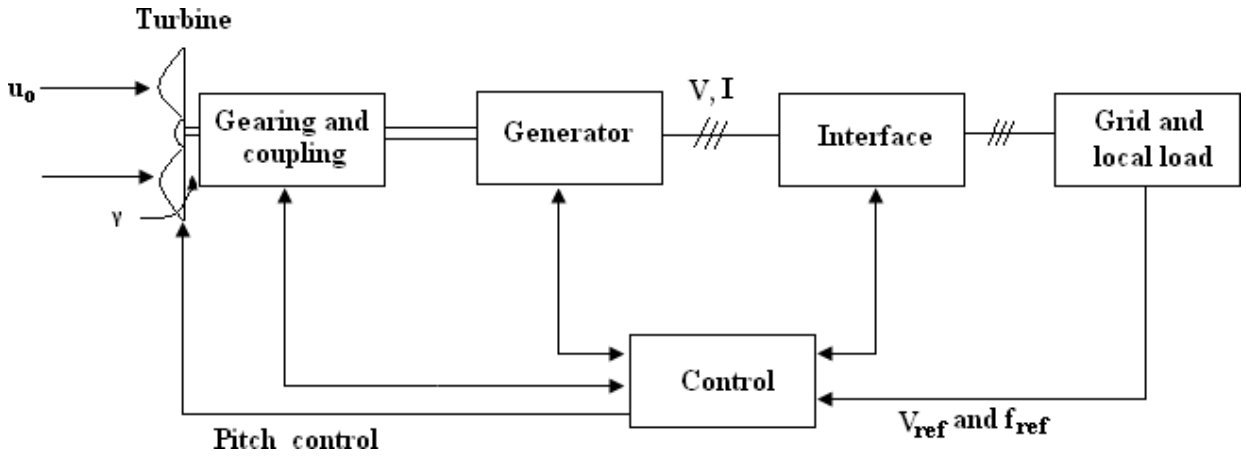
Compared to the two blade design, the three blade machine has smoother power output and balanced gyroscopic force.

- There is no need to teeter the rotor, allowing the use of a simple rigid hub. The blades may be cross-linked for greater rigidity.
- Adding a third blade increases the power output by about 5%
- only, while the weight and cost of a rotor increases by 50%,thus giving a diminished rate of return for additional 50% weight and cost.
- The two blade rotor is also simpler to erect, since it can be assembled on the ground and lifted

38.Draw the power Vs wind speed characteristics.



39.Draw the block diagram of WECS



40.What are the types of generator drive for the operation of WECS?

The types of generator are suitable for the wind generations are:

- DC generator
- Synchronous Generator
- Induction generator

41.Define gusts.

Rapid fluctuations in the wind velocity over a wide range of frequencies and amplitudes, due to turbulence caused by mechanical mixing of lower layers of atmosphere by surface roughness, are commonly known as gusts.

42.What are the features of VAWT?

The features of VAWT:

- It can accept wind from any direction, eliminating the need of yaw control.
- The gearbox, generator, etc., are located at the ground, thus eliminating the heavy nacelle at the top of the tower, thus simplifying the design and installation of the whole structure, including the tower. The inspection and maintenance also gets easier
- It also reduces the overall cost.

43.Define power coefficient

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

Power coefficient = Power of wind turbine/Power available in the wind

44.List out the merits of WECS

It is a renewable source of energy

- Like all forms of solar energy, wind power systems are nonpolluting, so it has no adverse influence on the environment.
- Wind energy systems avoid fuel provision and transport.
- On a small scale upto a few kilowatt system is less costly. On a large- scale costs can be competitive with conventional electricity and lower coats can be competitive with conventional
- electricity and lower costs could be achieved by mass production.

45.List out the demerits of WECS

- Wind energy available in dilute and fluctuating in nature.
- Unlike water energy wind energy needs storage capacity because of its irregularity
- Wind energy systems are noisy in operation; a large unit can be heard many kilometers away.
- Large areas are needed, typically, propellers 1 to 3 m in diameter, deliver power in the 30 to 300W range.

46.What are the components of wind turbine generator units?

A wind turbine unit consists of the following major assemblies:

- A wind turbine with vertical axis or horizontal axis.
- Gear chain
- An electrical generator(synchronous or asynchronous (induction))
- Associated civil works, electrical and mechanical auxiliaries, control panels etc.,

47.Classify the schemes available for electric generation.

The schemes are available for electric generation is of three categories.

- Constant-speed constant frequency systems(CSCF)
- Variable speed constant frequency systems(VSCF)
- Variable speed variable frequency systems(VSVF)

48.Define wind turbine.

A wind turbine which converts wind power into rotary mechanical power. A wind turbine has aerofoil blades mounted on the rotor. The wind drives the rotor and produces rotary mechanical energy.

CUT IN SPEED

Wind speed at which wind turbine starts delivering shaft power.

