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AP/EEE

2129/SJCE

UNIT 1
INTRODUCTION

PART A

1.What is renewable energy resources?

A renewable energy resources is a resource which can be used repeatedly and replaced naturally. Examples include oxygen, fresh water, solar energy and biomass. renewable resources may include goods or commodities such as wood, paper and leather.

2.What are the types of renewable energy sources?

- Solar
- Wind
- Biomass
- Ocean
- Fuel cell
- Diesel generator

3.Explain the disadvantages of Solar energy?

- Sun does not shine consistently
- Solar energy is a diffuse source. To harness it, we must concentrate it into an amount and form that we can use, such as heat and electricity.
- High cost.

4.What is green house gas emission?

A green house gas is a gas in n atmosphere that absorbs and emits radiant energy within the thermal infrared range. This process is the fundamental cause of the greenhouse effect.

5.Explain the working principle of wind power plants?

Wind turbines operate on a simple principle. The energy in the wind turns two or three propeller like blades around the rotor. This rotor is connected to the main shaft, which spins a generator to create electricity.

6. State the Advantages of wind power?

- The wind blows day and night, which allows windmills to produce electricity throughout the day.
- Energy output from a wind turbine will vary as the wind varies, although the most rapid variations will to some extent be compensated for by the inertia of the wind turbine rotor.
- No pollution.
- Low maintenance cost

7. What is tidal power?

Tide is periodic rise and fall of the water level of the sea. Tides occur due to the attraction of seawater by the moon. These tides can be used to produce electrical power which is known as tidal power.

8. Classifications of tidal power plant?

1. Single basin system
    - One way system
    - Two way system
    - Two way with pump storage
2. Double basin system
    - Simple double basin
    - Double basin with pumping

9. Explain the double basin with pumping arrangement?

In this case, off peak power from the base load plant in a interconnected system is used either to pump the water up the high basin.Net energy gain is possible with such a system if the pumping head is lower than the basin to basin turbine generating head.

10.List out the components of tidal power plants

- Power house
- Dam (or)barrage
- Sluice way from the basins to sea and vice versa.

11.List out the advantages/disadvantages of tidal power plant?

- It is free from pollution.
- It is much superior to hydro power plant as it is totally independent of rain which fluctuates year to year.
- It has unique capacity to meet peak load.
- Low operating cost

Disadvantages:

- These power plants can be developed only if natural sites are available.
- High transportation cost.
- High capital cost.
- Power output depends on lunar cycle

12. Explain the working principle of fuel cell?

The fuel represents one of the successful way by converting the chemical energy of fuels into electricity. It may be defined as an electrochemical device for the continuous conversion of the portion of the free energy change in a chemical reaction to electrical energy.

13.List out the advantages of fuel cells?

- No cooling water is needed.
- As it does not make noise.
- The fuel cell takes little time to go into operation.
- There is no efficiency penalty for part load operation.

14.List out the challenge of fuel cell technology?

- Cost
- Durability
- Reliability
- System size

15.Define-Biomass

Biomass is commonly plant matter grown to generate electricity or produce heat .In this sense living biomass can also be included as plants can also generate electricity while still alive.

16. List out the Classification of biogas plants?
- Floating drum plant
- Fixed dome plant
-

17.List out the types of fuel cell?
- Polymer electrolyte membrane
- Direct methanol
- Alkaline
- Phosphoric acid
-

18. Explain the characterization of fuel cell?
Cyclic voltammetry is typically used to characterize fuel cell catalyst activity in more detail. pore structure, catalyst surface area, electrode/electrolyte microstructure and its chemistry are among the most important characteristics to evaluate.

19. Write the demerits of PAO
- One of the major drawbacks of the perturb and observe method is that under steady state operation, the output power oscillates around the maximum power point.
- This algorithm can track wrongly under rapidly varying irradiation conditions.

20. Define Controller
The controller should keep testing if the PV system is operating at the PV maximum power point. It should force the system to track this MPP. Continuous measuring of the voltage and current from the PV array, and then performing either voltage or power feedback control is the method used.

PART B

1. Illustrate the design and principle of operation of general Fuel cell and its types
2. Explain the impact of renewable energy generation of environment in detail
3. Describe various biomass energy conversion techniques.
4. Describe the operation and control strategy of solar power conversion systems.

