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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

# Subject Name: Environmental Impact Assessment

# Prepared by (Faculty (s) Name):S.SANDEEPKUMAR

**Year and Sem, Department:III/ II**

**Unit-I: (**EIA, Types of EIA)

**1.Inorganic salts**: Inorganic salts, which are present in most industrial wastes as well as in nature itself, cause water to be "hard" and make a stream undesirable for industrial, municipal and agricultural usage. Salt laden waters deposit scale on municipal water- distribution pipelines, increasing resistance to flow and lowering the overall capacity of the lines. Another disadvantage is that, under proper environmental conditions, inorganic salts especially nitrogen and phosphorous induce the growth of microscopic plant life (algae) in surface waters

**2.Acids and /or Alkalis**: Acids and Alkalis discharged by chemical and other industrial plants make a stream undesirable not only recreational uses such as swimming and boating, but also for propagation of fish and other aquatic life. High concentrations of sulfuric acid, sufficient to lower the pH below 7.0 when free chlorine is present, have been reported to cause eye irritation to swimmers. A low ph may cause corrosion in air conditioning equipment and a ph greater than enhances laundering

**3.Organic matter**: Organic Matter exhausts the oxygen resources of rivers and creates unpleasant tastes, odours and general septic conditions. It is generally conceded that the critical range for fish survival is 3to 4 mg/l of D.O certain organic chemicals such as phenols, affect the taste of domestic water supplies.

**4.Suspended solids**: Suspended solids settle to the bottom or wash up on the banks and decompose, cause sing odours and depleting oxygen in the river water. Fish often die because of a sudden lowering of the oxygen content of a stream. Visible sludge creates unsightly conditions and destroys the use of a river for recreational purposes. These solids also increase the turbidity of the watercourse.

**5.Floating Solids and liquids**: These includes oils, greases, and other materials which float on the surface, they not only make the river unsightly but also obstruct passage of light through the water, retarding the growth of vital plant food.

Some specific objections to oil in streams are that it

* + 1. Interferes with natural reaeration
    2. is toxic to certain species of fish and aquatic life
    3. Causes trouble in conventional water treatment processes by imparting tastes and odours to water and coating sand filters with a tenacious film.

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

**5.Heated Water**: An increase in water temperature, brought about by discharging wastes such as condenser waters in to streams, has various adverse effects. Streams waters which vary in temperature from one hour to the next are difficult to process efficiently in Municipal and industrial water treatment plants, and heated stream water are of decreased value for industrial cooling, indeed are industry may so increase the temperature of a stream that a neighboring industry downstream cannot use the water since there may be less D.O in warm water than in cold, aquatic life suffers and less D.O is available for natural biological degradation of any organic pollution discharged into these warm surface waters. Also bacterial action increases in higher temperatures, resulting in accelerated repletion of the streams oxygen resources.

**6.Colour** : Colour is contributed by textile and paper mills, tanneries, slaughterhouses and other industries, is an indicator of pollution. Colour interferes with the transmission of sunlight into the stream and therefore lessens photosynthetic action. Furthermore, municipal and industrial water plants have great difficulty, and scant success in removing colour from raw water.

**7.Toxic chemicals**: Both inorganic and organic chemicals, even in extremely low concentrations, may be poisonous to fresh water fish and other smaller aquatic microorganisms. Many of these compounds are not removed by municipal treatment plants and have a cumulative effect on biological systems.

**8.Microorganisms** : A few industries, such as tanneries and slaughterhouses, sometimes discharge wastes containing bacteria. These bacteria are of two significant types:

1. bacteria which assist in the degradation of the organic matter as the waste moves down stream. This process may aid in "seeding" a stream and in accelerating the occurrence of oxygen sag in water.
2. bacteria which are pathogenic, not only to other bacteria but also to humans.

**9.Radio Active Materials**: Cumulative damaging effects on living cells.Foam Producing Matter: Foam producing matter such as is discharged by textile mills, paper and pulp mills and chemical plants, gives an undesirable appearance to the receiving streams. It is an indicator of contamination and is often more objectionable in a stream than lack of oxygen.

**10.Effects On Sewage Treatment Plants**:

The Pollution Characteristics of Wastes having readily definable effects on Sewers and Treatment Plants can be Classified as follows:

**11.Bio Chemical Oxygen Demand**: It is usually exerted by Dissolved and Colloidal Organic Matter and imposes a load on the Biological units of the Treatment Plant. Oxygen must be provided so that Bacteria



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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

can grow and oxidise the organic matter. An Added B.O.D load, caused by an increase in Organic Waste, requires more Bacterial Activity, more oxygen, and greater Biological Unit capacity for its Treatment, which (makes) increases the capital cost and operating cost.

