1. Explain the necessity of energy conservation.
Ans

Need for Energy Conservation:

There are several reasons why energy conservation is important and why we should make efforts to conserve energy:

1. **Environmental Impact:** Energy production and consumption are major contributors to environmental issues such as air pollution, climate change, and resource depletion. By conserving energy, we can reduce the demand for energy generation, which often involves burning fossil fuels and emitting greenhouse gases. Energy conservation helps to mitigate climate change and minimize the environmental impact associated with energy production.

2. **Climate Change Mitigation:** The excessive use of energy derived from fossil fuels releases large amounts of carbon dioxide and other greenhouse gases into the atmosphere, contributing to global warming and climate change. By conserving energy, wecan reduce greenhouse gas emissions and limit the rate of global temperature rise, helping to mitigate the impacts of climate change.

3. **Resource Conservation:** Many sources of energy, such as fossil fuels (coal, oil, and natural gas), are finite and non- renewable. Conserving energy helps to extend the lifespan of these resources, ensuring their availability for future generations. Additionally, extracting and processing these resources can have detrimental environmental impacts, so reducing energy consumption can help minimize the need for resource extraction.

4. **Energy Security:** Dependence on imported energy resources can leave a country vulnerable to supply disruptions and price fluctuations. By conserving energy and diversifying energy sources, countries can enhance their energy security, reduce dependence on foreign energy, and promote domestic energy production from renewable sources.

5. **Cost Savings:** Energy conservation can lead to significant cost savings for individuals, households, businesses, and governments. By using energy-efficient technologies and practices, we can reduce energy bills and 6.operational costs. Energy conservation also promotes the development and adoption of energy-efficient technologies, which can stimulate economic growth and job creation.

7. Sustainable Development: Energy conservation is a crucial aspect of sustainable development. By using energy more efficiently and responsibly, we can meet our present needs without compromising the ability of future generations to meet theirown needs. Energy conservation is aligned with the principles of sustainable development, promoting a balance between economic growth, social well-being, and environmental protection.

Overall, energy conservation plays a vital role in mitigating climate change, preserving natural resources, enhancing energy security, and promoting sustainable development. It is a collective responsibility that requires individual actions, policy support,technological advancements, and a shift towards cleaner and more efficient energy sources.

(or)

2.How treated wastewater is useful for non-potable purpose? Explain with suitable example?
Ans

reated wastewater can be incredibly useful for non-potable purposes, helping to conserve freshwater resources and reduce environmental impacts. Here are a few key applications, along with an example:

Applications of Treated Wastewater

1. **Agricultural Irrigation**: Treated wastewater can be used to irrigate crops, providing essential nutrients while conserving freshwater.
2. **Landscape Irrigation**: Parks, golf courses, and public gardens can utilize treated wastewater, maintaining greenery without stressing freshwater supplies.
3. **Industrial Processes**: Many industries can use treated wastewater for cooling, washing, or as a raw material in processes.
4. **Toilet Flushing**: Treated wastewater can be used in residential and commercial buildings for flushing toilets, reducing the demand for potable water.
5. **Construction Activities**: It can be used for dust control, mixing concrete, and other construction-related needs.

Example

1. **Rainwater Harvesting:** Rainwater harvesting systems capture and store rainwater from rooftops or other surfaces for later use. The collected water can be used for non-potable purposes such as landscape irrigation, toilet flushing, and cleaning. Rainwater harvesting systems typically include collection surfaces, gutters, downspouts, filters, storage tanks, and distribution systems.

2. **Greywater Recycling:** Greywater recycling involves treating and reusing wastewater generated from sources such as sinks, showers, and laundry. Greywater recycling systems filter and disinfect the wastewater, making it suitable for non-potable applications like toilet flushing, landscape irrigation, and industrial processes. These systems help reduce freshwater usage and alleviate strain on municipal water supplies.

3. a) Write about the success case studies of fully solar energy-based buildings in India.

Ans

The Suzlon One Earth Corporate Headquarters campus spread over ten acres of land in Hadapsar, Pune, India. However, the place conceived with a business and practical need to bring all trade verticals and corporate services under 1 roof. That although connected to each other would be independent sufficiently to be able to act as per their respective needs and requirements

Case Study :1 **of Suzlon One Earth Corporate Headquarters**

- Location: Hadapsar, Pune, India.
- Site area: 4,53,930sq. feet
- Client –Suzlon Energy Ltd.
- Principal Architect –Christopher Charles Benninger Architects
- Landscape Architects –Ravi and Varsha Gavandi
- Interior Architects –Tao Architecture and Space Matrix
- Green Building Design and Certification –Environmental Design Solution

Project Typology

The campus is a Corporate Campus. Also, the occupancy profile of the campus twenty-four by seven global shared service providers and the think-tank' for the globe across all places. However, the headquarters changed from a strategic center to a global control headquarter.