Cut in speed: While operating - 7m/s

While stopping - 5m/s

CUT OUT SPEED

At high velocities during storms, it is necessary to cut out the power conversion of wind turbine by furling the wind turbine blades. The speed at which power conversion is cut out is called cut out wind speed or furling wind speed.

Cut out speed: While operating - 20m/s

While stopping - 17m/

Rated speed - 14m/s

49.Name the two natural phenomena in the atmosphere of different origins.

Winds are natural phenomena in the atmosphere and have two different origins.

Planetary Winds are caused by daily rotation of earth around its polar axis and unequal temperatures between polar regions and equatorial region.

Local Winds are caused by unequal heating and cooling of ground surfaces and ocean/lake surfaces during day and night.

50.Name the characteristics in which the speed of a wind turbine rotor depends.

The speed of a wind turbine rotor depends principally on

- Wind speed
- Pitch of the turbine blades
- Mechanical and electrical load i.e., shaft load,friction,breaking
- force etc.,
- Orientation of yaw with reference to the wind

51.List the factors affecting biodigestion or generation of gas.

The factors affecting biodigestion or generation of gas are:

- pH or the hydrogen-ion concentration
- Temperature
- Total sold content of the feed material
- Loading rate
- Seeding
- Uniform feeding
- Nutrients
- Type of feed stocks
- Toxicity due end product
- Pressure
- Acid accumulation inside the digester

52.Why the biogases are mainly utilized?

Biogases are mainly utilized.

- The biogas can be utilized effectively for
- Household cooking,
- Lighting,
- Operating small engines,
- Utilizing power for pumping water,
- Chaffing fodder and
- Grinding flour.

PART-B

1.Describe in detail the Sources and potentials.

Refer page no.227, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

2.Write short notes on:

Horizontal and vertical axis windmills.

Refer page no.245, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

3.What is the principle I.C.Engine operation and economic aspects.

Refer page no.458, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

4.Explain the Performance characteristics of wind energy?

Refer page no.287, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

5.a) Name the various model of biogas plant.b) What are the main problems in straw fermentation?

Refer page no.342, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

6.Sketch and describe any one type of bio-mass gas generation plant. Mention 4uses of the biogas produced.

Refer page no.319, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

7.How are biogas plant classified? Explain continuous and batch type plants and compare them with regard to operation and efficiency.

Refer page no.342, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

8.Write short notes on a) Continuous type plant b) Flexible dome type plant.

Refer page no.345, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

9.What is community biogas plant? What is the main problem encountered with operation?

Refer page no.347, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

10.List out the various points to be carried out for selection of site for a biogas plant.

Refer page no.319, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

11.Draw schematic diagram of biogas power plant and explain its operation. State and justify the potential of this in satisfying energy demand of our country.

Refer page no.325, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

12.Write briefly on power production from agricultural waste. Draw relevant sketches and point out the relative merits of this technique.

Refer page no.325, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

13. What is biomass gasification? Explain its classification with neat diagram.

Refer page no.319, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

14. How ethanol is produced from biomass? Explain its major classification.

Refer page no.319, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

15. What is meant by cogeneration? How they are classified? Explain its principles.

Refer page no418, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

16.Explain the following cogeneration systems.

a) Steam turbine

b) Gas turbine

Refer page no.345, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

17. Explain the following cogeneration systems.

a) Reciprocating IC Engine

b) Combined cycle.

Refer page no.458, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

18. Enumerate the application of the following.

a)Cogeneration in Utility sector

b) Biomass

Refer page no.418, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

UNIT V – OTHER TYPES OF ENERGY

Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, minihydel power plants and their economic

PART A

1. List out the four geothermal resources.? (**Nov/Dec 2024) BTL1 PO1,7 CO311.5**

- **Hydrothermal reservoirs** – Naturally occurring hot water or steam.
- **Geo-pressurized reservoirs** – Underground hot water with dissolved methane.
- **Hot Dry Rocks (HDR)** – Deep, dry rocks heated by Earth's core.
- **Magma resources** – Molten rock with extreme heat potential

2. Differentiate between Spring Tide and Neap Tide.? **Nov/Dec 2024) BTL1 PO1,7 CO311.5**

Feature	Spring Tide	Neap Tide
Occurrence	During full moon and new moon	During first and third quarter moon
Gravitational Pull	Strongest (Sun & Moon aligned)	Weakest (Sun & Moon at 90°)
Tide Height	Higher high tides & lower low tides	Lower high tides & higher low tides

3.What is meant by tidal current

The tidal rise and fall of water is accompanied by periodic horizontal to andfro motion of water called tidal currents.

4.Define tidal range

The tidal range is the difference between consecutive high and low tide waterlevels. It is denoted by R unit is metre.R= (High tide level) – (low tide level) m

5.Define the following termsa) Spring tides b) Neap tidesa) Spring tides

The tidal range is maximum on full moon and new moon and suchtides are called spring tides.

b)Neap tides

The tidal range is minimum on first quarter and third quarter moonand such tides are called the neap tides.