**12.Suspended Solids**: Suspended Solids are found in considerable quantity in many Industrial Wastes, such as Paper& Pulp Effluents. Solids removed by settling and separated from the flowing Sewage are called Sludge, which may then undergo an Anaerobic Decomposition known as Digestion and pumped to drying beds or vacuum filters for extraction of additional water. Suspended Solids in Industrial Waste may settle more rapidly or slowly than Sewage Suspende Matter. If Industrial Solids settle faster than those of Municipal Sewage, Sludge should be removed at shorter intervals to prevent excessive build up: a Slow Settling one will require a longer detention period and larger basins and increases the likelihood of sludge Decomposition with accompanying nuisances, during Sewage-Flow Periods.

Any Increased demands on the System usually require larger Sludge handling devices and may ultimately necessitates an increase in the Plants capacity, with resulting Higher Capital and Operating Expenses.

13.**Floating and Coloured Materials**: Floating Materials and Coloured Matter such as Oil, Grease and Dyes From Textile-Finishing Mills, are disagreeable and visible nuisances. A Modern Treatment Plant will remove normal Grease loads in Primary Settling Tanks, but abnormally high loads of predominantly emulsified Greases from Laundries, Slaughterhouses etc Passing through the Primary Units into the Biological Units will clog Flow Distributing Devices and Air Nozzles.

Volume: A Sewage Plant can handle any Volume of Flow if its units are sufficiently large. The Hydraulic Capacity of all Units must be analysed, Sewer Lines must be examined for Carrying Capacity, and all other Treatment Units are to be Designed for excessive loading

14.**Harmful Constituents**:Toxic Metals, Acids, or Alkalis, Pieces of Fat, Flammable Substances, Detergents and Phenols etc. cause nuisance in Treatment Pla

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

**Short Questions**

1. Define Industrial wastewater
2. Define wastewater treatment
3. Write a short note on effluent and Influent of a Industry
4. What are different sources of pollution?
5. Write the physical properties of Industrial Waste Water.
6. Write the Chemical properties of Industrial Waste Water
7. Write the Organic properties of Industrial Waste Water
8. Write the Biological properties of Industrial Waste Water.
9. Write a short note on Domestic waste water
10. Write a short note on Industrial waste water

**LONG Questions**

1. Explain in detail about the different sources of Industrial waste waters
2. Discuss in detail about the Physical properties of Industrial wastewater
3. Discuss in detail about the Chemical properties of Industrial wastewater
4. Discuss in detail about the Organic properties of Industrial wastewater
5. Discuss in detail about the Biological properties of Industrial wastewater
6. Explain the difference between Industrial and Municipal wastewaters
7. Explain in detail the effects of Industrial effluents on sewers.
8. Explain in detail the effects of Industrial effluents on Natural water bodies.
9. Give the detailed information with respect to Waste water sources and its characteristics.
10. Give the detailed information with respect to manufacturing process
11. Describe the following characteristics of waste water in detail of the following 1. pH, 2. Solids, 3. BOD, 4. COD, 5. Heavy Metals
12. State the various types of benefits of water pollution control by doing treatment of industrial waste.
13. State the importance of Industrial waste treatment.
14. What are the factors affecting self purification of polluted streams? Give suggestions to control?
15. Explain briefly the methods of removal of suspended solids from industrial waste water

Multiple Choice Questions **/ Choose the Best: (Minimum 10 to 15 with Answers)**

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|  |  |
| --- | --- |
| 1. | The minimum recommended diameter of sewers, is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 5 cm | | [**B.**](javascript:%20void%200;) | 10 cm | | [**C.**](javascript:%20void%200;) | 15 cm | | [**D.**](javascript:%20void%200;) | 20 cm. |   **Answer:** Option **C** |

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

|  |  |
| --- | --- |
| 2. | Aerobic bacterias |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | flourish in the presence of free oxygen | | [**B.**](javascript:%20void%200;) | consume organic matter as their food | | [**C.**](javascript:%20void%200;) | oxidise organic matter in sewage | | [**D.**](javascript:%20void%200;) | All the above. |   **Answer:** Option **D** |
| 3. | The rate of accumulation of sludge in septic tanks is recommended as |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 30 litres/person/year | | [**B.**](javascript:%20void%200;) | 25 litres/person/year | | [**C.**](javascript:%20void%200;) | 30 litres/person/month | | [**D.**](javascript:%20void%200;) | 25 litres/person/month. |   **Answer:** Option **A**   |  |  | | --- | --- | | 4. | If 2% solution of a sewage sample is incubated for 5 days at 20°C and depletion of oxygen was found to be 5 ppm, B.O.D. of the sewage is | | |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 200 ppm | | [**B.**](javascript:%20void%200;) | 225 ppm | | [**C.**](javascript:%20void%200;) | 250 ppm | | [**D.**](javascript:%20void%200;) | None of these. |   **Answer:** Option **C** | | 5. | If *D* is the diameter of upper circular portion, the overall depth of a standard egg shaped section, is | | |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | *D* | | [**B.**](javascript:%20void%200;) | 1.25 *D* | | [**C.**](javascript:%20void%200;) | 1.5 *D* | | [**D.**](javascript:%20void%200;) | 1.75 *D* | | [**E.**](javascript:%20void%200;) | 2 *D*. |   **Answer:** Option **C** | | 6. | If the diameter of sewer is 225 mm, the gradient required for generating self cleansing velocity, is | | |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 1 in 60 | | [**B.**](javascript:%20void%200;) | 1 in 100 | | [**C.**](javascript:%20void%200;) | 1 in 120 | | [**D.**](javascript:%20void%200;) | none of these. |   **Answer:** Option **C** | | 7. | Pick up the correct statement from the following : | | |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | pH value indicates acidity and alkalinity of sewage | | [**B.**](javascript:%20void%200;) | In acidic sewage, the pH value is less than 7 | | [**C.**](javascript:%20void%200;) | In alkaline sewage, the pH value is more than 7 | | [**D.**](javascript:%20void%200;) | Fresh sewage is generally alkaline | | [**E.**](javascript:%20void%200;) | All the above. |   **Answer:** Option **E**  **:** | |