Philosophy of Suzlon One Earth Corporate Headquarters

To be a corporation that serves communities with sufferable wind power on a commercial scale with a focus. On continuously growing efficiency and reliability of wind turbines. With a philosophy that emphasizes innovation, to drive every aspect; the company has turned the dream of a greener world into a sustainable and profitable business

About site

This location surrounded by large townships and IT parks. The site rests amidst a fast-growing suburb context. The Corporate Campus developed by M/s Vascon Hadapsar Venture. The Plot Area is approximately 45,392 sq.m. The built-up area shall beapproximately 70865.58 sq.m.The Campus shall also accommodate approximately 2500 Suzlon Employees.

Concept of Suzlon One Earth Corporate Headquarters

- The southwest side of the structure put with an overload water tank and with minimum openings/windows.
- The center 'Bramhasthal' of the building is open to the sky to get enough light.
- The direction of the building is North-South direction.
- The water feature should be on the east side of the plot
- All sides of the structure have roads for better accessibility.
- The team was conscious of the reality that each of the Suzlon values should reflect and express itself in the campusdesign, interiors, landscape, and communication.
- The integrity seen in the campus design with connected buildings through some service elements.
- All the possible sides have peripheral routes and entry from them. (indirect access)
- The northeast part of the structure is low in elevation and has the highest openings.
- The entire plot divided into 2 parts with the corporate building placed on the eastern side and the learning center placed on the western side.

Architectural features of Suzlon One Earth Corporate Headquarters

- Suzlon One Earth derives its inspiration from big Indian historical campuses like Fatehpur Sikri and the Meenakshi Temple complex in Madurai.
- Both employ an inter-positioning of open and closed spaces that counteracts one another. Both have strong horizontalfeatures that tie the complexes together and accent qualities that emphasize quadrants and sacred places, like the Gopura at Meenakshi.
- The Panch Mahal at Fatehpur Sikri, a multi-storied construction. That maintains its scale through the employment ofmodular construction, whose elements expressed, imparting the structure scale and proportions. In these recordedprecedents, there are also water bodies and open courtyards, as in Suzlon One Earth.
- It is the need of the hour that architecture should borrow components of critical rationalism, with overhangs, louvers,pergolas, courtyards, water, and natural light permeation
- The design strategy started with the premise of creating a central meeting space, or Brahmasthan, with the sky as itsceiling.
- There is visible access to the big central gardens from everyplace. They act as visible connectors between all the floors.
- The Deepa Stambh, set in the middle of the Suzlon reflecting pool. The waterbody in the lineal basin links the Brahmasthal to a fountain toward the east. These auspicious elements protect the campus from unwanted influences and create a central focus and landmark. They carry very Indian

elements within a very global, high-tech ambiance.

- A big water body in the central court helps in enhancing the air quality and evaporative cooling. All the exterior landscape areas brought into the indoors along the perimeter of the structure bringing fresh air, nature, and natural light into the work areas so as to improve the productivity of occupants.

b) Discuss few construction and operation of various solar appliances.
Ans

2. **Solar Water Heater**

This refers to the solar water heaters used in residential buildings and commercial buildings that have been traditionally powered by electricity being powered by solar power at present. But, it is possible only if does require certain installation processes for you to harness the solar energy to power the heater. It includes setting up thermal panels in the roof, installing a tank to store water and using other accessories such as a circulating pump and thermal regulator. The panels in the roof absorb light from the sun's rays. It is converted into heat energy. This heats up the water in the tank when it is passed into the tank by means of the circulating pump. You may gain additional benefits in the form of reduced electricity bills if the hot water is used for the washing machine and dishwasher.

3. **Solar Water Pumps**

The solar water pumps are used as water lifting systems that can deliver drinking water. It can also be used to meet the irrigation requirements for agricultural purposes. The process of water lifting is done by the electricity that is generated from the panels placed to harness solar energy. You can use solar pumps to extract water from borewells, rivers, pods and any other source of water. It can also be used to supply water for various purposes that are required. The solar panels that receive sunlight convert it into DC or direct current. If your motor cannot run on DC current, you may use the inverter. this would convert the DC current into AC or alternating current and this can be used to power the water pump. However, once the initial installation is done, it is easy to operate and incurs low maintenance costs too.

4. **Solar Air Conditioner**

Solar energy technologies have made it possible to power cooling systems effectively. You now have solar thermal hybrid air conditioners the compressors of which is powered by solar energy. Electricity is just used to operate the electric control components and to run the fans. You also have Solar PV hybrid airconditioners that are capable of switching between solar power and battery power as per the need of the hour. The solar AC is considered to be very efficient in terms of cooling as well as bringing down the expenses for electricity. Once the upfront installation costs are met, you can get ready to pay less for electricity generated from the grid. It is an environment-friendly airconditioner that emits very less carbon into the atmosphere.