5. Discuss (a) biomass energy (b) green house effect
6. Explain the operating principle wind energy system
7. Describe various ocean energy conversion techniques

UNIT II
ELECTRICAL MACHINES FOR RENEWABLE ENERGY

PART A

1.What are the essential features of synchronous machine?
i. The rotor speed is synchronous with stator rotating field. ii. Varying its field current can easily vary the speed.
iii. It is used for constant speed operation.

2. What are advantages of rotating field system type of construction of synchronous machines used in renewable energy?
· Form Stationary connection between external circuit and system of conditions enable the machine to handle large amount of volt-ampere as high as 500 MVA.
· The relatively small amount of power required for field system can be easily supplied to the rotating field system via slip rings and brushes.
· More space is available in the stator part of the machine for providing more insulation to the system of conductors.

3. Write down the equation for frequency of emf induced in an alternator.
F = PN / 120 Hertz
Where P = No. Of poles
N = Speed in rpm.

4. What are the advantages of salient pole type of construction used for synchronous machines?

- They allow better ventilation.
- The pole faces are so shaped radial air gap length increases from the pole center to the pole tips so that flux distribution in the air gap is sinusoidal in shape which will help to generate sinusoidal emf.

- due the variable reluctance, the machine develops additional reluctance power, which is independent of excitation.

5. Which type of synchronous generators are used in renewable plants and why?
As the speed of operation is low, for hydro turbines used in hydroelectric plants, salient pole type synchronous generators are used. These allow better ventilation and also have other advantages over smooth cylindrical type rotor.

6 . What is the relation between electrical degree and mechanical degree?
Electrical degree θe and mechanical degree are related to one another by the number of poles P, the electrical machine has, as given by the following equation.

$$\theta e = (P/2)\, \theta m$$

7. Define winding factor of DFIG based renewable source?
The winding factor Kw is defined as the ratio of phasor addition of emf induced in all the coils belonging to each phase winding of their arithmetic addition.

8. What is the necessity for predetermination of voltage regulation in wind power plant?
Most of the alternators are manufactured with large power rating and large voltage ratings. Conduction load test is not possible for such alternators. Hence other indirect methods of testing are used and the performance can be predetermined at any desired load currents and power factors.

9. Why is the MMF method of estimating the voltage regulation is considered as the optimization method?
Compared to EMF method, MMF method involves more number of complex calculation steps. Further the OCC is referred twice and SCC is referred once while predetermining the voltage regulation for each load condition. Reference of OCC takes core saturation effect.

10. Write the applications of synchronous motor.
a. Used for power factor improvement in sub-stations and in industries. b. Used in industries for power applications.
c. Used for constant speed drives such as motor-generator set, pumps and compressors.

11. What is an inverted 'V' curve?
For a constant load, if the power factor is plotted against various values of field exciting current, the curve formed is inverted V Shape and called as inverted 'V' curve.

12. Why an induction motor will never run at its synchronous speed?
If it runs at synchronous speed then there would be no related speed between the two, hence no rotor emf, no rotor current so no rotor torques to maintain rotation. That is why the rotor runs at its synchronous speed

13. Define pullout torque?
The pullout torque is the torque, beyond which the synchronous link between field poles and resultant flux wave is severed and the machine falls out-of-slip.

14. What is the main advantage of POTIER method?
The voltage regulation calculated by potier's method is quite accurate.

15. What is meant by the subtransient period?
The initial period of decay of the short circuit current is called the subtransient, in which the current decay is governed mainly by the damper winding constant.

16. Why the rotor slots of a 3-phase induction motor are skewed?
The rotor slots of a three -phase induction motor are skewed

i. to make the motor run quietly by reducing the magnetic hum
ii. ii. to reduce the locking tendency of the rotor

17. Why the induction motor is called asynchronous motor?
Since the induction motor runs always at a speed lesser than synchronous speed, it is called asynchronous motor.

18. What are slip rings?
The slip rings are made of copper alloys and are fixed around the shaft insulating it. Through these slip rings and brushes the rotor winding can be connected to external circuits.

19. Explain why the no load current of an induction motor is much higher than that of an equivalent transformer.
In induction motor, due to the presence of the air gap, the magnetizing current that is required to set up the flux is much higher. The working component of the current has to meet the hysteresis loss, eddy current loss, friction and windage losses. Hence the no load current of induction motor is higher.