**SAMSKRUTI COLLEGE OF ENGINEERING & TECHNOLOGY**

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

|  |  |
| --- | --- |
| 8. | The non-clog pump which permits solid matter to pass out with the liquid sewage, is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | centrifugal pump | | [**B.**](javascript:%20void%200;) | reciprocating pump | | [**C.**](javascript:%20void%200;) | pneumatic ejector | | [**D.**](javascript:%20void%200;) | none of these. |   **Answer:** Option **A** |
| 9. | Assertion (A) : Discharging the effluents from the oxidation ponds just up stream of lakes or reservoirs is undesirable.  Reason (R) : The discharged algae get settled in the reservoirs and cause anaerobic decomposition and other water qualities. |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | Both A and R are true and R is the correct explanation of A | | [**B.**](javascript:%20void%200;) | Both A and R are true but R is not a correct explanation of A | | [**C.**](javascript:%20void%200;) | A is true but R is false | | [**D.**](javascript:%20void%200;) | A is false but R is true. |   **Answer:** Option **A** |
| 10. | The width of a rectangular sewer is twice its depth while discharging 1.5 m/sec. The width of the sewer is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 0.68 m | | [**B.**](javascript:%20void%200;) | 0.88 m | | [**C.**](javascript:%20void%200;) | 1.36 m | | [**D.**](javascript:%20void%200;) | 1.76 m. |   **Answer:** Option **C** |

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

**Unit-II: (DESIGN OF PRELIMINARY AND PRIMARY TREATMENT OPERATIONS)**

1. Screening:

It is a process through which large materials like wooden pieces, metal pieces, paper, rags, pebbles, fibres etc. are removed. The rotary and circulation filters are used now a days in modern industries to remove large materials.

These both methods are effective and help in reducing suspended solids and BOD of the industrial effluent. The micro strainer is also used to remove five suspended particles in some treatment processes. To remove, colloidal matter, ultra filters are also used although they are costly.

1. Neutralization:

When pH of the industrial waste is too high or too low then it should be neutralized by acid or alkali and only neutral effluent should be discharged into the nullah or public sewer.

1. Lime stone treatment:

For acidic effluent, lime stone should be used as it will form calcium compounds [CaCl2, CaBr2, Ca(NO3) or CaSO4] depending upon the presence and amount of acid.

b) Caustic soda treatment:

Although it is costly method but it is also utilized for neutralizing the acid. Here caustic soda is added in the effluent to make the pH neutral. Only small amount of caustic soda is needed for this work.

For neutralization of alkaline effluent the following techniques are used.

1.Carbon dioxide treatment:

If factory is producing carbon dioxide then only this method should be utilized for neutralizing the pH otherwise it would be costlier affair. Here CO2 is passed in alkaline effluent to make its pH almost 7.

2.Sulphuric acid treatment:

This is a common method of neutralizing alkaline effluent. Here sulphuric acid is added in the effluent till pH becomes almost 7.

3.Utilizing waste boiler – Flue gas:

The stack gas which contains about 12% carbon dioxide is utilized to react alkaline effluent to make it neutral.

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

4.Equalization:

When effluent is discharged from factory then its pH along with the quantity of suspended solids, dissolved solids etc. vary from the beginning to the last depending upon the dilution, velocity and the amount of reactants etc.

Hence as the character of the effluent do not remain the same throughout hence proper treatment is not possible. So equalization tank is necessary where effluent is keep for 10 hrs or more for the stabilization of pH and BOD. During equalization suspended solids settle down & new acid of alkaline treatment becomes economical.

5.Sedimentation:

This treatment is only employed for the settlement of suspended particles by gravity. This technique is only used in the beginning to settle down the solid particles in a high suspension effluent.

6. Coagulation:

Experimental results have shown that a slit particle of size 0.05 mm requires about 11 hours to settle down through a depth of 3 m and clay particles of size 0.002 mm require about 4 days‘ time to settle the same height of 3 m of at normal temperature of about 25°C. As we know that water contains colloidal impurities which are even finer than 0.0001 mm and which also carry electrical charge on them.