5. **Solar Water RO**

Water purification systems are being increasingly sought out to ensure that you get pure drinking water that is free of harmful bacteria and dust particles. These systems, however, use electricity for the purification process. The solar-powered RO systems are a fine combination of best water purification technologies as well as solar technology to power them. The purification systems are powered by solar power rather than the power from the electric grid. This makes it perfect to be installed even in remote places that are off the grid-like army camps, remote villages, etc.

6. **Solar phone**

You need electric power to charge the batteries that power the cell phones. Samsung introduced a solar-powered cell-phone called GuruE1107 as early as 2009. The in-built solar cell in the backplate of the phone made use of solar energy to generate

electricity that was enough to charge the phone's battery. Though there haven't been any other solar cell phones in the market, you can surely expect more models in a short period of time.

Solar Charger

The primary purpose of the charger is to supply electricity to the batteries of products that feature chargeable batteries. A solar charger in contrast to the electricity produced from fossil fuels that are supplied by ordinary chargers supplies electricity produced from the light from the Sun's rays. You have cell phone chargers as well as multi-use solar chargers that can supply electricity for the operation of devices or charge the batteries in them. The products include drones, cameras, DSLR, laptops, tab, etc.

(or)

4.a)Discuss about use of renewable energy resources.

Ans

Renewable energy is energy produced from sources like the sun and wind that are naturally replenished and do not run out. Renewable energy can be used for electricity generation, space and water heating and cooling, and transportation

RENEWABLE ENERGY is sustainable, clean energy harvested from sources that do not deplete with use or are replenished on a human timescale. This is in contrast to non-renewable energy sources, like oil, coal and natural gas, which are derived from a finite resource. Solar and wind power are examples of renewable energy sources. Harvesting energy from the Sun and wind today will not result in less sunshine or wind tomorrow.

Wind energy is an underutilized renewable energy source. Many people are familiar with the idea of wind power, but not quite certain exactly what it is or how it is used. This brief introduction of wind power provides basics on what wind energy is, how it is harvested, and how it is stored for future use.

Benefits of Renewable Energy Use

- Less global warming.
- Improved public health.
- Inexhaustible energy.
- Jobs and other economic benefits.
- Stable energy prices.
- Reliability and resilience

b)Explain the case study of ITC Maurya Hotel in New Delhi?

Ans

The ITC Maurya Hotel in New Delhi is a notable example of a sustainable luxury hotel that has successfully integrated green building practices. Here's an overview of its key features and achievements:

Overview

Location: New Delhi, India
Ownership: ITC Limited
Opened: 1979 (renovated and upgraded with sustainable features in later years)

Sustainability Features

1. **Energy Efficiency**
    - **Energy Management Systems**: The hotel employs advanced energy management systems to monitor and optimize energy consumption.
    - **Renewable Energy**: ITC Maurya sources a significant portion of its energy from renewable sources, including solar energy. The hotel also incorporates energy-efficient lighting and appliances.
2. **Water Conservation**
    - **Rainwater Harvesting**: The hotel has implemented rainwater harvesting systems to collect and use rainwater for irrigation and other non-potable needs.
    - **Water Recycling**: The facility utilizes advanced water treatment technologies to recycle wastewater, significantly reducing its overall water consumption.
3. **Indoor Environmental Quality**
    - **Use of Non-Toxic Materials**: The hotel prioritizes low-VOC materials and finishes to improve indoor air quality.
    - **Natural Ventilation**: Architectural designs include natural ventilation strategies, reducing reliance on air conditioning.
4. **Waste Management**
    - **Segregation and Recycling**: ITC Maurya practices comprehensive waste segregation and recycling, diverting a significant portion of waste from landfills.
    - **Composting**: Organic waste is composted and used in landscaping, promoting a circular economy approach.
5. **Sustainable Site Development**
    - **Landscaping**: The hotel features extensive green spaces with native plants, which help to enhance local biodiversity and reduce water usage for landscaping.

Certifications and Recognition

- **LEED Certification**: ITC Maurya has achieved Leadership in Energy and Environmental Design (LEED) certification, reflecting its commitment to sustainability.
- **Green Globe Certification**: The hotel has also received Green Globe certification for its sustainability initiatives.

Community Engagement

- **Local Sourcing**: The hotel emphasizes sourcing food and materials locally, supporting local farmers and businesses.
- **Employee Training**: Staff members are trained in sustainability practices, ensuring that everyone is aligned with the hotel's green objectives.

Impact

The ITC Maurya Hotel demonstrates that luxury and sustainability can coexist. By implementing innovative practices and technologies, the hotel has reduced its environmental footprint while providing high-quality service to guests. Its efforts have set a benchmark in the hospitality industry, inspiring other hotels to adopt similar sustainable practices.

Conclusion

The case study of ITC Maurya illustrates how a commitment to sustainability can enhance operational efficiency, reduce costs, and improve guest satisfaction, all while contributing positively to the environment and local community.

