#132, AECS Layout, IT Park Road, Kundalahalli, Bangalore – 560 037 T:+9180 28524466 / 77

CMR INSTITUTE OF TECHNOLOGY

Department of Civil Engineering

18CV46 – WATER SUPPLY AND TREATMENT ENGINEERING

Scheme and Evaluation

Subject	Water supply and Engineering treatment Engineering	Branch	CIVIL
Sub Code	18CV46	Date	21/05 / 2021
Duration	90 min's	Sem	VI
IAT-1; Max Marks: 50			

Sl. No.	Question	Marks	Scheme
1	What is meant by per capita demand? List and discuss the factors that affect the per capita demand.	10	Definition - 2M Description – 8M
2	What is peaking factor? Explain the factor governing design period	10	Definition -5M Description -5M
3	The following population data are available for a town. Estimate the probable population in the year 2031 by geometrical and incremental increase methods Year: 1971 | 1981 | 1991 | 2001 Population: 80,000 | 1,20,000 | 1,68000 | 2,28,000	10	Method a – 5M Method b – 5M
4	The population of a city in three consecutive years i.e. 1991, 2001 and 2011 is 80000 , 250000 and 480000 Determine (i) The saturation population (ii) The equation of logistic curve (iii) Expected population in 2021	10	i) 3M ii) 3M iii)4M
5	5 List the objectives of water treatment and discuss the complete sequence of water treatment plant with a flow diagram	10	Definition -10M

1> The annual average daily draft in l/day required by a town can be worked out by multiplying the possible number of persons who are going to use the facilities provided by the scheme and the annual average daily consumption of each person called per capita demand.

* Factor affecting per-capita demand :-

1> Size of city : If the city is small, the water consump-tion is less and if the big city is big the water consumption will be more.

2> climate condition : At hotter and dry places, the consumption of water is generally more, because more of bathing, cleaning, air coolers, air condition etc

3> Types of gentry and Habits of people :

The rate of consumption will be more due to better standard of living person. The higher e Consumption when compared to middl

4) Industrial & commercial activities: The pressure of industrial and commercial activities at a particular place increases the water consumption by large amount. The water consumption is more industries are located and more commercial activities are taking place in the city.

5) Quality of water supplies: Improved water quality will lead to more water consumption. unpleasant taste and odour will lead to reduced water consumption.

6) pressure in Distribution system: Increase in distribution pressure will increase water consumption. Increase 2-3 kg/cm^2 lead to increase in water consumption to an extent about 25 to 30%.

7) Development of sewage facilities: The water consumption will be more, if the city is provided with 'flush system' and shall be less if the old 'conservation system' of latrines is adopted.

9) Cost of water:

If the water rates are high lesser quality may be consumed by the people. This may not lead to large saving as the affluent and rich people are little affected by such policies.

2> Peak factor: Maximum hourly consumption of the maximum day is called peak demand. This is nothing but a factor of safety.

* Factors governing the design period

1> Length or life of structures: useful life of peerless pipes, structure and equipments used in the water works and the chances of their becoming old and obsolete.

2> Ease of Extension: The anticipated rate of growth of population. If the rate is more, design period is less.

3> First cost: The rate of interest of loans taken for the construction of the project. If this rate is more the design period will be less.

4> Economy of Scale: The rate of inflation during the period of repayment loans. When the inflation rate is high a longer design period is adopted.

5> Lead time: Efficiency of components units of the project during early years of working, when they are not loaded to their capacity. The more the efficiency, the longer the design of period.

4) $P_0 = 80{,}000$ $t_0 = 0$

$P_1 = 2{,}50{,}000$ $t_1 = 10\text{yrs}$

$P_2 = 4{,}80{,}000$ $t_2 = 20\text{yrs}$

Calculating saturation

$$P_s = \frac{2P_0P_1P_2 - P_1^2(P_0+P_2)}{P_0P_2 - P_1^2}$$

$$P_s = \frac{2\times 80{,}000\times 2{,}50{,}000\times 4{,}80{,}000 - 2{,}50{,}000^2(80{,}000+4{,}80{,}000)}{80{,}000\times 4{,}80{,}000 - 2{,}50{,}000\times 2{,}50{,}000}$$