Due to electrical charges they remain in motion and never settle down. Therefore when water is turbid due to presence of such fine size and colloidal impurities, plain sedimentation is of no use. It is also not possible to provide detention periods of longer than 4 — 9 hours. The coagulation becomes necessary when the turbidity is more than 40 — 55 ppm.

For dealing waters with such impurities a chemical process was evolved. This process removes all these impurities within reasonable period of 3 — 4 hours. This chemical process is called coagulation and the chemical used in the process is called coagulant.

7.Principle of Coagulation:

The principle of coagulation can be explained from the following two aspects:

1.Floe formation, and

2.Electrical charges.

8.Floe formation:

When coagulant is added to the water and thoroughly mixed, it produces a thick insoluble gelatinous precipitate. This precipitate is called floe. The floe has the property of arresting the suspended impurities in water during its downward settlement towards the bottom of the tank.

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

The gelatinous precipitate has therefore the property of removing fine and colloidal particles quickly. The coagulation process also removes colour and test in general.

9.Electrical charges:

The flock ions are electrically charged (positive) while all the colloidal particles have negative charge. Therefore floes attract the colloidal particles and cause their removal easily by settlement at bottom of the vessel in which it is used.

**Short Questions**

1. List the different stages of waste water treatment
2. Explain the different stages of wastewater treatment plant.
3. Write a short on Volume Reduction of Industrial waste water
4. Write a short note on Pre-treatment of waste water treatment
5. Write a short on Neutralization of Industrial waste water
6. Write a short on Equalization of Industrial waste water
7. Write a short on Proportioning of Industrial waste water
8. Give a short note on Oil Separation.
9. What are the different Chemical treatment methods of Industrial wastewater?
10. Give the different Methods for treating Organic matter

**LONG Questions**

1. Explain the necessity of equalization and proportioning for industrial waste water treatment..
2. Enumerate the basic theories of Industrial wastewater management and Explain the strength reduction
3. What is volume reduction? List and explain any four methods of the volume reduction in industrial wastewater?
4. What is the necessity of Neutralization in Industrial waste treatment? Explain the working of the same with suitable examples.
5. Explain the process of Oil Separation by floatation method.
6. Explain about the flow equalization process.? Explain the Neutralization process.
7. Discuss the phenomenon of discrete sitting of particles in Primary treatment process.
8. Explain the various methods of volume and strength reduction adopted for the industrial waste.
9. Brief the various aerobic and anaerobic treatment methods
10. Draw the sketches of following and explain the mechanism of the treatment.1) Stabilization ponds, 2) Oxidation ditch

**SAMSKRUTI COLLEGE OF ENGINEERING & TECHNOLOGY**



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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

Multiple Choice Questions **/ Choose the Best: (Minimum 10 to 15 with Answers)**

|  |  |
| --- | --- |
| 1. | The most dangerous pollutant in vehicular emissions is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | CO | | [**B.**](javascript:%20void%200;) | SO2 | | [**C.**](javascript:%20void%200;) | CO2 | | [**D.**](javascript:%20void%200;) | O3. |   **Answer:** Option **A** |
| 2. | If the depletion of oxygen is found to be 2.5 mg/litre after incubating 2.5 ml of sewage diluted to 250 ml for 5 days at 20°C, B.O.D. of the sewage is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 50 mg/l | | [**B.**](javascript:%20void%200;) | 100 mg/l | | [**C.**](javascript:%20void%200;) | 150 mg/l | | [**D.**](javascript:%20void%200;) | 200 mg/l | | [**E.**](javascript:%20void%200;) | 250 mg/l. |   **Answer:** Option **E** |
| 3. | The clarigesters are |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | circular septic tanks | | [**B.**](javascript:%20void%200;) | rectangular septic tanks | | [**C.**](javascript:%20void%200;) | circular Imhoff double tanks with bottom hoppers | | [**D.**](javascript:%20void%200;) | circular Imhoff double storey tanks without bottom hoppers. |   **Answer:** Option **D** |
| 4. | Rate of flow of sewage is generally assumed |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | more than the rate of water supply | | [**B.**](javascript:%20void%200;) | equal to the rate of water supply | | [**C.**](javascript:%20void%200;) | less than the rate of water supply | | [**D.**](javascript:%20void%200;) | at 150 litres per capita. |   **Answer:** Option **C** |
| 5. | Maximum permissible velocity 1.5 m/sec, is adopted in drains |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | with beds of rocks and gravels | | [**B.**](javascript:%20void%200;) | lined with stones | | [**C.**](javascript:%20void%200;) | both (a) and (b) | | [**D.**](javascript:%20void%200;) | neither (a) nor (b). |   **Answer:** Option **C** |

