

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,  
LONERE – RAIGAD - 402 103  
Semester Examination – December - 2017**

**Branch: B.Tech (Group A/Group B)**

**Sem.:- I**

**Subject with Subject Code:-Energy and Environmental Engineering (CHE106)**

**Marks: 60**

**Date:-**

**Time:- 3 Hr.**

**Instructions to the Students**

1. Each question carries 12 marks.
2. Attempt any five questions of the following.
3. Illustrate your answers with neat sketches, diagram, etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

**Q.1. Solve any Two of the following:**

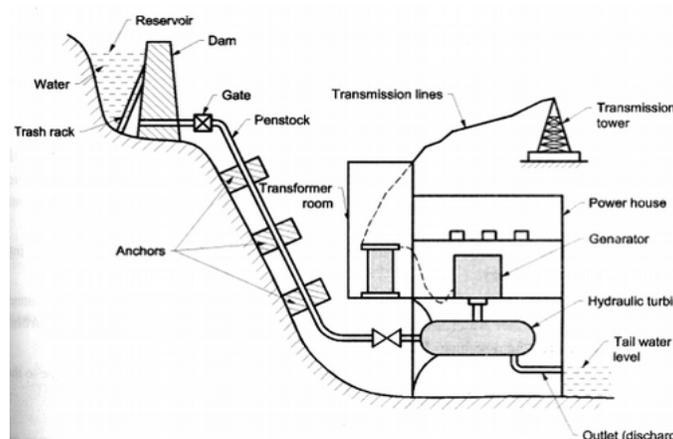
**(Marks)  
(6×2=12)**

**(a) Explain the working of a Hydro Electric Power plant with a neat diagram? Write at least four advantages and disadvantages each of the Hydro Electric Power.**

**Ans:**

A hydroelectric plant is basically a structure where water flows over the turbine which rotate it coupled to generator that generating electricity because of rotation of generator shaft.

The dam is a barrier that creates a head from which water flows. A pipe (penstock) carries the water from the reservoir to the turbine. The fast-moving water pushes the turbine blades, something like a pinwheel in the wind. The water force on the turbine blades turns the rotor, the moving part of the electric generator. When coils of wire on the rotor sweep past the generators stationary coil (stator), electricity is produced. Vast networks of transmission lines and facilities are used to bring electricity to us in a usable form.



## **Advantages**

- It is a clean and renewable energy source.
- It produces no air pollutants, and no toxic waste by-products.
- The plants have low operational costs and a long life span.
- It can be used for both base load and peak demand.
- The power contributes to a stable and reliable electricity grid.
- Reservoirs of dams can be used for irrigation, flood control and recreation

## **Disadvantages**

- Its high initial capital costs.
- It takes a great deal of money and resources to build large hydro plants and dams.
- Like all energy projects, hydropower affects the environment, ie. disturb the natural habitat.
- May cause flooding in surrounding areas
- May inhibit the migration of fish
- May affect water quality downstream
- Long construction time (10 to 15 years)
- Expensive to construct

**(b) Enumerate the various systems and components used in Thermal Power plant. Describe Fly ash circuit and Cooling water circuit in these power plants.**

Ans: The different types of systems and components used in steam power plant are as follows:

- (a) High pressure boiler
- (b) Prime mover
- (c) Condensers and cooling towers
- (d) Coal handling system
- (e) Ash and dust handling system
- (f) Draught system
- (g) Feed water purification plant
- (h) Pumping system
- (i) Air preheater, economizer, super heater, feed heaters.

### **Fly ash Circuit**

As the coal burns, it produces emissions (carbon dioxide, sulphur dioxide and nitrogen oxides) and ash. The gases, together with the lighter ash (fly ash), are vented from the boiler up the stack. Large air filters called electrostatic precipitators remove nearly all the fly ash before it is released into the atmosphere. The heavier ash (bottom ash) collects in the floor of the boilers and is removed. Scrubbers and other pollution control equipment are used to reduce emissions into the air.

Air taken from the atmosphere is first passed through the air pre-heater, where it is heated by flue gases. The hot air then passes through the furnace. The flue gases after passing over boiler and superheater tubes, flow through the dust collector and then through economiser, air pre-heater and finally they are exhausted to the atmosphere through the chimney.