20. Give the conditions for maximum torque for 3-phase induction motor?
The rotor resistance and rotor reactance should be equal for developing maximum torque i.e. R2 = s X2 where s is the slip –under running conditions.
R2 = X2 under starting conditions

PART B

1. Explain the construction, principle of working of SCIG with neat sketches.
2. Describe the principle of operation of DFIG with neat diagram used for renewable energy conversion
3. Discuss Permanent Magnet Synchronous generator (PMSG) and explain the construction and principle of operation in detail
4. Describe the following (a) Clarks Transformation (b) Parks Transformation
5. Compose the merits and demerits of main excited and capacitor excited induction generator.
6.Explain machine capacity factor and capacity utilization factor.
7.Explain the induction generator used for wind energy conversion system

UNIT III
POWER CONVERTERS
PART A

1. What is the function of freewheeling diodes in controlled rectifier?
It serves two process.
a. It prevents the output voltage from becoming negative.

b. The load current is transferred from the main thyristors to the freewheeling diode, thereby allowing all of its thyristors to regain their blocking states.

2. What are the different methods of firing circuits for line commutated converter?
a. UJT firing circuit.
b. The cosine wave crossing pulse timing control.
c. Digital firing schemes.

3. What is meant by step-up and step-down chopper?
In a step- down chopper or Buck converter, the average output voltage is less than the input voltage. In a step- up chopper or Boost converter, the average output voltage is more than the input voltage.

4. What are the two types of TRC?
a. Constant frequency control
b. Variable frequency control

5. What is meant by PWM control in dc chopper?
In this control method, the on time Ton is varied but chopping frequency is kept constant. The width of the pulse is varied and hence this type of control is known as Pulse Width Modulation (PWM).

6. What are the different types of chopper with respect to commutation process?
a. Voltage commutated chopper.
b. Current commutated chopper.

7. What is meant by load commutation?
In this process, the load current flowing through the thyristor either becomes zero or is transferred to another device from the conducting thyristor.

8. What are the advantages of current commutated chopper?
a. The capacitor always remains charged with the correct polarity.
b. Commutation is reliable as load current is less than the peak commutation current ICP.

c. The auxiliary thyristor TA is naturally commutated as its current passes through zero value.

9. What are the applications of an inverter?
a. Adjustable speed drives
b. Induction heating
c. Stand-by aircraft power supplies
d. UPS
e. HVDC transmission

10.Give two advantages of CSI.
a. CSI does not require any feedback diodes.
b. Commutation circuit is simple as it involves only thyristors.

11. What is the condition to be satisfied in the selection of L and C in a series inverter?
Condition : R2 < 4L

12. What are the applications of a series inverter?
The thyristorised series inverter produces an approximately sinusoidal waveform at a high output frequency, ranging from 200 Hz to 100kHz. It is commonly used for fixed output applications such as
a. Ultrasonic generator.
b. Induction heating.
c. Sonar Transmitter
d. Fluorescent lighting.

13. What are the methods of reduction of harmonic content?
a. Transformer connections
b. Sinusoidal PWM
c. Multiple commutation in each cycle
d. Stepped wave inverters

14. What are the advantages of ac voltage controllers?
a. High efficiency
b. Flexibility in control

c. Less maintenance

15. What is the difference between ON-OFF control and phase control?
ON-OFF control: In this method, the thyristors are employed as switches to connect the load circuit to the source for a few cycles of the load voltage and disconnect it for another few cycles. Phase control: In this method, thyristor switches connect the load to the ac source for a portion of each half cycle of input voltage.

16. What are the disadvantages of unidirectional or half-wave ac voltage controller?
a. Due to the presence of diode on the circuit, the control range is limited and the effective RMS output voltage can be varied between 70.7% and 100%.
b. The input current and output voltage are asymmetrical and contain a dc component. If there is an input transformer, saturation problem will occur
c. It is only used for low power resistive load.

17. What is meant by sequence control of ac voltage regulators?
It means that the stages of voltage controllers in parallel triggered in a proper sequence one after the other so as to obtain a variable output with low harmonic content.

