MODULE 4 QB -PP

1) Illustrate the causes, effects and control measures of water pollution.

Ans)

Causes and effects:

Disease causing agents (pathogens):

- It includes bacteria, viruses, protozoa and parasitic worms that enter water from domestic sewage and untreated human and animal wastes.
- These bacteria normally grow in the large intestine of humans where they are responsible for some food digestion and for the production of vitamin K.

Oxygen depleting wastes:

- Anaerobic bacteria begin to break down the wastes.
- Their anaerobic respiration produces chemicals that have a foul odour and an un-pleasant taste that is harmful to human health.

Inorganic plant nutrients:

- These are water soluble nitrates and phosphates that cause excessive growth of algae and other aquatic plants.
- As the organic matter decays, oxygen levels decrease and fish and other aquatic species die.

Water soluble inorganic chemicals:

- These are acids, salts and compounds of toxic metals such as mercury and lead.
- High levels of these chemicals can make the water unfit to drink, harm fish and other aquatic life, reduce crop yields and accelerate corrosion of equipments.

Organic chemicals:

- It includes oil, gasoline, plastics, pesticides, cleaning solvents, detergent and many other chemicals.
- These are harmful to aquatic life and human health.

Sediment of suspended matter:

- This is another class of water pollutants.
- These are insoluble particles of soil and other solids that become suspended in water.
- This occurs when soil is eroded from the land.

Water soluble radioactive isotopes:

- These are yet another source of water pollution.
- These can be concentrated in various tissues and organs as they pass through food chains and food webs.

Hot water:

- These are let out by power plants and industries that use large volumes of water to cool the plant.
- It results in rise in temperature of the local water bodies.

Groundwater pollution:

- While oil spills are highly visible and often get a lot of media attention, a much greater threat to human life comes from our groundwater being polluted which is used for drinking and irrigation.

Control measures:

- Setting up effluent treatment plants and treating waste can reduce the pollution load in the recipient water.

- The treated effluent can be reused for either gardening or cooling purposes wherever possible.
- A few years ago a new technology called the Root Zone Process has been developed by Thermax.
- This system involves running contaminated water through the root zones of specially designed reed beds.
- The reeds, which are essentially wetland plants, have the capacity to absorb oxygen from the
- surrounding air through their stomatal openings.
- The oxygen is pushed through the porous stem of the reeds into the hollow roots where it enters the root zone and creates conditions suitable for the growth of numerous bacteria and fungi.
- These micro-organisms oxidize impurities in the wastewaters, so that the water which finally comes out is clean.

2) Illustrate the causes, effects and control measures of air pollution.

Ans)

Causes:

- Carbon monoxide is a colourless, odorless and toxic gas produced when organic materials such as natural gas, coal or wood are incompletely burnt.
- Vehicular exhausts are the single largest source of carbon monoxide.
- Sulphur oxides are produced when sulphur containing fossil fuels are burnt.
- Nitrogen oxides are found in vehicular exhausts.
- Hydrocarbons are a group of compounds consisting of carbon and hydrogen atoms.
- They either evaporate from fuel supplies or are remnants of fuel that did not burn completely.
- Particulates are small pieces of solid material dispersed into the atmosphere.
- Lead is a major air pollutant that remains largely unmonitored and is emitted by vehicles.
- Cigarette smoking is responsible for the greatest exposure to carbon monoxide.

Effects:

- Carbon monoxide reduces the oxygen carrying capacity of blood.
- Sulphur dioxide irritates respiratory tissues.
- Nitrogen oxides, especially NO, can irritate the lungs, aggravate asthma or chronic bronchitis.
- Exposure to suspended particles over a long period of time contributes to the development of chronic respiratory disease and cancer.
- When some gaseous pollutants enter leaf pores they damage the leaves of crop plants.
- Air pollutants break down exterior paint on cars and houses.

Measures:

- One of the effective means of controlling air pollution is to have proper equipment in place.
- This includes devices for removal of pollutants.
- Providing a greater height to the stacks can help in facilitating the discharge of pollutants as far away from the ground as possible.
- Industries should be located in places so as to minimize the effects of pollution after considering the topography and the wind directions.
- Substitution of raw material that causes more pollution with those that cause less pollution can be done.
- Vehicles should be tested once in every 6 months.

3) Illustrate the causes, effects and control measures of marine pollution.