### **Cooling water circuit**

The steam exits the turbines and passes over cool tubes in the condenser. The condenser captures the used steam and converts it back to water. The cooled water is then pumped back to the boiler to repeat the heating process. If sufficient quantity of water is not available the hot water coming out of the condenser may be cooled in cooling towers and circulated again through the condenser.

**(c) What are the fossil fuels used for generation of conventional power? Write the correct type of energy produced by the following power plants.**

**1) kalkappam in Tamil Nadu, 2) Reliance Power in Pokharan in Rajashthan, 3) Almatti in Karnataka, and 4) Koradi in Maharashtra**

**Ans:**

The fossil fuels used for generation of power are-  
Coal, Diesel, Petrol, Uranium, Natural gas, Etc.

Coal is the most widely used fossil fuel for electricity generation; its composition is a complex combination of organic compounds and inorganic, mineral matter.

Fuel oil is derived from crude petroleum and is the most widely used liquid fuel for power generation. Distillate and residual fuel oils are the two major categories of this type of fuel.

After coal and oil, natural gas is the third type of fuel most widely used for electricity generation. The main component of natural gas is methane (85–90%); it also contains propane, ethane, butane, some inert gases such as nitrogen, helium and carbon dioxide, and trace amounts of other gases.

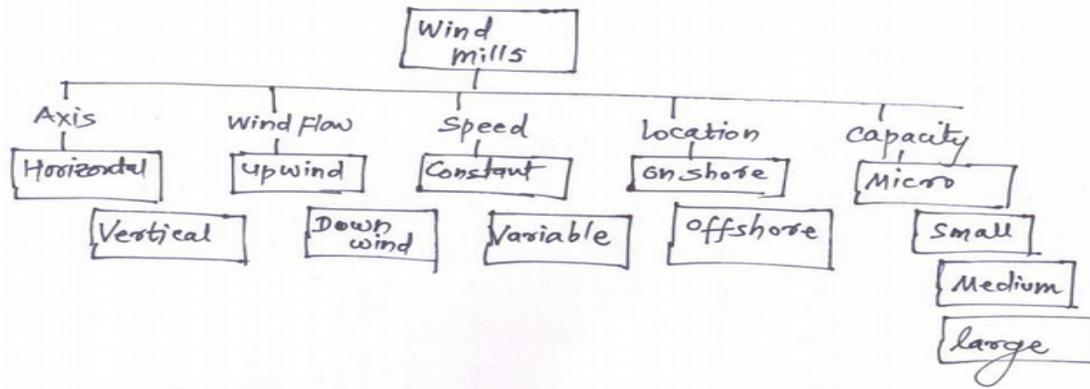
- 1) kalkappam in Tamil Nadu – Nuclear power
- 2) Reliance Power, Pokharan in Rajasthan – Solar power
- 3) Almatti in Karnataka – Hydro electric power
- 4) Koradi in Maharashtra – Thermal power

**Q.2. Solve any Two of the following:**

**(6×2=12)**

**(a) How the wind mills are classified? Show with a flow chart. Explain briefly about vertical wind mill with a neat sketch.**

Ans: Wind mills are classified as –



Vertical Axis wind mill consists of -  
**Tower (or Rotor Shaft)**

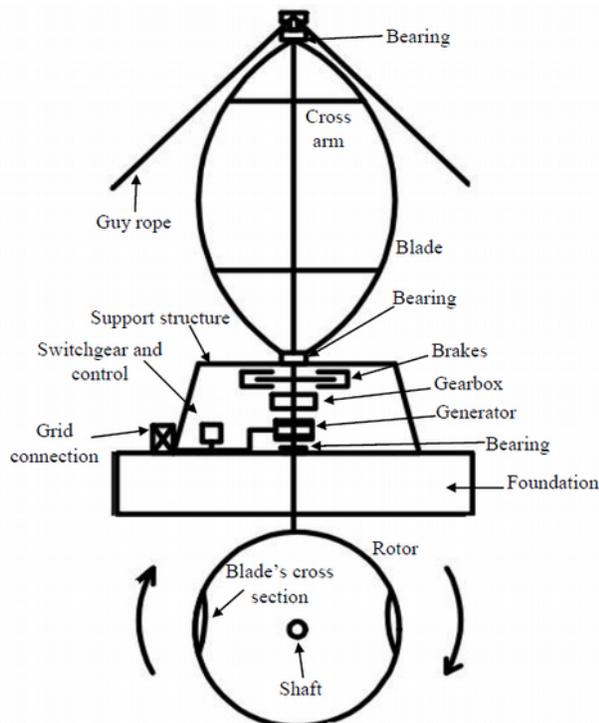
The tower is a hollow vertical rotor shaft, which rotates freely about the vertical axis between, the top and bottom bearings. It is installed above a support structure. The upper part of the tower supported by guy ropes.