18. What are the advantages of sequence control of ac voltage regulators?
a. System power factor is improved.
b. Harmonics are reduced in the source current and the load voltage.

19. What is meant by positive converter group in a cyclo converter?
The part of the cycloconverter circuit that permits the flow of current during Positive half cycle of output current is called positive converter group.

20. What is meant by negative converter group in a cyclo converter?
The part of the cyclo converter circuit that permits the flow of current during negative half cycle of output current is called negative converter group.

PART B

1.Draw the block diagram of the solar PV system and describe the principle of operation in detail.
2. Draw the schematic diagram of Buck-Boost converter and explain the operation in detail.
3. Describe the grid interactive inverters in detail.
4. Discuss the principle and operation of three phase AC controller with neat diagram.
5. Draw and compose the converter topologies used in solar technologies
6. Explain the voltage control in PWM controller with diagram
7. Explain the following
i) array sizing ii)inverter sizing iii)selection of inverter
8. Discuss the three phase uncontrolled rectifier with its waveform diagram
9.Explain the boost,buck boost converters with its waveform.

UNIT IV
ANALYSIS OF PV AND WIND SYSTEM

PART A

1.List out the reasons of using integrated HRES ?

- Reduction of greenhouse gas (GHG) emissions through increased use of RE and other clean distributed generation
- Increase in use of integrated distributed systems and customer loads to reduce peak load and thus price volatility
- Enhancement in RE system (RES) and energy efficiency

2. List out the Energy models which are prepared using analysis of wind and PV system?

- Calculation of energy exported to grid from RE sources
- Income from energy export
- Gross and net GHG emission reduction
- GHG reduction income
- Total annual cost
- Total annual saving and income
- Financial viability including simple and equity payback

3.Write the recent ly developed Integration of RE systems ?

- WES and PV system
- PV system and BES
- BES and WES

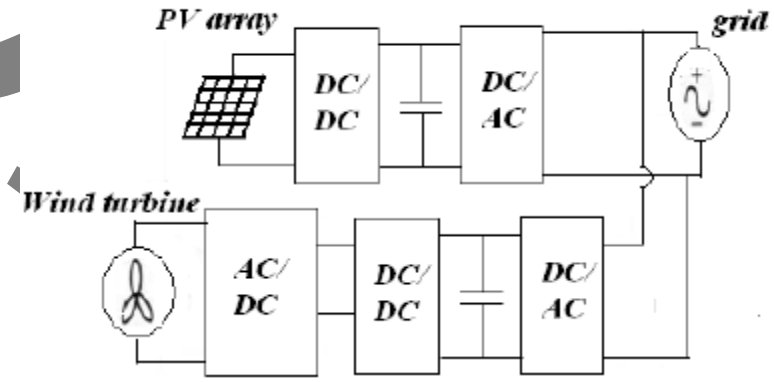
4 What the processes are required before building a renewable system?

Before building a system with several intermittent energy sources and variable consumption, guidance on selecting the dimensions of the individual components should be obtained by simulating the system operation under the local conditions like weather, insolation, wind speed etc. In general, a key objective of such a system is to use the maximum proportion of RE as mentioned above, but other factors including the financial investment, social aspects, local infrastructure, durability etc. must also be considered.

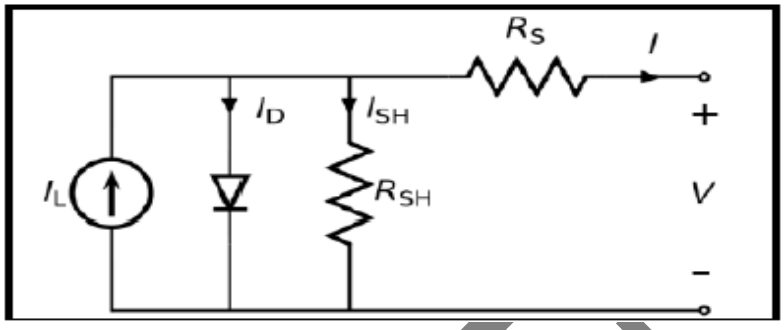
5.Give the example of integrated renewable energy system?

Minambakkam, a suburb of Chennai, India is selected for a project of integrated of PV energy system and BES suitable for a comparable load demand of 1.5 MW. Rice is one of the main agricultural products in this area; hence availability of rice husk is sufficient to supply any biomass gasifier generating electricity.