6.List out the Limitations of tidal energy

The main limitations of tidal energy areEconomic recovery of energy from tides is feasible only at thosesites where energy is concentrated in the form of tidal range ofabout 5m or more and the geography provides a favorable site foreconomic construction of a tidal plant. Thus it is site specific.Due to mismatch of lunar driven period of 12 hours 25 min andhuman (solar)

period of 24 hours, the optimum tidal powergeneration is not in phase with demand.Changing tidal range in two-week periods produces changingpower.The turbines are required to operate at variable head.Requirement of large water volume flow at low head necessitatesparallel

operation of many turbines.Tidal plant disrupts marine life at the location and can causepotential harm to ecology.

7.List out the advantages of small hydro schemes.

Small hydro plants can be tailored to the needs of the end usemarket within the limits of water resources available.It serves to enhance economic development and livingstandards, especially in remote areas with limited or noelectricity at all.It has a short gestation period.There is no need of long transmission lines because the output isconsumed near the source.High performing electrical equipment can be easily found in themarket.

8.List out the disadvantages of small hydro schemes.

Hydro systems, unlike solar components for example, dorequire some maintenance.The quality of output of small power stations is not as good asthat of bigger ones as these power plants are generally designedon the basis of short term raw data. Thus, the ground conditionsof operation are much different from those considered for thedesign.Spilling of water over spillways can result in super saturation ofwater with gases from the air. The gas bubbles absorbed intofish tissues, may cause damage and ultimately kill the fish.In the absence of adequate hydrological and geological data,there are always uncertainties about their potential as aresource.

9.Mention the Components of micro hydro scheme

The main components of micro hydro scheme are (i) diversion weir (ii)water conductor system with regulating gates and spillways (iii) desiltingtank with spillway, (iv) headrace channel, (v) forebay tank with desiltingbasin and spillway, (vi) penstock (vii) powerhouse and (viii) tailrace channel.

10. Define the following termsa) Forebay b) Penstock c) Tailracea)

Forebay

A Forebay is a temporary storage of water (pondage), to be finallyutilized for energy generation. The storage size ranges from 2 minutes to 6hours depending on the economic justifiability.

b) Penstock

A penstock is water conduit joining a forebay and a turbine. Penstockcan be made of steel pipes, hume pipes and PVC pipes depending on thedesign pressure.

c) Tailrace

Tailrace is a simple water channel to transport discharge from theturbine back to the river with maximum flow of 1 m/s.

11. What are the kinds of geothermal resources?

There are five kinds of geothermal resources. They are:Hydrothermal convective systems.

•Vapour dominated or dry steam fields.

•Liquid dominated system or wet steam fields and

•Hot water fieldsGeopressure resourcesPetro-thermal or hot dry rocks(HDR)Magma resourcesValcanoes.

12. What is meant by OTEC?

The temperature gradient can be utilized in a heat engine to generatepower is called as ocean thermal energy conversion(OTEC).This energy hasform has very low efficiency and has very high capital cost, because thetemperature difference is small even in tropics.

13. How the fuel cells are classified?

The classifications of fuel cells are:Based on the type of electrolyteBased on the types of the fuel and oxidantBased on operating temperatureBased on applicationBased on the chemical nature of electrolyte

14. Mention some advantages of fuel cells.

It is quiet in operationLess pollutantConversion efficiency is more due to direct single stage energyconversionFuel cell plant can be installed near the point of use, thustransmission and distribution losses are avoided.Fuel cell plant are compact and require less spaceNo charging is required

15. What is meant by Stirling Engine?

A stirling engine is a mechanical device which operates on a closedregenerative thermodynamic cycle, with cycle compression and expansion ofthe working fluid at different temperature levels and where the flow iscontrolled by volume changes, so that there is a net conversion of heat towork or vice versa.

16. Main components of stirling engine

There are five main components of Stirling engine. They are:

(a)Heater

(b)Regenerator

(c)Coolers

(d)Displacer

(e)Power piston

17. Mention some uses of Stirling engine.

Uses of Stirling engine are:Automobile engine

•Low air pollution levels that are possible

•Low noise levels because there are no explosions as ininternal combustion engines and

•Ability to use a variety of fuels such as natural or syntheticgaseous or liquid hydrocarbons, stored in solar energy, oreven possibly powdered coal.Stationary engines.