Ans)

Causes:

- Waste through pipes directly discharging wastes into the sea.

- Very often municipal waste and sewage from residences and hotels in coastal towns are directly discharged into the sea.
- Pesticides and fertilizers from agriculture which are washed off the land by rain, enter water courses and eventually reach the sea.
- Petroleum and oils washed off from the roads normally enter the sewage system but storm water overflows carry these materials into rivers and eventually into the seas
- Ship accidents and accidental spillages at sea can be very damaging to the marine environment.
- Offshore oil exploration and extraction also pollute the seawater to a large extent.

Effects:

- It leads to the development of red tides.
- Many important marine species are killed due to clogging of gills or other structures.
- When liquid oil is spilled on the sea it spreads over the surface of the water to form a thin film called an oil slick.
- Oil slicks damage marine life to a large extent.
- Salt marshes, mangrove swamps are likely to trap oil and the plants, which form the basis for these ecosystems to suffer.
- Fish and shellfish production facilities can also be affected by oil slicks.
- This reduces the market value of seafood.
- Most of the effects are same as water pollution.

Control measures:

- Various stages of treatment such as primary, secondary or advanced can be used depending on the quality of the effluent that is required to be treated.

Primary treatment:

- These treatment plants use physical processes such as screening and sedimentation to remove pollutants that will settle, float or, that are too large to pass through simple screening devices.
- This includes stones, sticks, rags, and all such material that can clog pipes.

Secondary treatment:

- The main objective of secondary treatment is to remove most of the BOD.
- There are three commonly used approaches: trickling filters, activated sludge process and oxidation ponds.
- Secondary treatment can remove at least 85% of the BOD.

4) Illustrate the causes, effects and control measures of thermal pollution.

Ans) Thermal pollution is the act of altering the temperature of a natural water body which may be a river lake or ocean environment.

Causes:

- It occurs when an industry remove water from a source, uses the water for cooling purposes and then returns the heated water to its source.
- Power plants heat water to convert it into steam to drive the turbines that generate electricity.
- The steam is condensed into water after it leaves the turbines.
- This condensation is done by taking water from a water body to absorb heat.
- This heated water is discharged back into the water body.
- This condition chiefly arises from the waste heat generated by an industrial process such as certain power generation plants.

Effects:

- The warmer temperature decreases the solubility of Oxygen and increases the metabolism of fish.
- This change is psychological balance of the river.
- Sudden changes in temperature results in the death of the fishes living in warmer waters.
- Due to decrease in dissolved oxygen levels there is suffocation of plants and animal species which creates an aerobic conditions.
- It causes harm to the aquatic organisms.
- The heated water is used for irrigation purposes to extend the plant growing seasons.
- We find decrease in biodiversity.

Control measures:

- Thermal Pollution can be controlled by passing the heated water through a cooling pond or cooling tower after it leaves the condenser.
- The heat is dissipated into the air and water can then be discharged into the river or pumped back to the plant for reuse as cooling water.
- One method is to construct a large Shallow pond.
- Hot water is pumped into one end of the pond and cooler water is removed from the other end.
- The heat gets it is separated from the pond into the atmosphere.
- A second method is to use a cooling tower.
- Here warm water scum coming from the condenser is sprayed downward over vertical sheets baffles where the water flows in thin films.
- Cool air enters the Tower through the water inlet that encircles the base of the tower and rises upward causing evaporative cooling.

5) Illustrate the causes, effects and control measures of noise pollution.

Ans) Noise is undesirable and unwanted sound.

Causes:

- There are several sources of noise pollution that contribute to both indoor and outdoor noise pollution.
- Noise emanating from factories, vehicle supplying of loudspeakers during various festivals can contribute to our outdoor noise pollution.
- Playing the music systems and other electronic gadgets can contribute to indoor noise pollution.

Effects:

Physical health:

- Physical damage to the ear and the temporary or permanent hearing loss.
- Below a sound level of 80 dBA hearing loss does not occur at all.
- However temporary effects are noticed at sound levels between 80 and 130 dBA. A sound level of 150 dBA or more can physically rupture the human ear drum.
- The degree of hearing loss depends on the duration as well as the intensity of the noise.
- In addition to hearing loss of successive sound levels can cause harmful effects on the circulatory system by raising blood pressure and altering Pulse rates.

Mental health:

- Noise can also cause emotional or psychological effects such as irritability.
- Noise can lead to lack of concentration and mental fatigue.