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

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| 6. | The digested sludge from septic tanks, is removed after a maximum period of |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 3 years | | [**B.**](javascript:%20void%200;) | 3.5 years | | [**C.**](javascript:%20void%200;) | 4 years | | [**D.**](javascript:%20void%200;) | 5 years. |   **Answer:** Option **A** |
| 7. | For providing an Indian type W.C., the R.C.C. slabs in the toilet portion |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | should be sunk by 20 cm | | [**B.**](javascript:%20void%200;) | should be kept 20 cm above the adjacent portion | | [**C.**](javascript:%20void%200;) | should be sunk by 50 cm | | [**D.**](javascript:%20void%200;) | need not be sunk. |   **Answer:** Option **C** |
| 8. | The gradient of sewers depends upon |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | velocity of flow | | [**B.**](javascript:%20void%200;) | diameter of the sewer | | [**C.**](javascript:%20void%200;) | discharge | | [**D.**](javascript:%20void%200;) | all the above. |   **Answer:** Option **D** |
| 9. | The settling velocity of the particles larger than 0.06 mm in a settling tank of depth 2.4 is 0.33 m per sec. The detention period recommended for the tank, is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 30 minutes | | [**B.**](javascript:%20void%200;) | 1 hour | | [**C.**](javascript:%20void%200;) | 1 hour and 30 minutes | | [**D.**](javascript:%20void%200;) | 2 hours | | [**E.**](javascript:%20void%200;) | 3 hours. |   **Answer:** Option **D** |
| 10. | The drop man holes are generally provided in sewers for |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | industrial areas | | [**B.**](javascript:%20void%200;) | large town ships | | [**C.**](javascript:%20void%200;) | hilly town ships | | [**D.**](javascript:%20void%200;) | cities in plains. |   **Answer:** Option **C** |

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**Unit-III: (Biological Treatment Processes**)

1. **Nitrification**

Nitrification is the biological process by which ammonia is first converted to nitrite and then to nitrate. Nitrification can be achieved in any aerobic-biological process at low organic loadings and where suitable environmental conditions are provided. Nitrifying bacteria are slower growing than the heterotrophic bacteria, which comprises the greater proportion of the biomass in both fixed film and suspended growth systems. The key requirement for nitrification to occur, therefore, is that the process should be so controlled that the net rate of accumulation of biomass, and hence, the net rate of withdrawal of biomass from the system, is less than the growth rate of the nitrifying bacteria (Barnes and Bliss, 1983). The processes currently used in the treatment of wastewater for nitrification are presented as follows.

**2.Trickling filters**

The extent of nitrification in trickling filters depended on a variety of factors; including temperature, dissolved oxygen, pH, presence of inhibitors, filter depth and media type, loading rate, and wastewater BOD (Parker and Richards, 1986). Low-rate trickling filters allowed the development of a high-nitrifying population.

3. **Rotating biological contractor**

RBC biofilm has an initial adsorption of microorganisms to the disk surface to form 1-4 mm thick biofilm that is responsible for BOD removal in rotating biological contractors. The rotating disks provided a large surface area for the attached biomass.

4. **Fixed bed reactor**

conducted a pilot scale research by using a fixed bed reactor for nitrification of the effluent from an extended aeration sewage treatment plant. The non-settled sewage influent of COD of 373 mg/L, NH4-N of 45 mg/L, SS of 297 mg/L and pH 8.1 were used in this study. With an HRT of 4 to 6 hours and recycle ratio of 3.5, removal efficiencies of 70% of COD, 67% of SS and 95% of NH4-N were obtained.

5. **Conventional activated sludge processes at low loadings**

Weismann (1994) studied the nitrification in a conventional activated sludge system and found that it was relatively low for carbon removal and nitrification of sewage because carbon removal and nitrification occurred in the same reactor with an activated sludge system. This resulted in a population mixture of mainly heterotrophs and few autotrophs.

6. **Two-stage activated sludge systems with separate carbonaceous oxidation and nitrification system**

The nitrification process requires a slow-growing nitrifying bacteria with sludge that has been aged for a long time and high dissolved oxygen concentration. In addition, they were susceptible to inhibition by a wide range of compounds at concentrations so low as not to affect the heterotrophic bacteria

7. **Denitrification**

Denitrification is the biological process by which nitrate is converted to nitrogen and other gaseous end products. The requirements for the denitrification process are: a) nitrogen present in the form of nitrates;

b) an organic carbon source, and c) an anaerobic environment

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

**8.Continuous flow stirred reactor (CFSR)** nitrate feed rate and cell residence time on complete mixed continuous-flow stirred-reactor (CFSR) operated at the steady state. They concluded that denitrification processes could be operated at near maximum unit removal rates and still obtained acceptable nitrogen conversion (less than 2 mg of NO3-N/L in the denitrified effluent) also indicated that cell retention time in the reactor would depend on the organic carbon requirement and nitrate removal efficiency. An SRT of at least 4 days was recommended for design at 20 C and 30 C. An SRT of at least 8 days was recommended for design at 10 C.

9.**Activated sludge systems**

Lesouef, et al. (1992), demonstrated a test on a two zone in activated sludge systems and showed to be capable of removing 75% of the total N from about 30 mg TN/L in the feed to

< 10 mg TN/L in the effluent. The multiple anoxic zones with a step feed process had recently been modeled and appeared to be the most cost effective denitrification option because it made the fullest use of the carbon that was present in the feed as the carbon source for step feed denitrification.

