Internal Assesment Test -IV–Jan-2022

Sub:	Municipal and Industrial Waste Water Engineering					Sub Code:	17CV71	Branch:	CIVIL
Date:		Duration:	90 min's	Max Marks:	50	Sem/Sec:	V11		OBE

Answer All Questions

		MARKS	CO	RBT
1	What are sewer appurtenances? Explain with a neat sketch the manhole	[10]	CO1	L2
2	Define DO and Explain with a neat sketch, the salient features of oxygen sag curve	[10]	CO2	L2
3	Explain the differences between domestic waste water and industrial waste water in detail	[10]	CO4	L2
4	Explain with flow diagram, treatment options for sugar mills	[10]	CO5	L2
5	Explain with help of flow chart, along with sources and characteristics of waste water from cotton textile mill	[10]	CO5	L2

1. Sewage flowing in the sewer line contains a large number of impurities in the form of silt, fats, oils, rags etc. Under normal flows they are not likely to settle and choke the sewers, but during small flows self-cleansing velocity is not likely to develop and the chances of choking of the sewers are increased. Choking have to be removed time to time and facilities should be provided on the sewer lines for this purpose. Therefore, for proper functioning and to facilitate maintenance of the sewage system, various additional structures have to be constructed on the sewer lines. These structures are known as sewer appurtenances

Following are the important appurtenances, 1. Manholes 2. Inlets 3. Catch basins 4. Flushing devices 5. Regulators 6. Inverted siphons 7. Grease and oil traps 8. Lamp holes 9.Leaping weirs 10. Junction chambers

Manholes: The manholes are R.C.C or masonry chambers constructed on the sewer line to facilitate a man to enter the sewer line and make the necessary inspection and repairs. These are fitted with suitable cast iron covers. The manholes should be installed at every point where there is a change in direction, change in pipe size, or considerable change in gradient. As far as possible sewer line between two subsequent man holes should be straight. The centre distance between manholes is less for sewers of smaller size while it may behave such a size that man can easily enter in the working chamber. The minimum size is 50cm diameter.

Size of Sewer Recommended spacing of Manhole

Dia up to 0.3 m 45 m
Dia up to 0.6 m 75 m
Dia up to0.9 m 90 m
Dia up to1.2 m 120 m
Dia up to1.5 m 250 m
Dia greater than 1.5 m 300 m

Classification of Manhole:

Shallow Manholes (Inspection Manholes) are the one which are about 0.75 to 0.9 m in depth. They are constructed at the start of a branch sewer.

Normal Manholes are those which are about 1.5 m in depth. They are constructed either in square (1 m * 1m) or rectangular (0.8 m * 1.2 m) in cross section.

Deep Manholes are those which are deeper than 1.5 m. The size of such a manhole is larger at the bottom, which is reduced at the top to reduce the size of manhole cover.

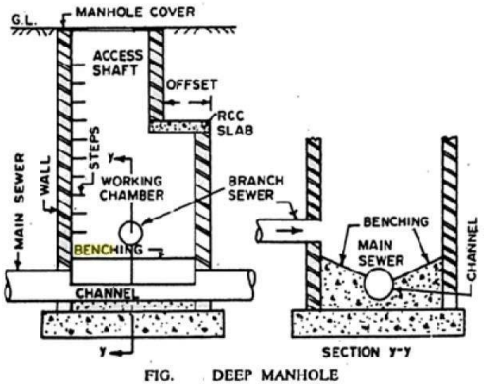


FIG. DEEP MANHOLE

Define BOD and Explain with a neat sketch, the salient features of oxygen sag curve

Biochemical oxygen demand or B.O.D. is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water or wastewater sample to break down organic material present in a given water or wastewater sample at certain temperature (200C) over a specific time period (5 days).

Oxygen Sag Curve:

The oxygen sag or oxygen deficit in the stream at any point of time during self purification process is the difference between the saturation DO content and actual DO content at that time.