Control measures:

- There are four fundamental ways in which noise can be controlled.

- Reduce noise at the source
- Block the path of noise
- Increase the path length
- Protect the recipient.

- In general, the pest control methods to reduce noise levels at the source.
- Source reduction can be done by effectively muffling vehicles and machinery to reduce noise.
- One of the best method of noise source reduction is regular and maintenance of operating machinery.
- Noise levels at construction sites can be controlled using proper construction planning and scheduling techniques.

6) Illustrate the causes, effects and control measures of soil pollution.

Ans) Soil erosion can be defined as the movement of surface l and top soil from one place to another.

Causes:

- Loss of the topsoil makes a soil less productive and reduces its water holding capacity.
- The top soil, which is washed away, also contributes to water pollution, increases turbidity of the water and also leads to loss of aquatic life.

Effects:

Industrial activity:-

- Industrial activity has been the biggest contributor to the problem.
- Most industries are dependent on extracting minerals from the Earth.
- Whether it is iron or coal the byproducts are contaminated and they are not disposed of in a manner that can be considered safe and makes it unsuitable for use.

Agricultural activities:-

- Chemical sterilization has gone up tremendously since the technology provided us with the modern pesticides and fertilizers.
- They contain chemicals that are not produced in nature and cannot be broken down by it.
- As a result, they seep into the ground after mixing with water and slowly reduce the fertility of the soil.
- Plants absorb many of these pesticides and when they decompose, pollutes the soil since they become a part of the land.

Waste disposal:-

- While Industrial waste is sure to cause contamination, there is another way in which we are adding to the pollution.
- Every human produces a certain amount of waste products by where defecation.
- While much of it moves into the CBR the system there is also a large amount that is dumped directly into landfills.
- Even the severe system ends at the landfill, where the biological waste pollutes the soil and water.
- This is because our bodies are full of toxins and chemicals which are now seeping into the land and causing pollution of soil.

Accidental oil spills:-

- Oil leaks can happen during storage and transport of chemicals.
- This can be seen at most of the fuel stations.
- The Chemicals present in the fuel deteriorate the quantity quality of the soil and makes them unstable for cultivation.
- These chemicals can enter into the ground water through soil and make the water unsafe for consumption.

Acid rain:-

- Acid rain is caused to the pollutants present in the air mixes up with the rain and returns on the ground.

Control measures:

- There are several techniques that can protect soil from erosion.
- The most commonly employed methods include the two types of treatment that are generally used.
- Area treatment which involves treating the land.
- Drainage line treatment which involves treating the natural water courses.
- Continuous contour trenches can be used to enhance infiltration of water reduce the runoff and check soil erosion.
- It involves Shallow trenches dug across the Slope of a line and along the contour lines basically for the purpose of soil and water conservation.
- They are most effective on gentle slopes and in areas of low to medium rain rainfall.
- Live check dams which are barriers created by planting grass, shrubs and trees across the gullies can be used for this purpose.
- A bund constructed out of stones across the stream can also be used for conserving soil and water.

7) What is Solid Waste? Explain the challenges involved in Urban and Industrial solid waste Management.

Ans) Waste, which is non effective and comes from city town or village as domestic and biomedical waste, is termed as solid waste.

- Modern methods of disposal such as incineration and the development of sanitary landfills, etc. are now attempting to solve these problems.
- Lack of space for dumping solid waste has become a serious problem in several cities and towns all over the world.
- Dumping and burning wastes is not an acceptable practice today from either an environmental or a health perspective.

Characteristics of municipal solid waste:

- Municipal solid waste contains a wide variety of materials.
- It contains food waste such as vegetable and meat material, left over food, egg shells, etc. which is classified as wet garbage.
- It contains wastes such as paper, plastic, plastic cans, newspaper, glass bottles, cardboard boxes, aluminum foil, metal items, wood pieces, etc. which is classified as dry garbage.

Control measures of urban and industrial wastes:

The strategy includes three main components:

1. Source reduction

2. Recycling

3. Disposal

Source reduction:

- This is one of the fundamental ways to reduce waste.
- This can be done by using less material when making a product, reuse of products on site, designing products or packaging to reduce their quantity.

Recycling:

- It is reusing some components of the waste that may have some economic value.
- Recycling has readily visible benefits such as conservation of resources reduction in energy used during manufacture and reducing pollution levels.