10.**Fixed film reactor**

studied denitrification results from a fixed-film anoxic sand reactor used for the treatment of drinking water. The anoxic reactor was operated downflow at 20 m3/h with a nitrate loading of 0.4-1.5 kg NO3- N/m3/d. They found that nitrate removal rates using sugar or glucose syrup as organic carbon sources were usually greater than 95%.

**11.Carbon and Nitrogen Removal Process**

Currently, the processes used for carbon and nitrogen removal can be divided into two major groups: separated stage and single stage processes. For multiple stages of carbon and nitrogen removal, there is a disadvantage for denitrification which occurs either in the addition of external carbon or the recycle part of the effluent of nitrifying bacteria. Carbon and nitrogen removal occurring in a single unit is a possibility to overcome these disadvantages

12. **Phosphorous in wastewater**

Municipal wastewaters may contain from 5 to 20 mg/l of total phosphorous, of which 1-5 mg/l is organic and the rest in inorganic.

13. **Orthophosphates**: available for biological metabolism without further breakdown

**14.Polyphosphates**: molecules with 2 or more phosphorous atoms, oxygen and in some cases hydrogen atoms combine in a complex molecule.

15. **Enhanced biological phosphorus removal (EBPR)**

The greatest interest and most recent progress has been made in EBPR, which has the potential to remove P down to very low levels at relatively lower costs.

16. **Precipitation**

Chemical precipitation has long been used for P removal. The chemicals most often employed are compounds of calcium, aluminum, and iron .

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**Short Questions**

1.List the different treatment methods of Wastewater.

2.Write a short on Nitrification of Industrial waste water

1. Write a short on De-nitrification of Industrial waste water.
2. Write the flow sheet of Separate Nitrification System
3. Write a short note Biological De-nitrification.
4. Write the flow sheet of Separate De-nitrification System.
5. Give the importance of Phosphorous removal from industrial effluent.
6. List the different processes involved in removal of Phosphorous removal from industrial effluent..
7. Write a short on Membrane separation technologies in Phosphorous removal.
8. What is the process involved in chemical treatment in Phosphorous removal?

**LONG Questions**

**1.** Write an essay on heavy metal poisoning and their prevention with a

suitable example.

2. Explain Membrane separation technologies in Phosphorous removal and

write different types of Membrane filtration?

3.Writea short notes on disposal of industrial wastewater after the treatment.

4. What do you understand by equalization, neutralization and

proportioning? Give examples from industry?

5. Why are solvents, grease, cyanide, phenol and sulphates considered undesirable for discharge into public sewers? Explain?

6. Enlist & Explain the Factors Affecting Adsorption

1. Discuss any two special treatment methods for treating industrial waste water.
2. Elaborate any two disposal methods of treated industrial waste water.
3. Nothing is a waste – discuss the statement with respect to industrial

waste disposal.

10. List various effects of discharging raw industrial waste to the streams.

Briefly explain any four.

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Multiple Choice Questions **/ Choose the Best: (Minimum 10 to 15 with Answers)**

|  |  |
| --- | --- |
| 1. | The pH value of fresh sewage is usually |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | equal to 7 | | [**B.**](javascript:%20void%200;) | more than 7 | | [**C.**](javascript:%20void%200;) | less than 7 | | [**D.**](javascript:%20void%200;) | equal to zero. |   **Answer:** Option **B** |
| 2. | The moisture content of a sludge is reduced from 90% to 80% in a sludge digestion tank. The percentage decrease in the volume of sludge, is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 25% | | [**B.**](javascript:%20void%200;) | 50% | | [**C.**](javascript:%20void%200;) | 10% | | [**D.**](javascript:%20void%200;) | 5%. |   **Answer:** Option **B** |
| 3. | Inter-distance between ventilation columns in a sewer line is kept |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 25 to 50 m | | [**B.**](javascript:%20void%200;) | 50 m to 100 m | | [**C.**](javascript:%20void%200;) | 100 m to 150 m | | [**D.**](javascript:%20void%200;) | 150 m to 300 m. |   **Answer:** Option **D** |
| 4. | If *q* is the average sewage flow from a city of population *P*, the maximum sewage flow |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | https://www.indiabix.com/_files/images/civil-engineering/waste-water-engineering/180-9.16-1.png | | [**B.**](javascript:%20void%200;) | https://www.indiabix.com/_files/images/civil-engineering/waste-water-engineering/180-9.16-2.png | | [**C.**](javascript:%20void%200;) | https://www.indiabix.com/_files/images/civil-engineering/waste-water-engineering/180-9.16-3.png | | [**D.**](javascript:%20void%200;) | https://www.indiabix.com/_files/images/civil-engineering/waste-water-engineering/180-9.16-4.png |   **Answer:** Option **C** |
| 5. | The factor responsible for purification of sewage in river is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | Hydrology | | [**B.**](javascript:%20void%200;) | Dissolved oxygen in water | | [**C.**](javascript:%20void%200;) | Temperature | | [**D.**](javascript:%20void%200;) | Turbulence | | [**E.**](javascript:%20void%200;) | All the above. |   **Answer:** Option **E** |