**Blades**

It has two or three thin, curved blades shaped like an eggbeater, with blades curved in a form that minimizes the bending stress caused by centrifugal forces. The diameter of the rotor is slightly less than the tower height.

**Support Structure**

The support structure is provided at the ground to support the weight of the rotor. Gearbox, generator, brakes, electrical switchgear and controls are housed within this structure.



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.

Inspection and maintenance is easier.

Overall cost is reduced.

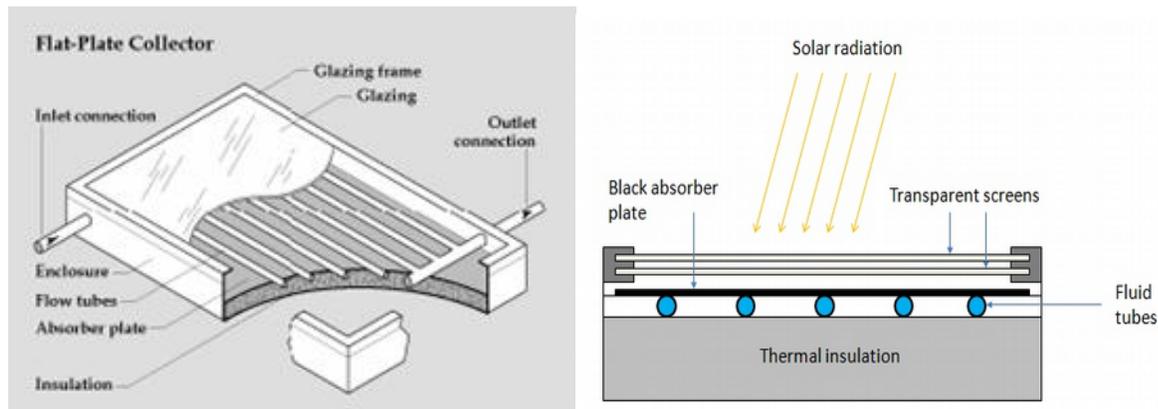
**(b) Define solar energy? What is flat plate collector? Describe its components with suitable sketch.**

Ans: Solar energy represents the entire electromagnetic radiation (visible light, infrared, ultraviolet, x-rays, and radio waves). Solar power - produced through the use of photovoltaic technology. In this process, photons, or particles of light, are absorbed by collectors and the energy released during this absorption is transferred as electrical current.

### Flat Plate Collector

A flat plate collector, as shown in the figure below, consists of the following components:

- 1) An absorber plate, treated with a selective surface coating to increase the fraction of incoming radiation absorbed
- 2) A transparent cover, or glazing, which limits the radiation and convection heat losses
- 3) A layer of insulation, which reduces conduction losses
- 4) An enclosure to contain the different elements
- 5) Flow tubes through which the heat transfer fluid circulates



**(c) Give classification of fuel cells using a flowchart. What are the advantages and disadvantages of a fuel cell? State any four each.**

Fuel cells transform the energy of a fuel directly into electricity without combustion. They run on hydrogen-rich fuels such as naphtha, methanol, natural gas and hydrogen.

