



SNS COLLEGE OF TECHNOLOGY

Coimbatore – 641 029

An Autonomous Institution



DEPARTMENT OF CIVIL ENGINEERING

ENVIRONMENTAL ENGINEERING

III YEAR / V SEMESTER

UNIT 1 : SOURCES, QUALITY AND DEMAND OF WATER

Topic 4 :Population forecast



UNIT 1 :SOURCES, QUALITY AND DEMAND OF WATER



1. Importance and necessity of water supply Engineering – Sources of water – Suitability of water –Choice of source
2. Types of demand -- Computation of quantity of water
3. Fluctuation in demand –Factors affecting demand
4. **Population forecast**
5. Population forecast - Methods
6. Impurities in water– Collection of water sample
7. Physical test
8. Chemical test
9. Biological test and Standards of quality of water



POPULATION FORECASTING



The present population of city is determined by conducting an official enumeration, called census.

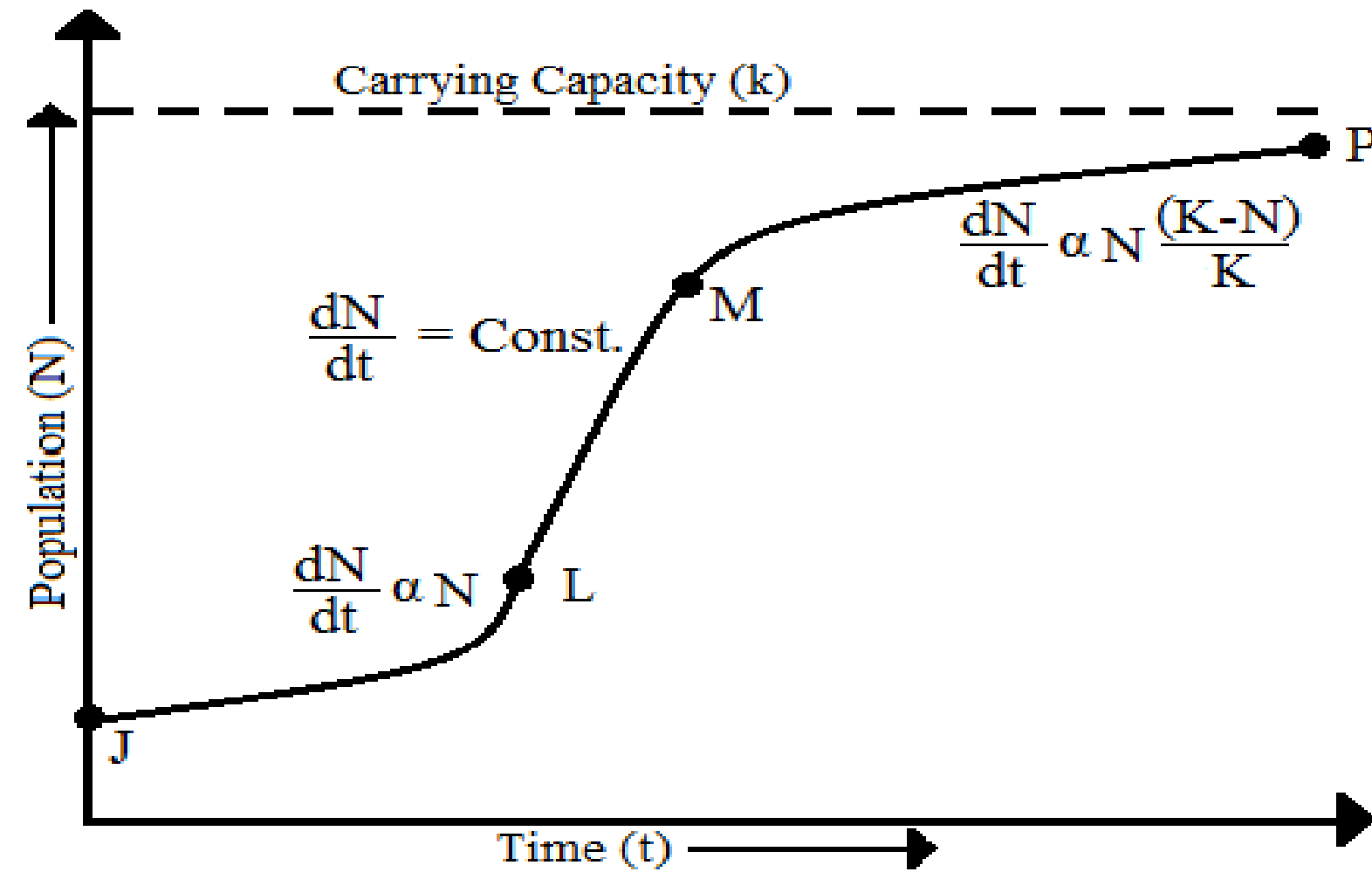
Population growth

- a) Births
- b) Deaths
- c) Migrations.