5a)Write about Modular wastewater treatment systems for built environment.
Ans Modular Waste Treatment Systems:

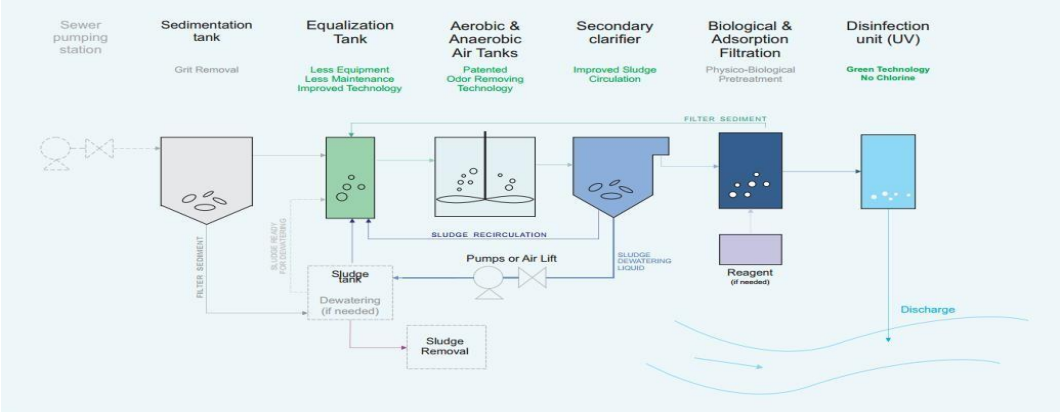
What is modular wastewater treatment plant?

Containerized MBR systems are designed with simplicity, flexibility and durability in mind. These containerized wastewater treatments plants provide high quality, portable treatment solutions ideal for remote and tight locations

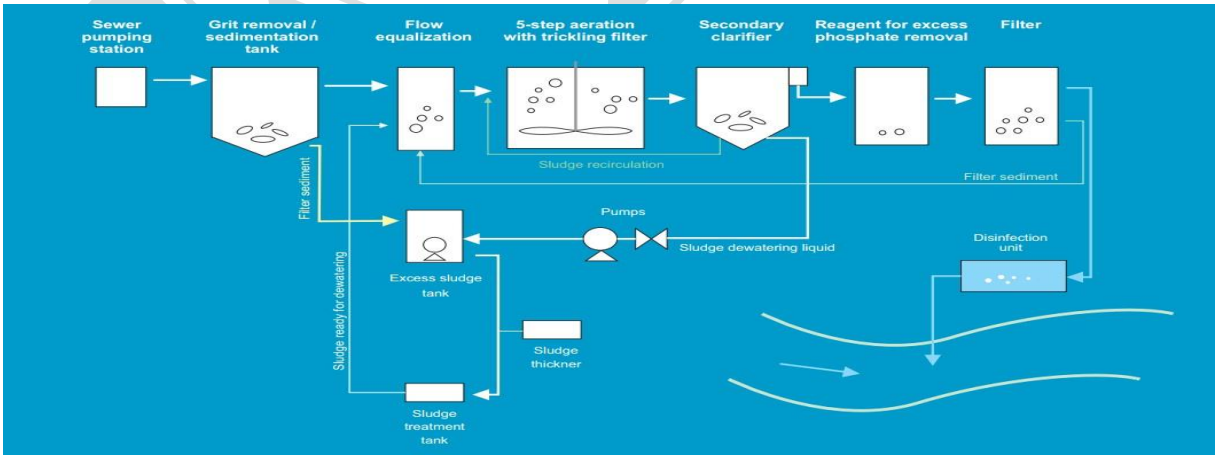
modular wastewater treatment plants are economical, require minimal maintenance and staff, and modular construction isdecreases environmental impact and budget friendly.

Modular waste treatment plants are quite, leak and smell proof with the capacity to expand seamlessly with the growing construction. The fairly compact nature of our wastewater treatment system gives you the ability to save on valuable real estate and comparatively low cost of maintenance and installation allows you to have room in your budget to concentrate on things youreally want to spend money

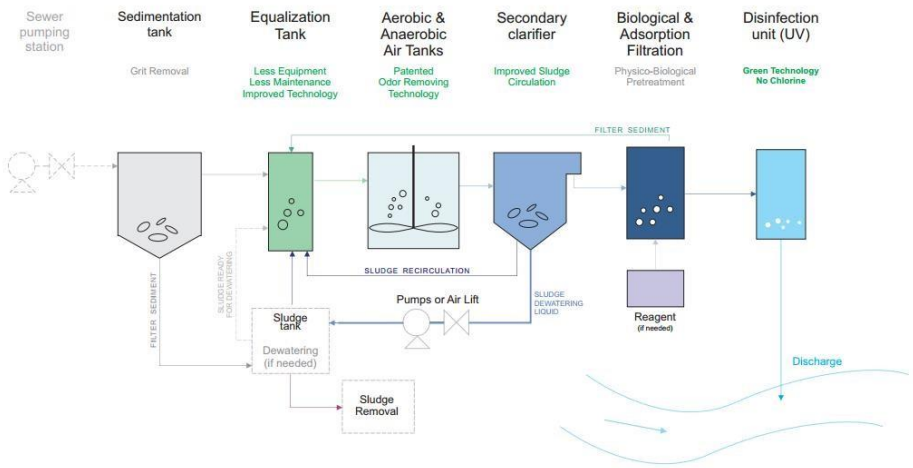
- Packaged wastewater Treatment system



- Residential wastewater Treatment System



- Compact wastewater Treatment System



b)What are the objectives of green building rating systems?
Ans

Green building rating systems aim to promote sustainable construction practices and improve the overall performance of buildings. Here are the key objectives of these systems:

1. Resource Efficiency

- **Minimize Resource Use**: Encourage efficient use of materials, water, and energy throughout the building's life cycle.
- **Sustainable Sourcing**: Promote the use of sustainable, recycled, or locally sourced materials.

2. Energy Efficiency

- **Reduce Energy Consumption**: Implement strategies to lower energy use through efficient design, appliances, and systems.
- **Utilize Renewable Energy**: Encourage the integration of renewable energy sources, such as solar panels or wind turbines.

3. Water Conservation

- **Reduce Water Use**: Promote water-saving fixtures and strategies for reducing water consumption.
- **Implement Rainwater Harvesting**: Encourage systems for collecting and using rainwater or gray water for irrigation and non-potable uses.

4. Indoor Environmental Quality

- **Enhance Occupant Health**: Focus on improving air quality, natural light, and thermal comfort to create healthier indoor environments.
- **Use Non-Toxic Materials**: Promote the use of low-VOC (volatile organic compounds) materials and finishes to reduce indoor pollutants.

5. Sustainable Site Development

- **Minimize Site Disturbance**: Encourage careful site selection and planning to minimize ecological disruption.
- **Promote Biodiversity**: Encourage landscaping practices that support local wildlife and preserve natural habitats.

6. Lifecycle Assessment

- **Holistic Approach**: Evaluate the environmental impact of buildings throughout their life cycle, from construction to demolition.

- **Encourage Reuse and Recycling**: Promote strategies for reusing materials and recycling waste generated during construction and operation.

7. Economic Benefits

- **Reduce Operational Costs**: Encourage designs that lead to lower utility bills through energy and water efficiency.
- **Increase Property Value**: Promote sustainable features that can enhance the marketability and value of buildings.

8. Community and Social Benefits

- **Enhance Community Well-being**: Encourage designs that foster community interaction and promote access to green spaces.
- **Support Local Economy**: Promote local materials and labor, contributing to economic development.

9. Awareness and Education

- **Promote Sustainability Awareness**: Increase knowledge and understanding of sustainable practices among builders, architects, and the general public.
- **Encourage Innovation**: Foster the development of new technologies and practices that advance sustainability in the building sector.

(or)

6a)Discuss about Green Building Rating Systems
Ans
Write about LEED and GRIHA present in set -2
b)Write about Modular wastewater treatment systems for built environment.
Ans 5a

SET-2

7Explain about technologies used in "Waste to Energy".
Ans

Waste-to-energy management in residential complexes or gated communities is an approach that aims to convert waste materials into usable energy, such as electricity or heat. It provides an environmentally sustainable solution for waste disposal while generating energy that can be used within the community. Here are some key aspects and considerations for waste-to-energy management in such settings

1. **Waste Segregation:** Proper waste segregation is crucial for effective waste-to-energy management. Residents should beeducated and encouraged to separate their waste into different categories, such as organic waste, recyclables, and non- recyclables. This ensures that the waste can be efficiently processed for energy recovery.
2. **Biogas Generation**: Organic waste, such as food scraps and garden waste, can be converted into biogas through a process called anaerobic digestion. Biogas can be used for cooking, heating, or generating electricity within the residential complex. Establishing a biogas plant on-site can be a viable option for communities with a substantial amount of organic waste.
3. **Composting:** Composting is another method for managing organic waste. The compost produced can be used as a nutrient-richsoil amendment for community gardens or landscaping purposes. Encouraging residents to compost their organic waste reduces the overall waste volume and enhances sustainability.
4. **Waste-to-Energy Facilities**: In larger residential complexes or gated communities, installing waste-to-energy facilities such asincinerators or gasification plants can be considered. These technologies convert non-recyclable waste into heat or electricity. However, such facilities require careful planning, environmental impact assessments, and compliance with local regulations to ensure proper air pollution control and ash disposal.
5. **Collaboration and Partnerships:** Waste-to-energy initiatives are often more successful when communities collaborate with local municipalities, waste management authorities, or private companies specializing in waste management. These partnershipscan provide expertise, funding, and infrastructure support for implementing waste-to-energy projects.