6. Draw the block diagram of grid-connected hybrid PV/wind energy system



7.Draw the PV cell equivalent circuit



8.How to model the PV cell?

PV cell are made up of semiconductor materials , which are treated so as to form an electric field , with positive and negative side. The model of a PV cell can be represented by a current source in parallel with a diode. The current source represent the current generated by photons (Iph or IL). The output is constant under constant incident radiations of light and under constant temperature.

9.Write down the purpose of series and shunt resistance in PV cell?

Rs and Rsh are the series and shunt resistance of the circuit. Rs consists of the contact resistance of the cables as well as the resistance of semiconductor itself. Parallel or shunt resistance Rp includes leakage currents at the photovoltaic cell edges. This is usually in the range of kΩ and so they have almost no effect on the current-voltage characteristics.

10.Define the performance of diode in PV cell?

The diode determines the current voltage characteristic of the cell. The output of the current source is directly proportional to the light falling on the cell.

11. Whart is the need of hybrid system?

Hybrid energy systems are omnipresent, freely available, environmental friendly, and maybe they represent the solution for power generating sources due to their availability and topological advantages for local power generations. In particular for remote areas, the hybrid wind turbine (WT) – photovoltaic (PV)– systems represent a green and reliable power system.

12.Write down the main drawback of PV/wind integrated system?

- The renewable energy sources such as photovoltaic and wind provides a more continuous electrical output, but they don't deliver a constant level of power.
- In a DC or AC distribution system, a storage system, converters, filters and the possibility of loading management or supervision system, which can be connected in different architectures.

13.Define Sizing of Hybrid Wind/Photovoltaic System ?

The effectiveness of any electric system depends on its sizing and use. The sizing should be based on meteorological data, solar radiation and wind speed and the exact load profile of consumers over long periods.

14. How do you calculate the Photovoltaic energy?

The energy produced by a photovoltaic generator per unit area is estimated using data from the global irradiance on an inclined plane, ambient temperature and the data sheet for the used photovoltaic panel.

15. Write the managing methodology of Hybrid Photovoltaic/Wind System?

Managing energy sources (photovoltaic and wind) is provided by a supervisor. For the design of the supervisor, it was decided that the photovoltaic subsystem would be the main generator, while the wind generator subsystem would be complementary. This choice is motivated by the design already made based on the monthly averages annual site rating.

16.Explain Three operating modes of hybrid control?

Case 1

This mode corresponds to the periods where photovoltaic power is sufficient for supplying the load demand.

Case 2

In this case, the photovoltaic system generates the maximum power (operating at maximum power point (MPPTw = 1) and the wind system is controlled to produce a reference power.

Case 3

In this case, the two photovoltaic and wind generator provide maximum power (operating at MPPT).

17. Explain the drawbacks of PAO?

- One of the major drawbacks of the perturb and observe method is that under steady state operation, the output power oscillates around the maximum power point.
- This algorithm can track wrongly under rapidly varying irradiation conditions.

18. What is green house gas emission?

A green house gas is a gas in n atmosphere that absorbs and emits radiant energy within the thermal infrared range. This process is the fundamental cause of the greenhouse effect.

19. Illustrate Voltage Feedback Control?

The control variable here is the PV array terminal voltage. The controller forces the PV array to operate at its MPP by changing the array terminal voltage. It neglects, however, the variation in the temperature and iosolation level.

20. List out the disadvantages of parallel configuration of hybrid system.

- Automatic control is essential for the reliable operation of the system.
- The inverter has to be a true sine-wave inverter with the ability to synchronize with a secondary AC source.
- System operation is less transparent to the untrained user of the system.

PART B

1. Describe the power conditioning schemes used in WECS.
2. Discuss (a) Grid integrated PMSG (b) SCIG based WECS (c) grid integrated solar system.
3. Discuss the various grid connected issues and its impact on system stability.
4. Draw and explain the grid integrated PMSG.
5. Discuss the standalone operation of solar energy conversion system.
6. Discuss the standalone operation of wind energy conversion system.
7. Draw and explain the characteristics of DFIG.