They are based on the electrolyte employed:

1. Alkali
2. Phosphoric acid
3. Solid Oxide
4. Molten Carbonate
5. Proton Exchange Membrane PEM
6. Direct Methanol DMFC

### **Advantages are -**

1. Energy content of hydrogen is the highest per unit of weight of any fuel. When water is broken down into H<sub>2</sub>O, otherwise known as oxy-hydrogen or Brown's Gas, it becomes a very much efficient fuel.
2. As the hydrogen is non-polluting and non-toxic. The only byproduct of hydrogen when it burns is heat and water.
3. Hydrogen is very plentiful and renewable.
4. It will greatly reduce the import of highly expensive oil demands of our country.
5. Cheap maintenance

### **Disadvantages are -**

1. Hydrogen is currently very expensive, because it's difficult to generate, handle, and store, requiring bulky and heavy tanks like those for compressed natural gas (CNG) or complex insulating bottles if stored as a cryogenic (super-cold) liquid like liquefied natural gas (LNG).
2. It can also be stored at moderate temperatures and pressures in a tank containing a metal-hydride absorber or carbon absorber, though these are currently very expensive.
3. In order to separate the atoms of the hydrogen and oxygen and actually generate hydrogen fuel, fossil fuels are needed.
4. While it may not be toxic, it sure is flammable. The source of the hazard comes from the hydrogen itself, which is very prone to catching on fire, or even exploding.

### **Q.3. Attempt the following:**

**(6×2=12)**

**(a) What do you mean by energy conservation? Explain the measures to be taken to reduce the energy conservation in domestic refrigerator. List any four measures.**

Ans: Energy conservation refers to adapting one's activities to cut energy use entirely. Efficient energy use means using less energy for everyday's task. It is nothing but a strategic use of energy in order to reduce the energy requirements per unit output.

#### **Energy conservation in Domestic Refrigerator**

☞ Only turn on anti-sweat heaters when ambient conditions cause condensation on the display doors. Try installing adaptive controls for these devices so they turn on and off automatically when necessary.

☞ Check door gaskets and auto closers to make sure they are in good condition. Warm, humid air can enter refrigeration compartments if these are not working properly, resulting in energy waste and spoiled food.

☞ Make sure the refrigeration system is clean and dust-free, especially the coils. This can help improve heat transfer within the system.

☞ Make sure the refrigeration system has enough space around it to ensure good airflow over the heat exchange coils. This helps lower the amount of wasted energy.

☞ Install motion sensors for case lighting systems. This will turn lights on and off only when needed.

☞ Install night curtains on open cases to help keep refrigerated air from escaping when standard business hours are over.

☞ Turn down your refrigerator temperature. Refrigerators account for about 20% of household electricity use. Use a thermometer to set your refrigerator temperature to 37°F / 2.7°C and your freezer as close to 3°F / -16°C or close as possible. Make sure that the energy saver switch is turned on.

☞ Check the gaskets around your refrigerator/freezer doors to make sure they are clean and tightly sealed.

☞ Do not keep your refrigerator and freezer at very low temperature. Energy usage may go high up to 20 to 30%, if we set it to 2 to 3 degrees lower than required.

☞ Never place refrigerator against west and south facing walls which are exposed to direct sunlight.

☞ Before placing food items, always letting it cool at room temperature.

☞ Always lid off or cover the liquid items in the refrigerator. It is because liquids may get vaporised and can add load to compressor.

☞ We can reduce the amount of time the door remains open. If we think about what we need before opening refrigerator door.

☞ Clean the condenser coils regularly to make sure that air can circulate freely. Otherwise, the motor will be more loaded to circulate the air and will consume more energy.

**(b) What is energy efficiency? Write atleast six practices that lead to increase in energy efficiency of the home appliances viz. mixer-grinder, water heater, flour mill, electric lighting, air conditioner, etc.**

**Ans:** Efficiency is a measure of how much work or energy is conserved in a process. It is the energy output divided by the energy input and expressed as percentage. It is the goal to reduce the amount of energy required to provide products and services.

**Six practices for increasing the energy efficiency**

☞ Replace light bulbs with compact fluorescent lights. Efficient fluorescent light bulbs use less than half the energy than traditional incandescent bulbs do to produce the same amount of light, and they last a lot longer.

☞ If we set temperature to above 22°C, then we can save 3 to 5% energy for each degree above 22°C. It is always recommendable to set the temperature of air conditioner at 25°C to have the better comfort at least energy usage.

☞ Turn down your water heater thermostat. Thermostats are often set to 60°C when 49°C is usually fine.

☞ Keep refrigerators ice free.