6. **Energy Distribution**: If a waste-to-energy facility generates excess electricity, the community can explore options for distributing or selling it to the grid, thereby contributing to the local energy supply. Alternatively, the generated energy can beused to power common areas, streetlights, or shared facilities within the residential complex.
7. **Monitoring and Evaluation**: It is essential to establish a monitoring and evaluation system to assess the effectiveness of the waste-to-energy management approach. Tracking waste reduction, energy generation, and environmental impacts can help identify areas for improvement and optimize the system over time.

(or)

8 Write about Wind and Solar Energy Harvesting?

Ans

HOW IS WIND ENERGY HARVESTED?

Harvesting wind energy for electricity operates on the same basic principles of older windmills. The specialty windmills that are used to convert wind energy into electricity are called wind turbines. There are two different types of wind turbines, horizontal- axis and vertical-axis. In vertical-axis wind turbines, the main rotor shaft (similar to the windshaft of older windmills) is set vertically, or perpendicular to the ground. In horizontal-axis wind turbines, the main rotor shaft is set horizontally and the blades are perpendicular to the ground. Most commercial wind turbines that are connected to the electrical grid are horizontal-axis wind turbines.

Modern horizontal-axis wind turbines are tall towers that typically have two or three blades. At the top of the the tower is a weather vane which is connected to a computer. This keeps the turbine facing into the wind. Like with the windmill, the wind moves the blades of the wind turbines. Although, the blades of the turbine work more like the wing of an airplane than windmill sails. When the wind blows, a pocket of low pressure air is formed on the back side of the blade, accompanying an area of high pressure air on the front. This creates a pressure differential and an aerodynamic force known as lift. Lift causes the blades to spinwhich, in turn, spins the main rotor shaft that is connected to a generator. The electric generator converts the mechanical energy of the rotor shaft into electricity

Solar Energy Harvesting:

Solar Power is a cost-effective and clean source of electricity. It is also an excellent alternative to power produced by fossil fuels like coal, oil, and natural gas. Solar power uses the energy from the sun to generate electricity. Solar panels are either photovoltaic (PV) panels or concentrating solar power (CSP) panels. Photovoltaic panels convert sunlight directly into electricity. The most common form of photovoltaic panels is crystalline silicon solar panels. Crystalline silicon solar panels are made of thin silicon layers and stacked on top of each other because of the thinness.
In green building technologies, Solar Power can be utilized into two types,

- **Active solar energy** is a form of solar energy generated from the sun using mechanical and electrical means that we can use in the future. This form of solar energy can convert the sun's energy into useful energy for all kinds of practical benefits. It provides energy to individual consumers, electric power stations, industries, hospitals, hotels, airports, and many other types of buildings and infrastructure projects and establishments. Solar energy is highly efficient and generates a great deal of power. It can also supply excess surplus energy generated to the Grid.

- **Passive solar energy** is a form of solar energy from the sun that requires no other energy or mechanical system. In this passivesolar design, the windows and walls collect and store solar energy for the winter and transmit solar energy to the interior duringthe summer. Passive solar design is unlike active solar heating systems. It does not involve the use of mechanical and electricaldevices.
  Passive solar design is a way of natural heating or cooling a building or a home. It works through the use of the sun's energy. Ituses the sun's energy to heat the building during the winter and cool the building during the summer.

8a)Explain the case study of Suzlon one Earth Corporate Headquarters?
Ans Present in previous set
b)Discuss about the potential of solar energy in India.
Ans

Potential of solar Energy in India:

India has undertaken ambitious targets under the Paris Agreement. India's climate action is dependent upon energy transition (in the electricity sector) by betting large on shift to solar energy. In 2014-15, the Government had set a target of producing 175 Gigawatt (GW) of renewable energy by 2022, with 100 GW of solar energy. The present installed capacity of solar energy is only 60% of the target. While, the Government is set to miss the ambitious target, nevertheless the progress in expansion of renewable and solar energy has been commendable. The installed renewable energy capacity has trebled from 38GW in 2014. The Government should take steps to address the challenges facing the sector and further enhance the pace of transition to clean energy.

What are the Potential, Targets and Status of Solar Energy in India?

Potential

India is endowed with vast solar energy potential. India receives nearly 3000 hours of sunshine every year. About **5,000 trillion kWh per year** energy is incident over India's land area with most parts receiving **4-7 kWh per sq. m per day**. Solar photovoltaics power can effectively be harnessed providing huge scalability in India.

National Institute of Solar Energy has assessed India's **solar potential to be about 750 GW** assuming 3% of the waste land area to be covered by Solar PV modules.

Gujarat and Rajasthan have the highest solar energy potential.