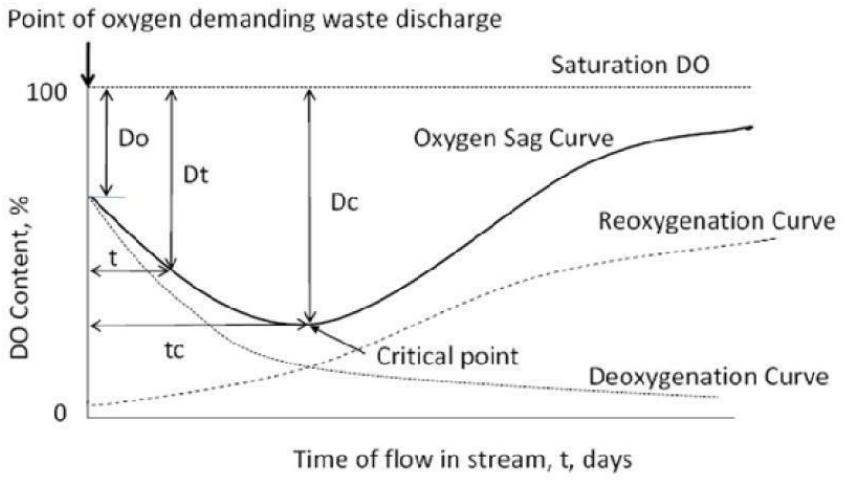
OR

The amount of resultant oxygen deflect can be obtained by algebraically adding the de - oxygenation and re -oxygenation curves. The resultant curve so obtained is called oxygen sag curve

Oxygen Deficit, D = Saturation DO – Actual DO

The saturation DO value for fresh water depends upon the temperature and total dissolved salts present in it and its value varies from 14.62 mg/L at 0oC to 7.63 mg/L at 30ºC, and lower DO at higher temperatures.

The DO in the stream may not be at saturation level and there may be initial oxygen deficit (D). At this stage, when the effluent with initial BOD load Lo, is discharged in to stream, the DO content of the stream starts depleting and the oxygen deficit (D) increases. The variation of oxygen deficit (D) with the distance along the stream, and hence with the time of flow from the point of pollution is depicted by the Oxygen Sag Curve. The major point in sag analysis is point of minimum DO, i.e., maximum deficit. The maximum or critical deficit (Dc) occurs at the inflexion points (as shown in fig) of the oxygen sag curve.



Deoxygenation, reoxygenation and oxygen sag curve

De-oxygenation curve: The curve which represents (or) showing the depletion of D.O with time at the given temperature

Re-oxygenation Curve: In order to counter balance the consumption of D.O due to the de – oxygenation, atmosphere supplies oxygen to the water and the process is called the re – oxygenation.

When wastewater is discharged in to the stream, the DO level in the stream goes on depleting. This depletion of DO content is known as de-oxygenation. The rate of de- oxygenation depends upon the amount of organic matter remaining (Lt), to be oxidized at anytime t, as well as temperature (T) at which reaction occurs. The variation of depletion of DO content of the stream with time is depicted by the de-oxygenation curve in the absence of aeration. The ordinates below the de-oxygenation curve indicate the oxygen remaining in the natural stream after satisfying the bio-chemical demand of oxygen. When the DO content of the stream is gradually consumed due to BOD load, atmosphere supplies oxygen continuously to the water, through the process of re-aeration or re-oxygenation, i.e., along with de-oxygenation, re-aeration is continuous process.