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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

|  |  |
| --- | --- |
| 6. | If the peak discharge of a storm water drain (S.W. Drain) is e.xpected to exceed 150 cumecs, the free board to be provided, is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 100 cm | | [**B.**](javascript:%20void%200;) | 90 cm | | [**C.**](javascript:%20void%200;) | 80 cm | | [**D.**](javascript:%20void%200;) | 50 cm. |   **Answer:** Option **A** |
| 7. | *PH* value of sludge during alkaline regression stage, is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | more than 7 | | [**B.**](javascript:%20void%200;) | less than 7 | | [**C.**](javascript:%20void%200;) | less than 6 | | [**D.**](javascript:%20void%200;) | more than 6. |   **Answer:** Option **A** |
| 8. | Depletion of ozone layer in the outer atmosphere may cause |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | lung cancer | | [**B.**](javascript:%20void%200;) | skin cancer | | [**C.**](javascript:%20void%200;) | bronchitis | | [**D.**](javascript:%20void%200;) | heart disorder. |   **Answer:** Option **B** |
| 9. | The spacing of bars of perforations of fine screens used for the treatment of sewage, is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 2 to 3 mm | | [**B.**](javascript:%20void%200;) | 3 to 5 mm | | [**C.**](javascript:%20void%200;) | 5 to 8 mm | | [**D.**](javascript:%20void%200;) | 8 to 10 mm. |   **Answer:** Option **A** |
| 10. | The self-cleansing velocity of water flowing through pipe lines, is |
| |  |  | | --- | --- | | [**A.**](javascript:%20void%200;) | 2 metres/sec | | [**B.**](javascript:%20void%200;) | 1 metre/sec | | [**C.**](javascript:%20void%200;) | 0.5 metre/sec | | [**D.**](javascript:%20void%200;) | 0.25 metre/sec. |   **Answer:** Option **A** |

**SAMSKRUTI COLLEGE OF ENGINEERING & TECHNOLOGY**



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# Kondapur(V), Ghatkesar(M), Medchal(Dist)

* + **Seismic waves** are **waves** of energy that travel through the Earth's layers, and are a result of an **earthquake**, explosion, or a volcano that gives out low-frequency acoustic energy.

1. RICHETER SCALE:

The **Richter magnitude scale** (also **Richter scale**) assigns a magnitude number to quantify the energy released by an earthquake.

### UNIT-IV

**GEOLOGY OF DAMS AND RESERVOIRS**

1. Seismic methods.
2. Geothermal methods.
3. Gravity methods.
4. Grating methods
5. Geothermal methods.
6. Brief on the structure of dam with a neat sketch.
7. Gravity dams.
8. Buttress dams.
9. Arch dams. 10.Earth dams.

**Long Questions**

**UNIT-IV**

**GEOLOGY OF DAMS AND RESERVOIRS**

1. What are the Geological Considerations necessary in the selection of a Dam Site?
2. Discuss the foundation and abutment competency of rocks with reference to dams.
3. Explain the geological Causes for the Failure of Dams, with a few Case Histories Explain the geological factors influencing water tightness and life of
4. reservoirs and write a short note on geological considerations in the leakage of reservoirs.
5. Discuss the influence of Geological Structures over Dams.
6. Explain the considerations of different types of rocks at the dam site construction.
7. Explain in detail the role of electrical methods of subsurface investigation in civil engineering practice.
8. Explain the following Geophysical methods.

(a) Seismic methods. (b) Geothermal methods.

1. Describe the principle of gravity method with the help of a neat sketch. What are the different parameters measured? Also explain different kinds of gravity methods that are followed during the investigations.
2. Write about the various electrical conductivity and resistivity methods

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Multiple Choice Questions **/ Choose the Best: (Minimum 10 to 15 with Answers)**

1. A solid barrier constructed at a suitable location across a river valley to impound water is called (B)
2. Reservoir
3. Dam
4. Bridge
5. Retaining wall
6. Which among the following is not an objective for the construction of dam? ( A)
7. To make sure rains occur periodically
8. Generation of hydropower energy
9. Providing water supply for domestic and industrial purposes
10. Providing irrigational facilities
11. The criteria to classify a dam as a large dam is ( D)
12. Length of the crest of the dam lesser than 500 m
13. Capacity of the reservoir less than 1 million cubic meters
14. Maximum flood discharge less than 2000 cubic meters/second
15. Capacity of the reservoir not less than 1 million cubic meters
16. Which state in India has most number of large dams? ( C)
17. Karnataka
18. Orissa
19. Maharashtra
20. Madhya Pradesh
21. Which is the longest dam in India? ( A)
22. Hirakud dam
23. Bhakra dam
24. Krishnarajasagar dam
25. Nagarjun sagar dam
26. Which is the tallest dam in India? ( B)
27. Hirakud dam
28. Bhakra dam
29. Krishnarajasagar dam
30. Nagarjun sagar dam
31. Which type of dam usually has triangular profile and can resist the forces by its own weight? ( A)
32. Gravity dam
33. Arch dam
34. Geotechnical dam
35. Embankment dam
36. What is very critical about gravity dams? ( C)
37. Strength of the concrete used
38. Strength of the masonry used
39. Strength of the rock foundation
40. The type of water stored in the reservoir