$$\boxed{P_s = 655602}$$

$$m = \frac{P_s - P_0}{P_0} = \frac{655602 - 80{,}000}{80{,}000} = 7.195$$

$$n = \frac{2.3}{t_1}\log_{10}\frac{P_0(P_s - P_1)}{P_1(P_s - P_0)}$$

$$= \frac{2.3}{t_1}\log_{10}\left(\frac{80{,}000(655602 - 2{,}50{,}000)}{2{,}50{,}000(655602 - 80000}\right)$$

$$\boxed{n = -0.1488}$$

Population in 2021

$$P = \frac{P_s}{1 + m \log_e^{-1}(not)}$$

$$= \frac{655602}{1 + 7.195 \times \log_e^{-1}(-0.1488 \times 30)}$$

$$= \frac{655602}{1 + 7.195 \times 0.0117}$$

$$\boxed{P = 6,05,436}$$

3) Geometric Method

year	population	Increase	% increase
1971	89,000		
		40,000	50 %
1981	1,20,000		
		40000	40 %
1991	1,68,000		
		40000	26.31 %
2001	2,28,000		

-10%

-13.69%

-23.69%

$\frac{-23.69\%}{2} = -11.36\%$

* Extend population for a year

$$2011 = 2,28000 + \frac{26.31 - [-11.845]}{100} * 2128000$$

$$= 314.993.4$$

$$2021 = 314993.4 + \frac{38.115\ [-11.465]}{100} \times 3,14993.4$$

$$= 472364.10$$

$$2031 = 472364.10 + \frac{49.96\ [-11.845]}{100} \times 472364.10$$

$$= 63,03,509.869$$

* Increament method

year	population	Increase	Increment of Incr.
1971	89,000		
1981	1,20,000	40,000	8000
1991	1,68,000	48,000	12000
2001	2,28,000	60,000	

$\bar{x} = 49333.33$

$\bar{y} = 10,000$

$$P_n = P_0 + n\bar{x} + \frac{n(n+1)}{2} \times \bar{y}$$

$$P_{2031} = P_{2001} + 3\ [49333.33] + \frac{3[4]}{2} \times 10000$$

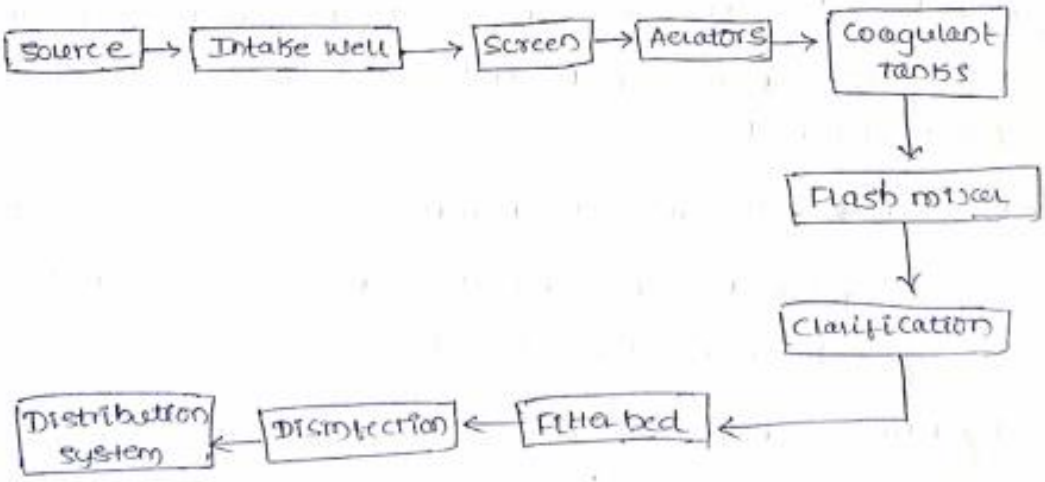
$$P_{2031} = 435999.99$$

5

Objectives of water treatment :

* The main objectives of the treatment process is to remove impurities of raw water & bring the quality of water to the required standards.
* To remove the dissolved gasses and water of colour of water.
* To kill all the pathogens, which are harmful to the Human health.
* To eliminate the corrosive properties of the water.
* To remove the harmful or toxic metal from the water.

Flow chart



CI:
Prof. Usha A

CCI:
Prof. Ruchir