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3. Difference between Domestic and Industrial wastewater

Domestic sewage consists of liquid waste originating from bathrooms, water closets, kitchen sinks, wash basins etc of residential, commercial or institutions buildings. For example, apartments, hotels, hospitals, shopping mall etc

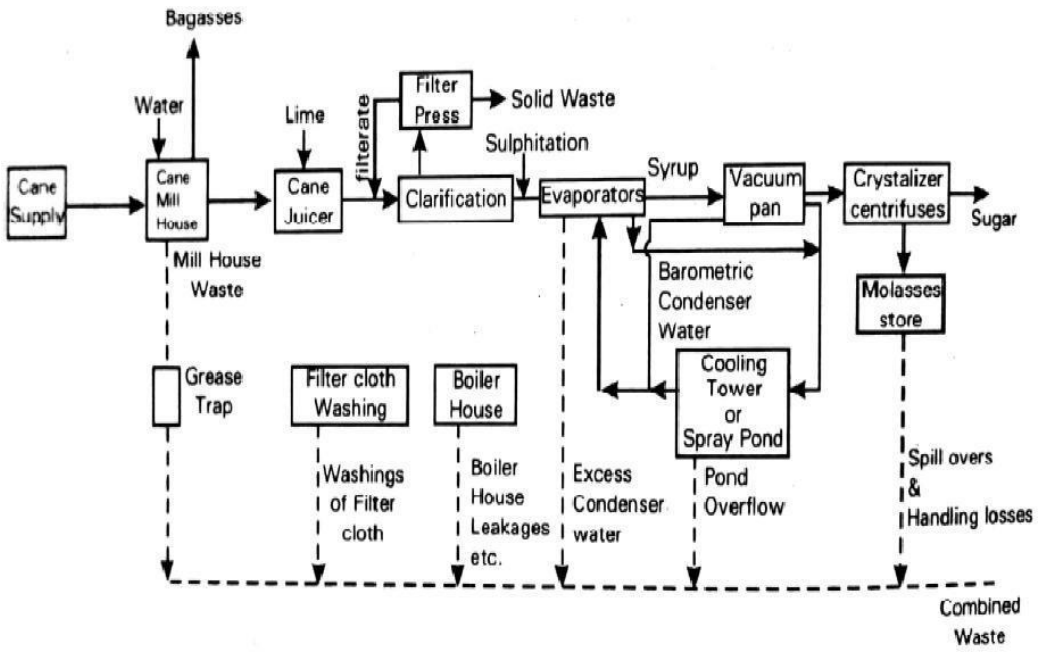
Industrial wastewater consists of wastes originating from the industrial processes of various industries such as paper manufacture, textile, sugar, brewing, dyeing etc. The quality of industrial wastewater depends largely upon the type of industry & the chemicals used in their process water. Sometimes, they may be very foul & may require extensive treatment before being disposed off in public sewage

Industrial waster as pointed out above, usually contains several chemical pollutants & toxic substances in too large proportions. The characteristics of the produced wastewater will usually vary from industry to industry & also vary from process to process even in the same industry, such industrial waster cannot always be treated easily by the normal methods of treating domestic wastewater & certain specially designed methods are sequence of methods may be necessary. The normal biological treatment methods for sewage are dependent up on the bacterial activity within the sewage, & as the toxic chemicals present in the industrial wastewater may hinder or destroy the bacterial activity. Therefore these normal methods may not be sufficient unless modify &/or supplemented by additional techniques.

4. The sugar cane is normally harvested manually in India, which eliminates the carriage of soil & trashes to the factory along with the sugar canes. The sugarcanes are cut into pieces & crushed in a series of rollers to extract the juice in the mill. Then for sugar canes of Lime is then added to the juice & heated where in all the colloidal & suspended impurities are coagulated. Much of the color is also removed during lime treatment. The coagulated juice is then clarified to remove the sludge. The clarifier sludge is further filtered through filter process & then disposed off as solution waste. The filtrate is recycled to the process and the entire quantity of clarified juice is treated by passing sulfur dioxide gas through it. The process is known as sulphitate process. Here color of the juice is completely bleached out due to this process.

The clarified juice is then pre- heated & concentrated in evaporators & vacuum pans. The partially crystallized syrup from the vacuum pan is known as Massecuite is then transferred to the crystallizers, where complete crystallization of sugar occurs. The massecuite is then centrifuged, to separate the sugar crystals from the mother liquor. The spent liquor is discarded as black strap molasses. The sugar is then dried & bagged for transport.