(or)

9a)Discuss about energy usage in buildings and their Consequences.
Ans

Energy usage in buildings is a critical aspect of sustainability and environmental impact. Buildings account for a significant portion of global energy consumption, leading to various consequences for the environment, economy, and human health. Here's a detailed discussion on energy usage in buildings and its implications:

Energy Usage in Buildings

1. **Types of Energy Consumption**
   - **Heating, Ventilation, and Air Conditioning (HVAC)**: A major portion of energy is consumed for heating and cooling, depending on the climate and design of the building.
   - **Lighting**: Energy is also heavily used for artificial lighting, which can be optimized with energy-efficient technologies.
   - **Appliances and Equipment**: Office equipment, kitchen appliances, and other electrical devices contribute significantly to energy consumption.
   - **Water Heating**: Hot water systems consume considerable energy, particularly in residential buildings.
2. **Sources of Energy**

- **Fossil Fuels**: Many buildings rely on non-renewable energy sources like coal, natural gas, and oil, which contribute to greenhouse gas emissions.
- **Renewable Energy**: Increasingly, buildings are utilizing renewable sources such as solar, wind, and geothermal energy to reduce their carbon footprint.

Consequences of Energy Usage in Buildings

1. **Environmental Impact**
   - **Greenhouse Gas Emissions**: High energy consumption from fossil fuels leads to increased CO2 emissions, contributing to climate change.
   - **Air Pollution**: Burning fossil fuels for energy can release harmful pollutants that affect air quality and public health.
   - **Resource Depletion**: Reliance on non-renewable energy sources contributes to resource depletion and environmental degradation.
2. **Economic Consequences**
   - **Operational Costs**: High energy consumption leads to increased utility bills, affecting the overall operational costs of buildings.
   - **Impact on Property Value**: Buildings that are energy-inefficient may see reduced property values as tenants and buyers increasingly prioritize sustainability.
3. **Social Implications**
   - **Health Effects**: Poor energy efficiency can result in inadequate indoor air quality and thermal comfort, leading to health issues such as respiratory problems and heat-related illnesses.
   - **Energy Poverty**: In some regions, high energy costs can lead to energy poverty, where occupants are unable to afford adequate heating or cooling, impacting quality of life.
4. **Climate Change**
   - **Contribution to Global Warming**: The energy sector is one of the largest contributors to greenhouse gas emissions. As buildings continue to consume large amounts of energy, they exacerbate the impacts of climate change.
   - **Extreme Weather Events**: Increased energy usage contributes to the frequency and severity of extreme weather events, impacting communities and infrastructure.

b)Explain the Passive Cooling Techniques in Green Buildings?
Ans

Passive cooling techniques are essential strategies in green building design aimed at reducing indoor temperatures and improving comfort without relying on mechanical air conditioning systems. These techniques leverage natural elements and building design principles to create a more energy-efficient and sustainable environment. Here's an overview of key passive cooling techniques:

1. Natural Ventilation

- **Cross Ventilation**: Designing windows and openings to facilitate airflow across the building, allowing cooler air to enter and warm air to escape.
- **Stack Ventilation**: Utilizing the natural buoyancy of warm air to create upward airflow, often achieved with high windows or vents that allow hot air to rise and exit.

2. Thermal Mass

- **Material Selection**: Using materials with high thermal mass (like concrete, brick, or stone) to absorb heat during the day and release it at night, helping to stabilize indoor temperatures.
- **Strategic Placement**: Positioning thermal mass elements in areas that receive direct sunlight can enhance heat absorption during the day.

3. Shading

- **Overhangs and Awnings**: Designing roof overhangs or exterior shading devices to block direct sunlight during peak hours while allowing indirect light.

- **Landscaping**: Planting trees and shrubs around the building to provide shade and reduce heat gain through natural foliage.

4. Reflective Surfaces

- **Light-Colored Roofs**: Utilizing reflective roofing materials that reduce heat absorption by reflecting sunlight away from the building.
- **Cool Pavements**: Choosing reflective or permeable materials for pavements to minimize heat absorption and urban heat island effect.

5. Building Orientation

- **Strategic Orientation**: Aligning the building's long axis with the prevailing winds and positioning windows to maximize natural ventilation while minimizing exposure to direct sunlight.

6. Green Roofs

- **Vegetative Layers**: Installing green roofs covered with vegetation, which provide insulation, reduce heat absorption, and promote evapotranspiration, helping to cool the building.
- **Biodiversity Benefits**: Green roofs also enhance biodiversity and manage stormwater runoff.

7. High Ceilings and Open Spaces

- **Volume and Airflow**: Incorporating high ceilings and open floor plans to promote better airflow and reduce heat buildup in enclosed spaces.
- **Clerestory Windows**: Installing high windows that allow hot air to escape while providing natural light.

8. Evaporative Cooling

- **Water Features**: Integrating fountains or ponds in landscaping can cool the air through evaporation, enhancing comfort in outdoor spaces and nearby interiors.
- **Wet Surfaces**: Using materials that can retain moisture to cool the surrounding air as the water evaporates.

10a)Explain about LEED Criteria in detail?
Ans

Earning a LEED rating for a building is a process that involves meeting specific requirements in various categories, such as energy efficiency, water conservation, and indoor environmental quality. The LEED rating system is divided into different categories, and buildings can earn points by meeting the requirements in each category.