8. Discuss the standalone operation of fixed and variable solar energy conversion system.

UNIT –V
HYBRID RENEWABLE ENERGY SYSTEMS

PART A

1. What is the need of hybrid system?

- Hybrid Solutions are powered by sun and wind, just in order to guarantee that the power is enough to be charged in the solar battery every day,
- If some day there is sunlight but without the wind energy, the solar panel charge the battery.
- The other way round, if some day there is wind energy but without the sunlight, the wind turbine can charge the power to the battery.
- When someday both wind & solar energy is enough, both can charge the battery.
- When the night is coming, the wind turbine is also can continue to work for supply the power to the system, so we sure the system will be popular in the coming future.

2. List out the types of hybrid system?

They can be classified according to their configuration as:

• Series hybrid energy systems.
• Switched hybrid energy systems.
• Parallel hybrid energy systems.

3. Write the advantages of Series Hybrid Energy System?

The engine-driven generator can be sized to be optimally loaded while supplying the load and charging the battery bank, until a battery SOC of 70–80% is reached.

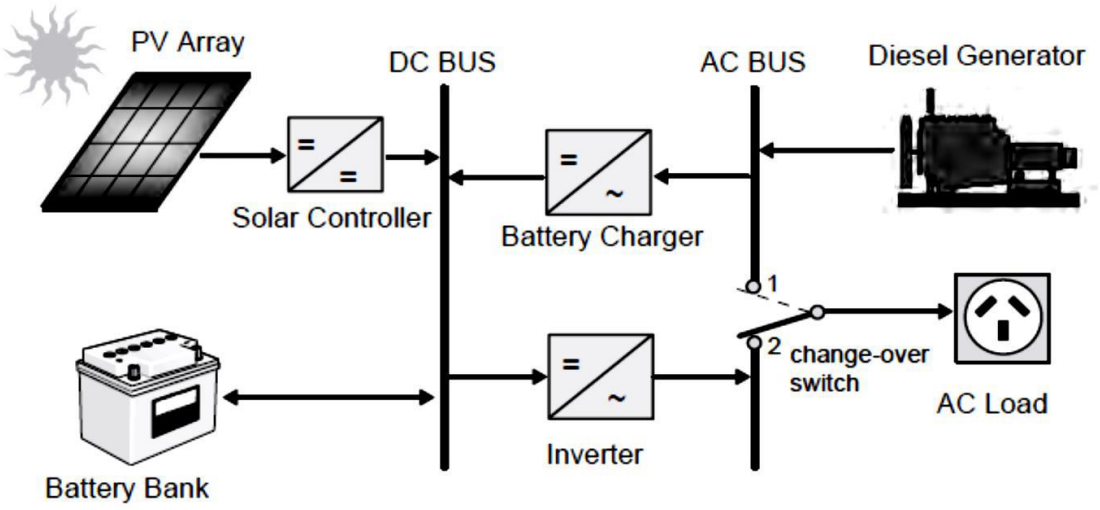
• No switching of AC power between the different energy sources is required, which simplifies the electrical output interface.
• The power supplied to the load is not interrupted when the diesel generator is started.

• The inverter can generate a sine-wave, modified square wave, or square-wave depending on the application.

4. List out the disadvantages of Series Hybrid Energy System
• The cycling profile requires a large battery bank to limit the depth-of-discharge (DOD).
• The overall system efficiency is low, since the diesel cannot supply power directly to the load.
• Inverter failure results in complete loss of power to the load, unless the load can be supplied directly from the diesel generator for emergency purposes.

5. Define Switched Configuration?
Despite its operational limitations, the switched configuration remains one of the most common installations in some developing countries. It allows operation with either the engine-driven generator or the inverter as the AC source, yet no parallel operation of the main generation sources is possible. The diesel generator and the RES can charge the battery bank. The main advantage compared with the series system is that the load can be supplied directly by the engine-driven generator, which results in a higher overall conversion efficiency.

6.Draw Switched Configuration of hybrid system.



7.List out the advantages of parallel configuration of hybrid system.
• The system load can be met in an optimal way.
• Diesel generator efficiency can be maximized.
• Diesel generator maintenance can be minimized.
• A reduction in the rated capacities of the diesel generator, battery bank, inverter, and renewable resources is feasible, while also meeting the peak loads.