☞ Adjust heating and cooling controls to reduce overheating or overcooling and use natural ventilation more effectively.

☞ Switch off appliances when not in use.

☞ Use the correct size burner for your pan.

**Q.4. Attempt the following:**

**(6×2=12)**

**(a) What is the difference between primary and secondary air pollutants? Give some examples of each? List several illnesses that are caused by the dirty air.**

Ans: Primary Pollutants are those gases or particles that are emitted into the air from the identified sources. They include carbon monoxide from automobile (cars) exhausts and sulfur dioxide from the combustion of coal.

Secondary Pollutants: When the primary pollutants mixed in the atmosphere and subsequent chemical reaction produce even more dangerous chemicals. Photochemical smog is an example of this, and is a secondary pollutant.

***Primary Air Pollutants examples are –***

- Carbon compounds, such as CO, CO<sub>2</sub>, CH<sub>4</sub>, and VOCs
- Nitrogen compounds, such as NO, NO<sub>2</sub>, and NH<sub>3</sub>
- Sulfur compounds, such as H<sub>2</sub>S and SO<sub>2</sub>, produced by the oxidation of fuel
- Halogen compounds such as chlorides, fluorides, and bromides, HF and HCl
- Particulate Matter (PM or “aerosols”), either in solid or liquid form suspended in the air, which is usually categorized into these groups based on the aerodynamic diameter of the particles

***Secondary Air Pollutants examples are –***

- NO<sub>2</sub> and HNO<sub>3</sub> formed from NO
- Ozone (O<sub>3</sub>) formed from photochemical reactions of nitrogen oxides and VOCs
- Sulfuric acid droplets formed from SO<sub>2</sub> and nitric acid droplets formed from NO<sub>2</sub>
- Sulfates and nitrates aerosols (e.g., ammonium bisulfate and ammonium nitrate) formed from reactions of sulfuric acid droplets and nitric acid droplets with NH<sub>3</sub>, respectively
- Organic aerosols formed from VOCs in gas-to-particle reactions photochemical smog

***Several illnesses caused by Dirty Air are –***

- Lead- Nerve damage – headache and Fatigue
- Carbon monoxide CO, Cotton dust – Respiratory illness, e.g. bronchitis and asthma
- SO<sub>x</sub>, SO<sub>3</sub>, NO<sub>2</sub> – Cardiovascular illness
- smog - asthma attacks in sensitive individuals, difficulty breathing, chest tightness, sore or itchy throat, cough, and irritated eyes.
- VOCs- skin disease, cancer, Nausea

**(b) What is “sick building syndrome”? How do you prevent it? Write any four corrective steps for making air free from lead as a particulate matter pollutant.**

**Ans: Sick building syndrome**

It is the situation or medical condition where people in a building suffer from symptoms of illness or feel unwell for no apparent reason. These symptoms are linked to time spent in a building but no specific illness or cause can be identified.

***Prevention of sick body syndrome***

- Maintaining the HVAC system for its proper functioning
- Ensuring adequate airflow and its distribution in the building
- Proper storage of chemicals with sufficient ventilation during its use

- Use carpets and furniture made of low VOC contents
- Use of low VOC paints
- Building location to prevent inflow of outdoor air pollution of vehicles

***Measures to reduce the lead from PM pollution***

Reduce the amount of particulate matter produced through smoke

- Stop smoking or smoke outside
- Do not burn the garden refuse
- Limit the use of fire places and stoves
- Switch to cleaner burning appliances
- Use of catalytic converter on the vehicle exhaust
- Take action to reduce wildfires
- Reduce vehicle emissions and increase fuel efficiency
- Keep proper maintenance of vehicles
- Reduce diesel emissions by replacing the older engines
- Walk, or take public transit or pool the cars

**Q.5. Solve any two of the following.**

**(6×2=12)**

**(a)What are the main causes of water pollution? Describe at least four measures to be taken for controlling water pollution.**

Ans: There are many causes of water pollution because water comes from many sources.

**Nutrient pollution** -Some wastewater, fertilizers and sewage contain high levels of nutrients. If they end up in water bodies, they encourage algae and weed growth in the water. This will make the water undrinkable

**Surface water Pollution** - includes natural water found on the earth's surface, like rivers, lakes, lagoons and oceans. Hazardous substances coming into contact with this surface water, dissolving or mixing physically with the water can be called surface water pollution.