18. What are the types of tidal power plants?

Single basin single effect plant

Single basin double effect plant

Double basin with linked basin operation

Double basin with paired basin operation

19. What are the important components of a tidal power plant

Barrange

Sluice gates

Power house with turbines each coupled to a generator along with auxiliaryequipment

20. What are the advantages of tidal plant?

Tidal power is predictable

It is free from pollution

It is inexhaustible and is a renewable source of energy

Does not require valuable land as they are located on sea sources

Tidal power with thermal plant can meet the load demand

After the capital power is paid off the cost of power generated is verylow

Tidal power is firm not changes seasonally

21. What are the disadvantages of tidal plant?

Tidal power plant output varies with the variation in tidal range

Tidal power supply is intermittent

Capital cost of plant is not economical compared to conventional sourcesof energy

Slitting of basins is a problem with tidal power plants

22. What are the advantages of wave energy generation?

It is a free and renewable energy source

Wave power devices use less land than solar and wind

Devices are pollution free. Remove energy from the waves; leave the water ina placid state

The degree of power concentration effected by waves is large

23. What are the disadvantages of wave energy generation?

Wave energy equipment must be capable of withstanding very reverse peakstress and storms

Wave energy equipments are complicated

Capital investment, cost of maintenance repair and replacement growth ofbiological organisms are other problems

Energy is available on the ocean. The extraction equipment must be operatedin a marine environment

24. Define lamberts law of absorption

Each water layer of identical thickness absorbs an equal fraction of light thatpasses through it. The intensity of heat decreases with the increase in water depth.

25. What are the types of OTEC plants?

Open

Closed and

Thermoelectric

26. What is Biofouling?

The raw ocean water which is pumped in for evaporator and condensercontains micro organisms which stick on the water side of both the heatexchangers. This biological impurity of sea water that deposits and grows on theevaporator and condenser metal surfaces creating thermal resistance for heattransfer is known as bio fouling.

27. Define small hydro plant

A power station having 5000KW output and having a low heat upto 15m. Butthere is no restriction on head.

28. Define micro & mini hydro plant

Stations upto 1000KW output – micro hydroplantStations upto 5000KW output- mini hydroplant

29. List the classifications of small hydro power stations based on capacity,load and scheme.

Depending on capacity

Depending on load

Based on scheme

30. What are the major components of small hydropower projects?

Diversion weir and intake

Desilting tank

Water conductor system

Forebay

Penstock

Spillway

Power house

Tail race

31. What are the three parts of earth?

Crust

Matle and

Core

32. What are the two parts of the crust?

Solid crust

Ocean crust

33. What are plate tectonics?

Movement of crust caused by the movement of the zithosphere over theasthenosphere

34. What are the types of geo thermal resources?

Hydrothermal

Vapour dominated resource

Hot dry rock resource

Geo pressured resource

Magma resource

35. Define magma?

Magma is a molten rock at temperature ranging from 7000c to 16000c. This hotviscous liquid comes out at active volcanic vents and solidifies.

36. What are the types of geothermal power generation?

Liquid dominated

Flashed steam engine

Binary cycle system

Vapour dominated resource

37. Write the field of utilization of geothermal energy

Power generation

Space heating

Extraction and refining at borax and sulphur

Green house heating

Refrigeration

38. What are the advantages of geothermal energy?

Versatile in its use

It is cheaper compared to the energies obtained from other sources bothzero fuels and fossil fuels

It delivers greater amount of net energy from its system than otheralternative of conventional systems

It has the highest annual load factor at 85% to 90% compared to us 50% forfossil fuel plants

Pollution produced is least.

39. What are the disadvantages of geothermal energy?

Over all efficiency is 15% compared to 35-40% for fossil fuel plants

The withdrawal of large amount of steam or water from a hydrothermalreservoir may result in surface subsidence

Drilling operation is noisy

Large areas are needed for exploitation of geothermal energy as much of it isdiffused

40. Define fuel cell

It is an electrochemical device that converts chemical energy of fuel in of fuelin to electricity with out involving a combustion cycle

41. What are the technical parameters of a fuel cell?

Individual cell -0.55 to 0.75V

No of cells arranged in stacks provides required level of voltage

Given power- electrode size & number of cells

42. What are configurations of stirling engine?

Single acting

Dual acting

43. What is meant by tidal current energy

Tidal currents are the flow of water during changing tidal level. The tidal currents flow in horizontal direction and have kinetic energy. This energy is called tidal current energy.

44. What is meant by tidal current

The tidal rise and fall of water is accompanied by periodic horizontal to and fro motion of water called tidal currents.

45. Define tidal range

The tidal range is the difference between consecutive high and low tide water levels. It is denoted by R unit is metre.

R= (High tide level) – (low tide level) m

46. Define the following terms

a) Spring tides b) Neap tides

a) Spring tides

The tidal range is maximum on full moon and new moon and such tides are called spring tides.

b) Neap tides

The tidal range is minimum on first quarter and third quarter moon and such tides are called the neap tides.

47. List out the Limitations of tidal energy

The main limitations of tidal energy are

- Economic recovery of energy from tides is feasible only at those sites where energy is concentrated in the form of tidal range of about 5m or more and the geography provides a favorable site for economic construction of a tidal plant. Thus it is site specific.
- Due to mismatch of lunar driven period of 12 hours 25 min and human (solar) period of 24 hours, the optimum tidal power generation is not in phase with demand.
- Changing tidal range in two-week periods produces changing power.
- The turbines are required to operate at variable head.
- Requirement of large water volume flow at low head necessitates parallel operation of many turbines.
- Tidal plant disrupts marine life at the location and can cause potential harm to ecology.