The first step in earning a LEED rating is to choose the appropriate rating system for the building. The LEED rating system includes several different categories, see above. Each rating system has different requirements, so it's important to choose the onethat best fits the building.

Once the appropriate rating system has been chosen, the building's design and construction team must register the project with the USGBC. This process involves providing information about the project's location, size, and proposed green building strategies.

The next step is for the building to be designed and constructed in accordance with the LEED requirements. This includes incorporating sustainable materials and technologies, such as energy-efficient lighting and HVAC systems, and promoting water conservation. The building must also be designed to promote indoor environmental quality and the well-being of the building's occupants.

After the building is completed, it must be independently verified by a LEED-accredited professional. This process involves a thorough review of the building's design and construction, as well as on-site inspections to ensure that the building meets the LEED requirements.

Once the building has been verified, it can be submitted for certification. The building will be awarded points based on how well it meets the LEED requirements, and it will be assigned a certification level of Certified, Silver, Gold, or Platinum.

b)Explain about Modular Wastewater treatment systems for gated Communities.
Ans
Present in set -1

(or)

11a)How to implement Green Rating Systems for Integrated Habitat Assessment? Explain
Ans

GRIHA (Green Rating for Integrated Habitat Assessment), the national green building rating system of India, is the product of the collaboration of The Energy and Resources Institute (TERI) with the Ministry of New and Renewable Energy (MNRE).

Being the country's own green building grading system, GRIHA analyzes a building's resource consumption, waste generation, and overall environmental impact.

Requirements of a Green Habitat

A green habitat strives to:

- Keep the demand for electricity, water, and other natural resources as minimal as possible in all phases of construction, operation, and demolition.
- Use renewable energy to generate on-site electricity.
- Meet all of its water requirements using environmentally friendly ways such as rainwater harvesting.
- Recycle and reuse all of its waste on-site, resulting in a minimal environmental effect.

GRIHA Ratings

Green Rating for Integrated Habitat Assessment (GRIHA) allocates points to buildings on a scale of 100, based on the 30 parameters discussed above. However, to be certified by GRIHA, a project must receive at least 50 points.

Rating	Points
5-star	86 above
4-star	71-85
3-star	56-70
2-star	41-55
1-star	25-40

Significance of GRIHA

- Environmental protection and climate change mitigation are fundamental problems for our country and the rest of the world.
- Urban infrastructure must provide critical services to the residents while also dealing with massive demographic transitions sustainably amidst rising urbanization.
- Cities bear a large amount of responsibility for balancing current requirements with the needs of future generations tomaintain a sustainable balance and reduce the negative environmental repercussions of urbanization.
- India lacks adequate infrastructure for water recycling, reuse, and treatment despite its enormous coastline and rivers.
- Green Buildings are crucial in ensuring that people don't misuse, abuse, and overuse resources to the point of scarcity in the coming years.

Green buildings can aid in the achievement of nine of the seventeen SDGs (Sustainable Development Goals

b)Discuss about Building Automation and Building Management Systems?
Ans

Building Automation and Building Management Systems :

The two terms are frequently used interchangeably in the industry. For some time, vendors were trying to differentiate Building Automation Systems as an advanced version of Building Management Systems. But then everybody started to call their BMS a BAS.

The software vendors looked at BAS as an evolution to BMS systems by adding smarter analytics and advanced automated controls. However, the building owners and operators view BAS as a subset to BMS with a focus on automating HVAC andLighting controls.

Two other terms that are synonymous with BMS are Building Control Systems (BCS) and Energy Management Systems(EMS/EMCS).

- **BMS** – Building Management Systems
- **BAS** – Building Automation Systems

The BMS's core function is to manage the internal environmental conditions within a building, i.e., temperature, in a way that is as energy-efficient as possible.

A Building Management System (BMS) is a computer-based system installed in buildings to control and monitor mechanical and electrical plants, including; HVAC (heating, ventilation, air conditioning), lighting, power systems, fire systems, and security systems.

Effective well-utilized Building Management Systems (BMS) provides the core management tool required by building managersto ensure monitoring and efficient management of energy and occupant comfort. It enables Building Managers to provide the optimal working environment while minimizing the landlords' and tenants' costs. Effective BMS utilization allows for optimal building performance by extending equipment and systems' operational life by reducing loads and operating hours. Therefore, maintenance and capital costs are reduced, and less embedded energy is consumed through equipment replacement and upgrades.

When a building has been completed, its structure's impact on its energy consumption performance is usually fixed until refurbishment occurs. However, base Building and Tenant Light and Power energy consumption can be increased or decreasedby the performance of both building systems and tenants. A BMS will show increases in energy use due to equipment failure oradjustments to operating parameters. For example, heating valves open when the building requires cooling or whole floors of lights for extended periods due to cleaning activity.

A BMS may also indicate that air-conditioning is starting up hours before the building is fully occupied due to security staff activities. With this information in hand, the building manager may rectify such issues through consultation or engineering solutions.