**Oxygen depletion-** If oxygen is depleted, aerobic organisms die, and anaerobic organism grow more to produce harmful toxins such as ammonia and sulfides.

**Underground water pollution-** The underground water in the cities and particularly in industrial area is mostly polluted. When humans apply pesticides, fertilizers and chemicals to soil, they are washed deep into the ground by rain water.

Effluent treatment, Septic tanks, radio-active substances, Agricultural activities, chemicals from industries, garbage, oil spillage, marine dumping, underground leakages, etc.

***Four measures to be taken for controlling water pollution.***

1. Sewage treatments: The household water should be treated properly so that they become environmentally safe. Adequate care should be taken to ensure that effective sewage treatment process is in place and that contaminated water does not get mixed with the environment. In order to prevent water pollution, human and animal excreta should be prevented from mixing with its sources. Construction of pit toilet and proper sewage treatments can offer some solution to this problem.

2. Treatment of wastes before discharge: Factories are expected to treat its effluent wastes prior to discharge. Toxic material must be treated chemically and converted into harmless materials. If possible, factories should try to recycle the treated water

3. Prevent river water to get polluted: The flowing water of the river cannot be cleaned easily by natural process. Since, a large number of external substances are discharged into the water, the river water becomes polluted. This may cause diseases to the people using river water. Thus, every effort should be made to prevent the river water to get contaminated. People should not be allowed to throw wastes into the river water.

4. Routine cleaning: Ponds, lakes and wells meant for human use should be routinely cleaned and treated, so that it remains fit for human use. It is an essential step that should not be avoided. A system of regular testing of pond and lake water can be introduced to ensure the safety of the water.

***(b) What are the sources and their corresponding effects of noise pollution on human health? Explain in detail.***

Ans: Sources of Noise Pollution are -

- Household sources

Gadgets like food mixer, grinder, vacuum cleaner, washing machine and dryer, cooler, air conditioners can be very noisy and injurious to health. Others include loud speakers of sound systems and TVs

- Social events

Places of worship, discos and gigs, parties and other social events also create a lot of noise for the people living in that area

- Commercial and industrial activities

Printing presses, manufacturing industries, construction sites, contribute to noise pollutions in large cities.

- Transportation

Transportation includes noise coming from railways, buses, airplanes, helicopters etc.

***Effect of noise pollution on human beings***

Noise is generally harmful and, therefore, has direct physically effects upon humans. Noise causes:

1. Hearing loss.

2. Interferes on sleep

3. Annoyance - Unwanted noise creates communication disruption, frustration and indignities. People in noisy environments easily get tired and are irritable

4. Physiological effects- physiological effects on circulation, respiration, digestion and even on the nervous system. Loud noise causes peptic ulcers, gastro-intestinal problems, allergy, nervousness, etc. Noise causes neurological reactions in children that make them irritable and hyperactive, birth defects, etc.

**(c) Define and explain the purpose of following:**

1. Environmental protection act
2. Wildlife protection act

Ans: ***Environmental protection act***

Environment Protection Act, 1986 is an act of the Parliament of India. In the wake of the Bhopal Tragedy, the Government of India enacted the Environment Protection Act of 1986 under Article 253 of the Constitution. This act is passed in March 1986 and came into force on 19 November 1986. The purpose of the act is to implement the decisions of the United Nations Conference on the Human Environments. They relate to the protection and improvement of the human environment and the prevention of hazards to human beings, other living creatures, plants and property.

***Wildlife protection act***

The Wildlife Protection Act, 1972 is an Act of the Parliament of India enacted for protection of plants and animal species. The Act established schedules of protected plant and animal species; hunting or harvesting these species was largely outlawed. The Act provides for the protection of wild animals, birds and plants; and for matters connected therewith or ancillary or incidental thereto. It has six schedules which give varying degrees of protection. Schedule I and part II of Schedule II provide absolute protection - offences under these are prescribed the highest penalties. Species listed in Schedule III and Schedule IV is also protected, but the penalties are much lower. Schedule V includes the animals which may be hunted. The plants in Schedule VI are prohibited from cultivation and planting.