48. List out the advantages of small hydro schemes.

- Small hydro plants can be tailored to the needs of the end use market within the limits of water resources available.
- It serves to enhance economic development and living standards, especially in remote areas with limited or no electricity at all.
- It has a short gestation period.

- There is no need of long transmission lines because the output is consumed near the source.
- High performing electrical equipment can be easily found in the market.

49. List out the disadvantages of small hydro schemes.

- Hydro systems, unlike solar components for example, do require some maintenance.
- The quality of output of small power stations is not as good as that of bigger ones as these power plants are generally designed on the basis of short term raw data. Thus, the ground conditions
- of operation are much different from those considered for the design.
- Spilling of water over spillways can result in super saturation of water with gases from the air. The gas bubbles absorbed into fish tissues, may cause damage and ultimately kill the fish.
- In the absence of adequate hydrological and geological data, there are always uncertainties about their potential as a resource.

50. Mention the Components of micro hydro scheme

The main components of micro hydro scheme are (i) diversion weir (ii) water conductor system with regulating gates and spillways (iii) desilting tank with spillway, (iv) headrace channel, (v) forebay tank with desilting basin and spillway, (vi) penstock (vii) powerhouse and (viii) tailrace channel.

51. Define the following terms

a) Forebay b) Penstock c) Tailrace

a) Forebay

A Forebay is a temporary storage of water (pondage), to be finally utilized for energy generation. The storage size ranges from 2 minutes to 6 hours depending on the economic justifiability.

b) Penstock

A penstock is water conduit joining a forebay and a turbine. Penstock can be made of steel pipes, hume pipes and PVC pipes depending on the design pressure.

c) Tailrace

Tailrace is a simple water channel to transport discharge from the turbine back to the river with maximum flow of 1 m/s.

52. What are the kinds of geothermal resources?

There are five kinds of geothermal resources. They are:

- Hydrothermal convective systems.
    - Vapour dominated or dry steam fields.
    - Liquid dominated system or wet steam fields and
    - Hot water fields
- Geopressure resources
- Petro-thermal or hot dry rocks(HDR)
- Magma resources
- Valcanoes.

53. What is meant by OTEC?

The temperature gradient can be utilized in a heat engine to generate power is called as ocean thermal energy conversion(OTEC).This energy has form has very low efficiency and has very high capital cost, because the temperature difference is small even in tropics.

54. How the fuel cells are classified?

The classifications of fuel cells are:

- Based on the type of electrolyte
- Based on the types of the fuel and oxidant
- Based on operating temperature
- Based on application
- Based on the chemical nature of electrolyte

55. Mention some advantages of fuel cells.

It is quiet in operation

- Less pollutant
- Conversion efficiency is more due to direct single stage energy conversion
- Fuel cell plant can be installed near the point of use, thus transmission and distribution losses are avoided.

- Fuel cell plant are compact and require less space
- No charging is required

56. What is meant by Stirling Engine?

A stirling engine is a mechanical device which operates on a closed regenerative thermodynamic cycle, with cycle compression and expansion of the working fluid at different temperature levels and where the flow is controlled by volume changes, so that there is a net conversion of heat to work or vice versa.

57. Main components of stirling engine

There are five main components of Stirling engine. They are:

(a) Heater

(b) Regenerator

(c) Coolers

(d) Displacer

(e) Power piston

58. Mention some uses of Stirling engine.

Uses of Stirling engine are:

- Automobile engine
- Low air pollution levels that are possible
- Low noise levels because there are no explosions as in internal combustion engines and
- Ability to use a variety of fuels such as natural or synthetic gaseous or liquid hydrocarbons, stored in solar energy, or even possibly powdered coal.
- Stationary engines.

59. What are the types of tidal power plants?

- Single basin single effect plant
- Single basin double effect plant
- Double basin with linked basin operation

- Double basin with paired basin operation

60. What are the types of tidal power plants?

- Single basin single effect plant
- Single basin double effect plant
- Double basin with linked basin operation
- Double basin with paired basin operation

61. What are the advantages of tidal plant?

- Tidal power is predictable
- It is free from pollution
- It is inexhaustible and is a renewable source of energy
- Does not require valuable land as they are located on sea sources
- Tidal power with thermal plant can meet the load demand
- After the capital power is paid off the cost of power generated is very low
- Tidal power is firm not changes seasonally

PART-B

1. Explain in detail the Types of wells, methods of harnessing the energy?

Refer page no.682, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

2. Describe the construction and working Ocean energy: OTEC.

Refer page no.497, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

3. Explain the working of a tidal power plant and the two way operating cyclefor its units.

Refer page no.510, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

4. Explain the theory of the origin of geothermal energy. Principles utilization, setting of OTEC plants, thermodynamic cycles

Refer page no.497, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

5.a) Compare tidal power plant with geothermal power plant.b) With relevant diagram, explain the operation of tidal power plant.