- Some materials such as aluminum and steel can be recycled many times.
- Metal, paper, glass and plastics are recyclable.

Disposal:

- The disposal of solid waste is done most commonly through a sanitary landfill or through incineration.

8) Enumerate the role of an individual in prevention of pollution.

Ans)

- Develop respect for all forms of life.
- Plant trees wherever you can and more importantly take care of them. They reduce air pollution.
- Reduce the use of wood and paper products wherever possible.
- Do not buy furniture door window frames made from tropical hardwoods such as teak and mahogany. These are forest based.
- Reduce the use of fossil fuels by either walking up a short distance, couple sharing a bike or using public transport. This reduces air pollution.
- Shut off the lights and fans when not needed.
- Don't use aerosol spray products and commercial room air fresheners. They damage the Ozone Layer.
- Use rechargeable batteries.
- Try to avoid asking for plastic carry bags when you buy groceries or vegetables or any other items use your own cloth bag instead.
- Use sponges, washable cloth napkins, dish towels and handkerchiefs instead of paper ones.
- Recycle all news paper, glass, alumnium and other items accepted for recycling in your area.
- Set up a compost bin in your garden or terrace and use it to produce a manual for your plants to reduce use of fertilizers
- Do not litter the roads and surroundings.
- Take care to put into practice what you preach "ENVIRONMENT PROTECTION BEGINS WITH YOU".

9) Write a short note on
i) Donora Air Pollution Disaster

Ans)

- Donora (Pennsylvania), USA) is a milltown steel mill, Zinc smelter, Sulphuric acid plant.
- Donora is in valley on Monongahela river surrounded by steep hills on each side of the river.
- 25-31 october 1948 fog due to accumulation of cold due to inversion.
- Effect of inversion- top fog layer reflected away the solar radiation during the day time.
- Insufficient heat to break the inversion.
- Pollutants of the mills got trapped in lower layer and remained for 4 days.
- 6000 of 14000 people living in Donora fell ill, 20 died.

ii) Bhopal Gas Tragedy
Ans)

- 2-3rd December 1984 - Union Carbide company - Bhopal major disaster. UCC manufactured carbaryl pesticide using Methyl Isocyanite (MIC).
- Cause of accident - Accidental entry of water in processing tank- overheating of mixture - failure of cooling system - safety devices were not in working condition - EXPLOSION.
- 40 tons of Methyl Isocyanite leaked into the atmosphere.
- Lungs, eyes and skin damages in 40 km^2 area. 5100 people died. 250000 people got exposed to methyl isocyanate. 65000 people suffered from severe diseases. 1000 people become blind .

- $570 million to cleanup and settlement of damages all because of lack of safety measures in proper working condition.

iii) Arsenic Pollution in ground water

Ans)

- West Bengal and Bangladesh are serial infected by toxic heavy metal arsenic (study report of 1978 - West Bengal, 1993 - Bangladesh).
- Bangladesh residents have been taking low dose of arsenic for 10 to 14 years through contaminated water.
- Result - white/black spots called Melanosis affecting the skin on palms and soles. Eventually rotting in pulses. Long exposure results in cancer. Affected people are socially boycotted.
- 24 Parganas, Hooghly, Murshidabad district are the most arsenic risk zones.
- Causes - excess use of a lead arsenate, copper arsenate as pesticides in summer paddy and jute crops.
- Short term remedy - Contaminated tube wells in the state are being painted **red** whereas safe water tube wells are painted **green** for the use of people.

iv) Chernobyl Nuclear Disaster

Ans)

- Worst nuclear disaster 26 April 1986 in a Chernobyl, Ukraine.
- The power plant designed to produce 1000 MW electrical energy was working continuously for two years.
- Was shutdown on 25th April for normal repair work.
- Due to the faulty shutting down process - severe explosion
- Severety - 1000 tonne steel - Concrete lid blew off-fire started temperature goes to 2000°C - fuel and radioactive debris spread out on volcanic cloud.
- Neighbouring countries like Sweden, Denmark and Norway were also affected.
- Damage - 506000 people were affected. Risk of severe diseases like a cancer and leukaemia. People also suffer from anemia, loss of hair, damage skin. 2000 people died. Flora and fauna destroyed. Agriculture producers were damaged for years.
- Future precautions - nuclear energy is a cheap non polluting sources of energy but lack of proper care and safety measures can create huge disasters.