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9. State true or false. The upstream face of a gravity dam is always vertical.( B)

1. True
2. False

10. Type of dam where the forces acting on the dam are transmitted onto the abutment rocks is ( B)

1. Gravity dam
2. Arch dam
3. Geotechnical dam
4. Embankment dam

11. Which type of dam cannot be constructed even on the rock foundations which are not sufficiently strong enough? ( A)

1. Gravity dam
2. Arch dam
3. Geotechnical dam
4. Embankment dam

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### Unit-v: (Title) TUNNELS

**Important points / Definitions: (Minimum 15 to 20 points covering complete topics in that unit)**

1. **PURPOSE OF TUNNELING:A Tunnel is an underground passage. In general, tunnels are at least twice as long**as they are wide and are completely enclosed on all sides, save for the openings at each end
2. . **Utility ducts:** Utility ducts are man-made tunnels created to carry two or more utility lines underground. Through co-location of different utilities in one tunnel, governments and companies are able to reduce the costs of building and maintaining utilities.
3. "tunnel effect", when talking about long stretches of road, refers to the environment surrounding the driver that begins to merge towards the central point of the horizon. This effect can be noted at high speeds, when driving on straight smooth roads. The effect is amplified if the environment surrounding is monotonous

The "tunnel effect", when talking about long stretches of road, refers to the environment surrounding the driver that begins to merge towards the central point of the horizon. This effect can be noted at high speeds, when driving on straight smooth roads. The effect is amplified if the environment surrounding is monotonous

1. Overbreak :of rock beyond the desgined periphery of a tunnel is a structural risk which more than occasionally results in filing of a claim by the contractor. It is difficult to estimate the overbreak risk at the time of tender with sufficient degree of accuracy because of the uncertainty associated with the geology, construction technique, and the interaction of these two domains

### UNIT-V TUNNELS

1. Purposes of tunneling.
2. Lining of tunnels.
3. Over break.
4. Different purposes of tunnels
5. Tunnels faulted strata
6. Tunnels in folded strata
7. Tunnels in Faulted formations
8. Write the importance of ground water condition
9. What are mining substances 10.Define folds and faults

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**Long Questions**

**UNIT-V TUNNELS**



* 1. What is a tunnel? Explain the terms that are used in tunnels with neat sketches. Also explain the purpose of tunneling.

2.

1. .Mention the deteriorating effects produced in the ground during the excavation of tunnels.
2. Mention the variety of purposes served by tunnels.
3. What is the role of lithology and geological structures in successful tunneling?
4. Write a short notes on a) effects of tunneling on the ground and b) Over break 5.

What is meant by lining in tunnels? Discuss the lithological and structural reasons

that necessitate lining.

1. What are the various geological factors to be considered for the construction of tunnels? Explain in detail with examples.
2. Explain how the study of bed rocks is essential before the construction of tunnels.

Multiple Choice Questions **/ Choose the Best: (Minimum 10 to 15 with Answers)**

1. The underground routes or passages driven through the ground without disturbing overlying soil cover are called (C)

a) Bridges b) Passages c) Tunnels

d) Sub-routes

1. Type of tunnels which are excavated to divert the traffic load of whatsoever type from surface to subsurface routes. (A)
2. Traffic tunnels
3. Hydropower tunnels c) Public utility tunnels d) Delivery tunnels
4. 3. Pick the tunnel which is not a sub-group of traffic tunnels.(B) a) Railway tunnels

b) Sewage tunnels c) Highway tunnels

d) Pedestrian tunnels

4.. Tunnels associated with hydropower generation are called (D) a) Energy tunnels

1. Power tunnels
2. Generation tunnels d) Hydropower tunnels

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1. Type of hydropower tunnel where water is conveyed under gravity is (A) a) Discharge tunnel

b) Pressure tunnel c) Supply tunnel d) Delivery tunnel

1. Type of hydropower tunnel where water is conveyed under high pressure to turbines is (B) a) Discharge tunnel

b) Pressure tunnel c) Supply tunnel d) Delivery tunnel

1. Underground excavations for carrying pipes, sewage etc. fall under which type?( C) a) Traffic tunnels

b) Hydropower tunnels c) Public utility tunnels d) Delivery tunnels

1. Subway and tube railways are studied under which type of tunnels? ( C) a) Traffic tunnels

b) Hydropower tunnels c) Public utility tunnels d) Delivery tunnels

1. Method of placing tubes in public utility tunnels is called ( D) a) Covering method
2. Digging method
3. Slash and cover method d) Cut and cover method
4. Geologically, how many classes of tunnels are recognized? ( A) a) 2
5. 3
6. 5
7. 4
8. Traffic tunnels are always constructed for kilometres. State true or false. ( B) a) True

b) False

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