The various methods adopted for estimating future populations



POPULATION GROWTH CURVE





POPULATION FORECAST



Arithmetical
Increase method

Geometric
Increase Method

Incremental
Increase Method

Decreasing Rate
of Growth
Method

Graphical
Extension
Method

Graphical
Comparison
Method

Zoning or Master
Plan Method

Ratio or
Correlation
Method

Growth
Composition
Analysis Method



METHODS OF POPULATION FORECASTING



1. ARITHMETIC INCREASE METHOD

- Rate of change of population with time is constant.
- Applicable to old and large cities
- Also applicable to cities with no industrial growth and reached a saturation or max. development
- Yields lower results for rapidly growing cities

$$P_n = (P_o + n \cdot \bar{x})$$

Where, P_o = latest known population

P_n = Prospective population after 'n' decades $\bar{x}$ = avg. increase in population per decade



1. The population of town for the last four census years was recorded as below. Determine the population in 2021 by using Arithmetic Increase Method:



Census	Population
1981	11092
1991	13751
2001	15206
2011	19723



1. The population of town for the last four census years was recorded as below. Determine the population in 2021 by using Arithmetic Increase Method:

Census	Population	Increase in Population
1981	11092	--
1991	13751	2659
2001	15206	1455
2011	19723	4517

Sol.: Avg. increase in population per decade (x) = $8631/3 = 2877$

$$P_n = (P_o + n \cdot \bar{x})$$

$$P_n = (19723 + 1 \times 2877) = 22600$$



METHODS OF POPULATION FORECASTING



2. GEOMETRIC INCREASE METHOD

- % increase in population from decade to decade is constant.
- Avg. % of growth of last few decades is determined and from this forecasting is done.

$$P_n = P_o (1 + (r / 100))^n$$

Where, P_o = latest known population

P_n = Prospective population after 'n' decades r =



2. The population of town for the last four census years was recorded as below.
Determine the population in 2021 by using Geometric Increase Method:



Census	Population	Increase in Population	% increase in population
1981	11092	--	--
1991	13751	2659	23.97
2001	15206	1455	10.58
2011	19723	4517	29.70

Sol.: Avg. % increase in population per decade (r) = $64.25/3 = 21.42\%$

Geometric Mean % in population in decade (r) = $(23.97 * 10.58 * 29.70)^{1/3} = 19.6\%$

$$P_n = P_o \left[1 + \left(\frac{r}{100} \right) \right]^n$$

$$P_n = 19723 \left[1 + \left(\frac{19.6}{100} \right) \right]^1$$

$$P_n = 23589$$



METHODS OF POPULATION FORECASTING



3. INCREAMENTAL INCREASE METHOD

- Best method for any city whether old or new.
- Combination of first two methods.
- First the avg. of increase in population is calculated according to arithmetical increase method
- Then the avg. of the net increment increase is added to this.
- $P_n = P_o + n \cdot x + \left(\frac{n(n+1)}{2} \right) y$
- Where, P_o = latest known population
- P_n = Prospective population after 'n' decades
- y = avg. of incremental increase in population



3. The population of town for the last four census years was recorded as below. Determine the population in 2021 by using Incremental Increase Method:

Census	Population	Increase in Population	Incremental increase
1981	11092	--	--
1991	13751	2659	--
2001	15206	1455	-1204
2011	19723	4517	3062

Sol.: Avg. increase in population per decade (x) = $8631/3 = 2877$

Avg. incremental increase in population per decade (y) = $1858/2 = 929$

$$P_n = P_o + n \cdot x + \left[\frac{n(n+1)}{2} \right] y$$

$$P_n = 19723 + (1 \times 2877) + \left[\frac{(1(1+1))}{2} \right] 929$$

$$P_n = 23529$$



4. The population of the city are as below.

Year	Population
1941	20,000
1951	25,000
1961	35,000
1971	45,000
1981	55,000
1991	65,000
2001	75,000
2011	85,000

HOME ASSIGNMENT

Determine the population in 2021 by using Arithmetic Increase, Geometric and Incremental Increase Method:



References

- <https://nptel.ac.in/content/storage2/courses/105104102/Lecture%202.htm>
- <https://theconstructor.org/environmental-engg/population-forecasting-water-supply-system/38548/>
- <https://www.aboutcivil.org/estimation-of-water-demand-population-forecasting.html>



Thank You