Refer page no.497, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

6. Explain in detail any Mini-hydel power plants, and their economics

Refer page no.526, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

7. Explain the Direct energy conversion and Need for DEC?

Refer page no.533, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

b) With a neat sketch explain the Carnot cycle, limitations, principles of DEC.

Refer page no.537, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

8. Draw the schematic and explain the vapour dominated geo thermal plant.

Refer page no.526, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

9. Draw the layout of the micro-hydro scheme and explain its components.What are its advantages and disadvantages?

Refer page no.490, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

10. Draw and explain the following cycles

a) Open OTEC

b) Closed OTEC

Refer page no.497, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

11. What is Stirling engine? Explain its types.

Refer page no.496, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

12. What is wave energy? Explain the wave energy components with neat diagram. List out the merits and demerits

Refer page no.502, Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 2011

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 41530

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Sixth Semester

Electronics and Communication Engineering

OEE 351 – RENEWABLE ENERGY SYSTEM

(Common to Biomedical Engineering/Computer Science and Engineering/ Computer and Communication Engineering/Electronics and Telecommunication Engineering/Medical Electronics/Artificial Intelligence and Data Science/ Computer Science and Business Systems/Information Technology)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How do you define a renewable energy source?
2. Why are ocean, wave, and tidal energies not considered as main renewable sources?
3. Classify the Photovoltaic modules.
4. What do you meant by concentration ratio?
5. How local winds are created during day time?
6. List any two factors influencing the wind.
7. What is bio mass?
8. Distinguish between combustion and pyrolysis.
9. List out the four geothermal resources.
10. Differentiate between spring and neat tide.

11. (a) Describe about the undesirable emissions that are produced by the combustion of fossil fuels? What are the adverse effects produced by these emissions?

Or

(b) Explain the two main methods of tackling the concern over the depletion of fossil fuels and pollutant and greenhouse emissions associated by their combustion?

12. (a) Describe the features of grid-connected photovoltaic system and stand-alone photovoltaic system.

Or

(b) Evaluate the performance characteristic of the solar concentrating collector.

13. (a) Draw a neat diagram of Darrieus wind mill and explain its working.

Or

(b) Discuss the advantages and disadvantages of wind power generation over conventional systems.

14. (a) Discuss the combustion characteristic of bio gas.

Or

(b) Explain the design and constructional features of Bio-gas plant technology.

15. (a) Explain the working of low head and medium head hydel power plant.

Or

(b) Describe the working of closed cycle OTEC system. Discuss its advantages and disadvantages.

PART C — (1 × 15 = 15 marks)

16. (a) Explain with a help of line diagram the working of vapour dominated geothermal system.

Or

(b) Describe the working principle of a mini-hydel power plant with neat sketch. Discuss its advantages and disadvantages.

Reg. No. : | 3 | 1 | 0 | 8 | 2 | 1 | 1 | 0 | 6 | 0 | 5 | 4 |

Question Paper Code : 51461

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Sixth Semester

Biomedical Engineering

OEE 351 — RENEWABLE ENERGY SYSTEM

(Common to : Computer Science and Engineering / Computer and Communication Engineering / Electronics and Communication Engineering / Electronics and Telecommunication Engineering / Medical Electronics / Artificial Intelligence and Data Science / Computer Science and Business Systems/Information Technology)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the three methods of conversion of solar energy into other useful forms of energy?

2. What is the status of non-conventional energy sources in India?

3. What is the average range of solar radiation received on the earth's surface during the day?

4. Draw the equivalent circuit of a practical solar cell.

5. Classify wind turbines by the orientation of their axis of rotation and by the mechanism that provides torque to the rotating shaft.

6. The power potential of a wind turbine at a wind speed of 5 m/s is 50 kW. Find the power potential of the same turbine at a velocity of 8 m/s.

7. Compare the heating value of biogas to that of natural gas. Which is higher?

8. What are the sources of biomass energy?

9. What are the two main technologies of wave energy conversion?

10. What factors affect the surface water temperatures of oceans?

PART B — (5 × 13 = 65 marks)

11. (a) Explain about the different types of Renewable energy sources.

Or

(b) What are the major difficulties in developing power using solar energy in India? Discuss the developments which have taken place during the last 10 years.

12. (a) Enumerate the different types of concentrating type collectors.

Or

(b) Explain with a neat sketch the working principle of standalone and grid-connected solar system.

13. (a) There are three sites with the following average wind power densities: site A : 75 W/m², site B : 500 W/m², and site C : 800 W/m². Do you recommend a wind turbine installation for all three sites? Explain.

Or

(b) Sketch the diagram of a HAWT, and explain the function of its main components.

14. (a) Describe in detail the various factors affecting bio digestion of a gas.

Or

(b) Explain the process of commercial production of ethanol from biomass.

15. (a) Explain with a neat sketch, the methods of operation of tidal power generation.