**Q.6. Solve any two of the following:**

**(6×2=12)**

**(a) Define the term Water Pollution. Explain BOD and Eutrophication in connection with water pollution.**

Ans: ***Water Pollution***

Water pollution can be defined in several ways. Generally water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater), very often by human activities. Water pollution occurs when pollutants (particles, chemicals or substances that make water contaminated) are discharged directly or indirectly into water bodies without enough treatment to get rid of harmful compounds.

***BOD***

It is a measure of how much organic pollution is in water.

It measures the amount of dissolved molecular oxygen in mg in water that is needed by aerobic biological organisms to breakdown of organic pollutants in water at certain temperature in a certain number of days.

Microorganisms such as bacteria are responsible for decomposing organic waste. When organic matter such as dead plants, leaves, grass clippings, manure, sewage or food waste.

The BOD level is determined by comparing the dissolved oxygen levels of a water sample before and after 5 days of incubation in the dark. The difference between the two DO levels represents the amount of oxygen required for the decomposition of any organic material in the sample.

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### ***Eutrophication***

It is the phenomena when the environment becomes enriched with nutrients. Nitrates are the nutrients necessary for algae and phytoplankton growth. Discharge of nitrates to surface water bodies greatly accelerates the natural process of eutrophication. This causes algal blooms ultimately leading to depleting oxygen level and generally poor water quality.

Nitrogen and phosphorous from the run –off of agricultural land and household s and industry including phosphorous based detergents.

Oxygen depletion called Hypoxia has effect as fishing kills, especially the death of fish that needs high level of oxygen. In extreme conditions, hypoxic conditions promote the growth of bacteria that produce deadly toxins to birds and animals.

### **(b) What are the various methods of safe disposal of wastes? Describe the process of municipal sewage treatment with a simple sketch.**

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Ans: Methods of Waste Disposal are -

#### **Compost**

Compost not only benefits the environment and keeps unnecessary refuse out of landfills; it can even provide economic benefits. Instead of throwing out yard trimmings, using them as compost replenishes soil and reduces the need to pay for land reclamation.

#### **Landfills**

It is used for the non-hazardous waste that cannot be reclaimed or recycled. It offer a reasonable and fairly cheap solution. A good landfill has lining to protect from toxins leaking into water supplies and covers for full landfills.

#### **Burning**

An efficient and environmentally sound incinerator burn whatever trash lying around. Scrubbers and filters prevent acidic gases from release and prevent ash from burning into the air. Some incinerators recycle and reuse refuse as fuel to burn non-recyclable materials.

#### **Wastewater treatment**

It is the process of converting wastewater – water that is no longer suitable for use into bilge water that can be discharged back to the environment. Wastewater (liquid waste) from flushing the toilet, bathing, washing sinks and general cleaning goes down the drain and into a pipe, which joins a larger sewer pipe under the road. The larger pipe also joins a major pipe that leads to the treatment center.