The fibrous residue of the mill house known as bagasses may be burnt in the boilers or may be used as raw materials for the production of paper product. The black strap molasses may be used in the distilleries.

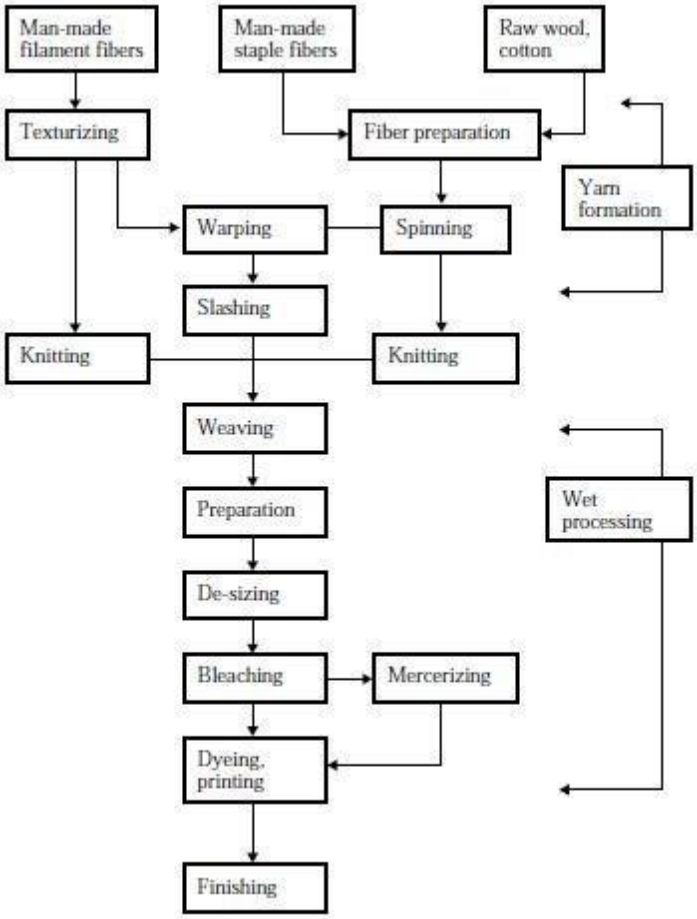


5. Cotton and Textile Industry Manufacturing process

An integrated cotton textile mill produces its own yarn from the raw cotton. Production of yarn from raw cotton includes steps like opening & cleaning picking, carding, and drawing spinning, winding & warping. All these sequences are dry operations and as such do not contribute to the liquid waste of the mill. The entire liquid waste from the textile mills comes from the following operation of slashing (sizing), scouring, desizing, bleaching, mercerzing, dyeing & finishing.

In slashing the yarn is strengthen by loading it with starch or other substances wastes originates from the sections due to spills & floor washings. The substitution of low BOD sizes (such as carboxy methyl cellulose) for the high BOD of the mill effluent by 40 to 90%. After slashing, the yarn goes for weaving. The prepared cloth now requires scouring & desizing to remove natural impurities and the slashing compounds. Enzymes are usually used in India to hydrolyze the starch, acids may also be used for the is purpose. Caustic soda, soda ash, detergents etc. are also used in this section. Bleaching operations use oxidizing chemicals like peroxides & hyper chloride to remove natural coloring material. The section contributes about 10% of the total pollution load.

Mercerzing consists of passing the sloth through 20% caustic soda solution. This process includes the strength elasticity luster & dye affinity. Waste from this section is recycled after sodium hydroxide recovery. Negligible waste which may come out of this section contributes little BOD but a high degree of alkalinity.


Man-made filament fibers
Man-made staple fibers
Raw wool, cotton
Texturizing
Fiber preparation
Yarn formation
Warping
Spinning
Slashing
Knitting
Knitting
Weaving
Preparation
Wet processing
De-sizing
Bleaching
Mercerizing
Dyeing, printing
Finishing