Or

(b) What is geothermal energy? Explain the working principle of a geothermal power plant with the help of a neat sketch.

PART C — (1 × 15 = 15 marks)

16. (a) Why is wind power not cost-competitive to conventional power systems? Describe oscillating water column technology of wave power conversion.

Or

(b) What are the main types of OTEC power plants? Describe their working in brief.

JEPPIAAR ENGINEERING COLLEGE

Department of ECE

Anna University Question Paper code :52920

B.E/B.TECH.DEGREE EXAMINATION, NOV/DEC 2019

Fifth Semester

ORO551 – RENEWABLE ENERGY SOURCES

Aeronautical Engineering

ORO 551: RENEWABLE ENERGY SOURCES

(Common to Agriculture Engineering/Automobile Engineering/Industrial Engineering)

(Regulations 2017)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions.

PART-A

(10x2=20 Marks)

1. What is the difference between Renewable and Non-Renewable Sources of energy?

Give examples.

Sr. No.	Point	Renewable Energy Sources	Non-Renewable Energy Sources
1	Definition	The energy resources which cannot be exhausted in human timescale and can be used again and again are called renewable energy resources.	The energy resources which can be exhausted one day and cannot be used repeatedly are called non-renewable energy resources.
2	Example	solar energy, wind energy, tidal energy and hydroelectric, geothermal, biogas etc.	coal, petroleum, natural gases, nuclear energy etc.
3	Pollution	It has low carbon emission and environment friendly. Pollution free	It has high carbon emission and not environment friendly. Make pollution

2. what is Solar Constant.

The solar constant is the amount of incoming solar radiation per unit area, measured on the outer surface of Earth's atmosphere, in a plane perpendicular to the rays.

- Solar constant for Earth,
  $S = 1350\ W/m^2$

3. What is Solar Collector ? What are different types of Collectors used ?

solar collector is a device that collects and/or concentrates solar radiation from the Sun. These devices are primarily used for active solar heating and allow for the heating of water for personal use

The different types of solar thermal panel collectors

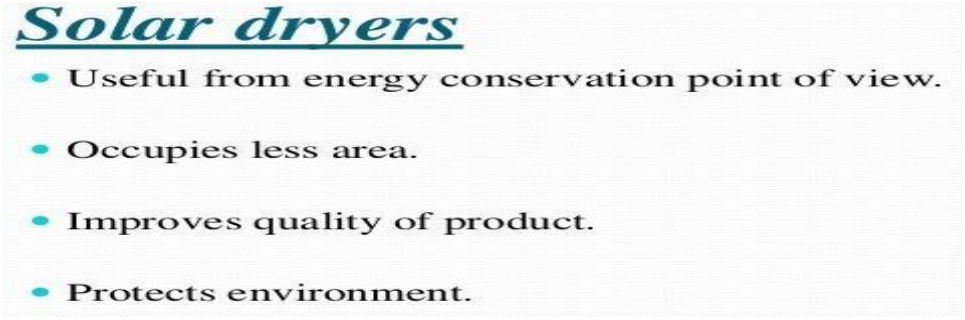
- Evacuated tube solar thermal systems. ...
- Flat plate solar thermal systems. ...
- Thermodynamic panels. ...
- Solar thermal air collectors. ...
- Solar thermal bowl collectors. ...
- Domestic Solar Hot Water Systems. ...
- Domestic Solar Water Heating Systems. ...
- Flat Plate Collectors.

4. State the usage of various types of concentrating collectors.

The principal **types of concentrating collectors** include: compound parabolic, parabolic trough, fixed reflector moving receiver, fixed receiver moving reflector, Fresnel lens, and central receiver. A PV **concentrating** module **uses** optical elements (Fresnel lens) to increase the amount of sunlight incident onto a PV cell.

5. When the Solar Distillation and dryers are used?

Solar distillation is the use of **solar** energy to evaporate water and collect its condensate within the same closed system. Unlike other forms of water purification it can turn salt or brackish water into fresh drinking water



6. What is Solar cell ? What are the uses of solar cells ?

A **solar cell**, or **photovoltaic cell**, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon.[1] It is a form of photoelectric cell, defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. Individual solar cell devices can be combined to form modules, otherwise known as solar panels. The common single junction silicon solar cell can produce a maximum open-circuit voltage of approximately 0.5 to 0.6 volts

Solar cells are very useful in powering space vehicles such as satellites and telescopes (e.g. Hubble). They provide a very economical and reliable way of powering objects which would otherwise need expensive and cumbersome fuel sources

7. How winds are formed ? State various applications of Wind Energy.

Wind is air in motion. **Wind** forms when the sun heats one part of the atmosphere differently than another part. This causes expansion of warmer air, making less pressure where it is warm than where it is cooler. Air always moves from high pressure to lower pressure, and this movement of air is **wind**.