8. List out the disadvantages of parallel configuration of hybrid system.
• Automatic control is essential for the reliable operation of the system.
The inverter has to be a true sine-wave inverter with the ability to synchronize with a secondary AC source.
• System operation is less transparent to the untrained user of the system.

9. Define-MAXIMUM POWER POINT TRACKING
MPPT or Maximum Power Point Tracking is algorithm that included in charge controllers used for extracting maximum available power from PV module under certain conditions. The voltage at which PV module can produce maximum power is called 'maximum power point' (or peak power voltage). Maximum power varies with solar radiation, ambient temperature and solar cell temperature.

10. How MPPT works?
The major principle of MPPT is to extract the maximum available power from PV module by making them operate at the most efficient voltage (maximum power point). That is to say: MPPT checks output of PV module, compares it to battery voltage then fixes what is the best power that PV module can produce to charge the battery and converts it to the best voltage to get maximum current into battery. It can also supply power to a DC load, which is connected directly to the battery.

11.List out the condition for most effective MPPT?

- Cold weather, cloudy or hazy days: Normally, PV module works better at cold temperatures and MPPT is utilized to extract maximum power available from them.

- When battery is deeply discharged: MPPT can extract more current and charge the battery if the state of charge in the battery is lowers.

12. Panel tracking –Define

This is where the panels are on a mount that follows the sun. The most common are the Zomeworks and Wattsun. These optimize output by following the sun across the sky for maximum sunlight. These typically give you about a 15% increase in winter and up to a 35% increase in summer.

13. Switch-mode Converter –Define

The switch-mode converter is the core of the entire supply. It allows energy at one potential to be drawn, stored as magnetic energy in an inductor, and then released at a different potential. By setting up the switch-mode section in various different topologies, either high-to-low (Buck converter) or low-to-high (Boost converter), voltage converters can then be built. The main goal is to provide a fixed input voltage and/or current, such that the array is held at the maximum power point, while allowing the output to match the battery.

14. What is Controller?

The controller should keep testing if the PV system is operating at the PV maximum power point. It should force the system to track this MPP. Continuous measuring of the voltage and current from the PV array, and then performing either voltage or power feedback control is the method used.

15. Illustrate Voltage Feedback Control?

The control variable here is the PV array terminal voltage. The controller forces the PV array to operate at its MPP by changing the array terminal voltage. It neglects, however, the variation in the temperature and insolation level.

16. Explain the Power Feedback Control of converter?

The control variable here is the power delivered to the load. To achieve maximum power the quantity dp/dv is forced to zero. This control scheme is not affected by the characteristics of the PV array, yet it maximizes power to the load and not power from the PV array. Fast shadows cause trackers to lose the MPP momentarily, and the time lost in seeking it again, because the point

has moved away quickly and then moved back to the original position, equating to the energy lost while the array is off power point.

17. List out the algorithms to accomplish MPPT controller?
Published MPPT methods include:
(1) Perturb and Observe (PAO) ,
(2) Incremental Conductance Technique (ICT), and
(3) Constant Reference Voltage/Current.

18. Explain the drawbacks of PAO?

- One of the major drawbacks of the perturb and observe method is that under steady state operation, the output power oscillates around the maximum power point.
- This algorithm can track wrongly under rapidly varying irradiation conditions.

19. Explain the merits of PAO?
This technique has an advantage over the perturb and observe method because it can stop and determine when the Maximum Power Point is reached without having to oscillate around this value.

- It can perform Maximum Power Point Tracking under rapidly varying irradiation conditions with higher accuracy than the perturb and observe method.

20. List out the drawback of constant voltage control?

- The current from the photovoltaic array must be set to zero momentarily to measure the open circuit voltage and then afterwards set to 76% of the measured voltage.
- Energy is wasted during the time time the current is set to zero.
- The approximation setting the voltage to 76% of the measured voltage is not accurate

PART B

1. Explain MPPT Techniques for WECS
2. Explain the hybrid energy conversion system

3. Describe the operating principle of PV Maximum PowerPoint Tracking in energy conversion
4. Discuss with case study how to get maximum power generation in wind energy conversion system
5. Explain the bidirectional hybrid energy conversion system.
6. Explain the design aspects of hybrid energy system.
7. Describe the case studies of solar energy system.
8. .Describe the case studies of wind energy system.