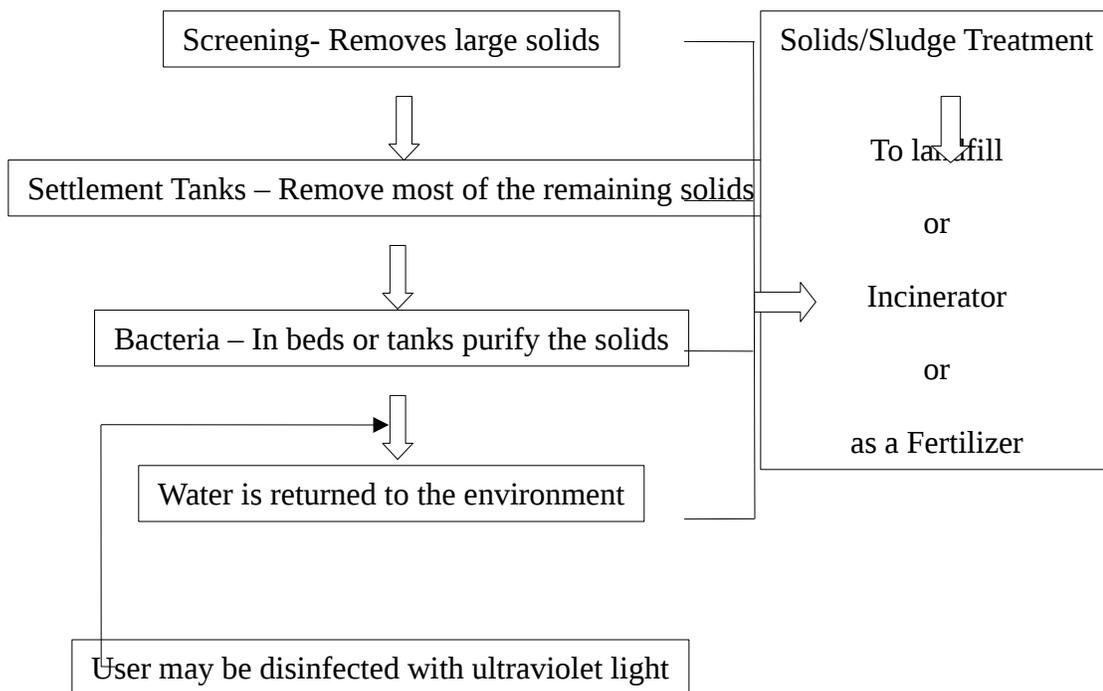
Screening is first stage of the wastewater treatment process. Screening removes large objects like, diapers, nappies, sanitary items, cotton buds, face wipes and even broken bottles, bottle tops, plastics and rags that may block or damage equipment.

Primary Treatment involves the separation of organic solid matter (or human waste) from the wastewater. This is done by putting the wastewater into large settlement tanks for the

solids to sink to the bottom of the tank. The settled solids are called 'sludge'. At the bottom of these circular tanks, large scrapers continuously scrape the floor of the tank and push the sludge towards the center where it is pumped away for further treatment. The rest of the water is then moved to the Secondary treatment.

In secondary treatment the water is put into large rectangular tanks. These are called aeration lanes. Air is pumped into the water to encourage bacteria to breakdown the tiny bits of sludge that escaped the sludge scraping process.

Next the 'almost' treated wastewater is passed through a settlement tank. Here, more sludge is formed at the bottom of the tank from the settling of the bacterial action. Again, the sludge is scrapped and collected for treatment. The water at this stage is almost free from harmful substances and chemicals. The water is allowed to flow over a wall where it is filtered through a bed of sand to remove any additional particles.



**(c) What is rain water harvesting? What is its necessity? Write the major components of a rainwater harvesting system at home.**

**Ans: Rainwater harvesting**

It is the activity of direct collection of rain water. Rain water can be stored for direct use or can be recharged into the ground water aquifer. It is used for collecting and storing rainwater from rooftops, the land surface or rock catchments using simple techniques such as jars and pots as well as more complex techniques such as underground check dams.

**Necessity of Rain Water Harvesting**

The following are the primary cause that leads to necessity of rainwater harvesting.

- Population increase
- Industrialization
- Urbanization
- In places where rain fed/ irrigation based crops are cultivated through ground water
- Decrease in surface area of Lakes, talab, tanks etc.
- Deforestation

*The typical roof top rain water harvesting system comprises of –*

- **Roof catchment** -The roof of the house is used as the catchment for collecting rain water.
- **Gutters** - Gutters are channels fixed to the edges of roof all around to collect & transport the rainwater from the roof. Gutters can be made in semi-circular and rectangular shape with cement pipe, plain galvanized iron sheet, PVC pipes, bamboos, etc.
- **Down pipe & first flushing pipe** - It is the pipe which carries the rainwater from the gutters to the filter & storage tank. Down pipe is joined with the gutters at one end & the other end is connected to the filter unit of the storage tank.
- **Filter Unit** - The filter unit is a container or chamber filled with filter media such as coarse sand, charcoal, coconut fiber, pebbles & gravels to remove the debris & dirt from water that enters the tank. The filter unit is placed over the storage tank or separately.
- **Storage Tank** - It is used to store the water that is collected from the roof through filter. For small scale water storage plastic buckets, jerry cans, clay or cement jars, ceramic jars, drums may be used. For larger quantities of water, the system will require a bigger tank with cylindrical or rectangular or square in shape.