- **Generation of Electricity** - Windmills harness wind energy to create electricity. Its a clean & green form of energy.
- **Transportation** - The power of the wind is used for propulsion in sailing vessels and sail boats
- **Pumping water** - Similar to windmills the energy from the wind is used to drive a pump.
- **Milling Grain** - Grain milling is certain locations are done using wind energy.
- **Sports** - A number of sports use wind energy as their source like Wind Surfing, Land Surfing, Kite boarding

8. How Bio-gas is obtained ? What is the composition of Bio-gas ?

Biogas can be **produced** from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. ... **Biogas is produced** by anaerobic digestion with methanogen or anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials.

Typical composition of biogas

Compound	Formula	%
Methane	CH_4	50–75
Carbon dioxide	CO_2	25–50
Nitrogen	N_2	0–10
Hydrogen	H_2	0–1
Hydrogen sulphide	H_2S	0–3
Oxygen	O_2	0–0

9.What is OTEC technology? Which Thermodynamic Cycle is used in OTEC

Ocean Thermal Energy Conversion (**OTEC**) is a process that can produce electricity by using the temperature difference between deep cold ocean water and warm tropical surface waters. **OTEC** plants pump large quantities of deep cold seawater and surface seawater to run a power cycle and produce electricity

Rankine cycle is a **thermodynamic cycle** of steam power machine .....The earliest **Rankine cycle** uses water as working medium, and now most of waste heat power generations prefer to **use** organic **Rankine cycle** with low boiling point organic working medium [2]. Pure ammonia is mostly **used** as working medium in **OTEC**

10. Which of the disadvantages of the current power generator system can be

Overcome by DEC devices What are these DEC devices

PART-B (5x13=65 Marks)

11. a) What is beam, diffuse and global radiation? Which instruments are used for

the measurement of these radiation ? Explain working of Solar pyranometer

measuring Global Radiation in detail.

Diffuse radiation is scattered out of the direct **beam** by molecules, aerosols, and clouds. The sum of the direct **beam**, **diffuse** , and ground-reflected **radiation** arriving at the surface is called total or **global** solar **radiation**. ... **diffuse radiation** on a horizontal surface. direct **beam radiation**

Geiger counter

A **Geiger counter** is an instrument used for detecting and measuring ionizing radiation. Also known as a Geiger–Muller counter (or **Geiger–Müller counter**), it is widely used in applications such as radiation dosimetry, radiological protection, experimental physics, and the nuclear industry.

(OR)

b) What is the need for studying alternative sources of Energy What are the different types of New and Renewable Sources of Energy What are the advantages and limitations of the use of Renewable Sources of Energy?

12. a) Explain the working of Flat Plate collector used in Solar Water Heating System using Thermosyphon method with the help of a neat sketch. How the orientation and Angle of Tilt of the Flat Plate collector is decided ? What are the advantages of Flat Plate collector system?

(OR)

b) Por what applications Concentrating collectors are used ? Explain the working of Cylindrical Parabolic Concentrator with help of neat sketch. What are the terms Tracking and 'Concentration Ratio in this concentrator means

13. a) In which applications Solar Energy Storage 18 required and when it is not required ? Explain briefly various methods of Thermal Energy Storage. List the considerations which determine the selection of method of storage.

(OR)

b)What are the applications of Solar Pond ? With the help of noat nketch explain the working and application of Solar Fond ? What are the operational problems aaROCIated with ita Operation and maintenance

14. a) What in Bio-maas ? What are various principles of Bio-Conversion and their energy producta? Explain the working of fixed IDome type Biogas Plant with the help of neat sketeh. What are the propertios of Biogan ? What are the advantagos and disadvantage8 of using Biogas as a fuel ?

(OR)

b) What are the advantages and cisncdvantages of Wind Energy Conversion? How wind mills are classified ? What are the basic components of Wind mills ?

15.a)What is the Geothermal Energy ? What are the various methods of harnessing this energy? What is the potential of Geothermal Energy in India ?

(OR)

b) What is the basic principle of Tidal Energy ? Explain the Principle of working of Simple Tidal Energy Conversion Plant with the help of a neat sketch. What 1s the status of Tidal Power Plants in the world and in India?

PART-C (1x15=15 Marks).

16. a) A flat Plate solar thermal collector is installed on the roof of a hotel in New = 28.58°N). The collector surface of 10 m- area is pointingDelhi (latitude towards south with angle of 30° with horizontal

a) The angle of incidence of sunlight (0) is to be calculated for First December at Local Apparent Time of 9 AM. (Corresponding hour angle o = 45)

b) With power density of 0.6k W/m", what is the power collection at the said time

c) The water tank of the thermal system contains 1000 kg of water, initially at 30'C. What will be the temperature of water atter I hour assuming constant power collection ? (OR)

b) A horizontal shaft, propeller type wind-turbine is located in area having Speed of wind 10 m/s at 1 atm and 15°C. Calculate the following:

a) Air density p, kg/m*

b) Total power density in wind stream, W/m4,

) Maximum possible obtainable power density, W/m

d) Actual obtainable power density, W/m-,