Unit - I

INTRODUCTION

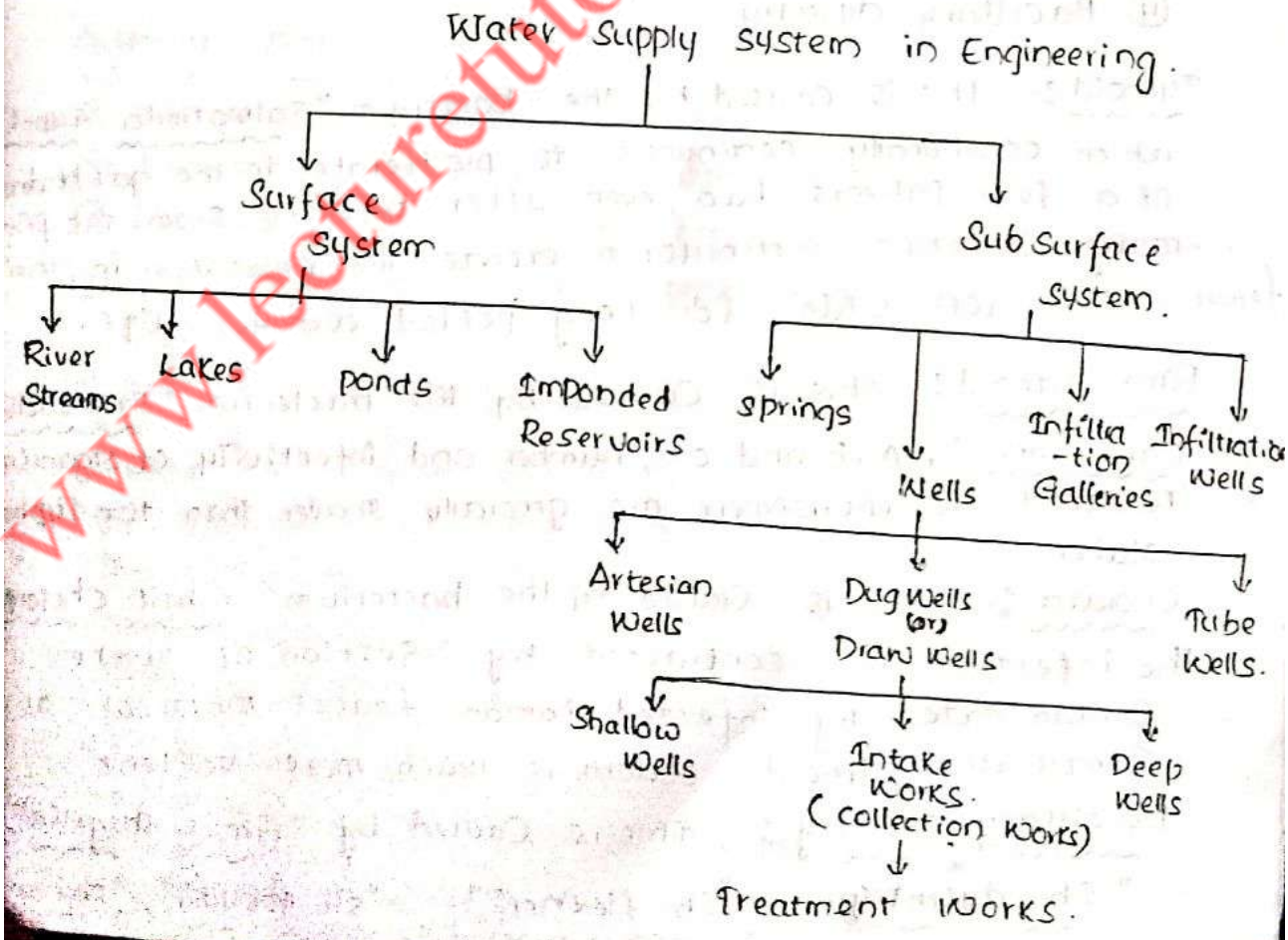
"Best of all things is water"

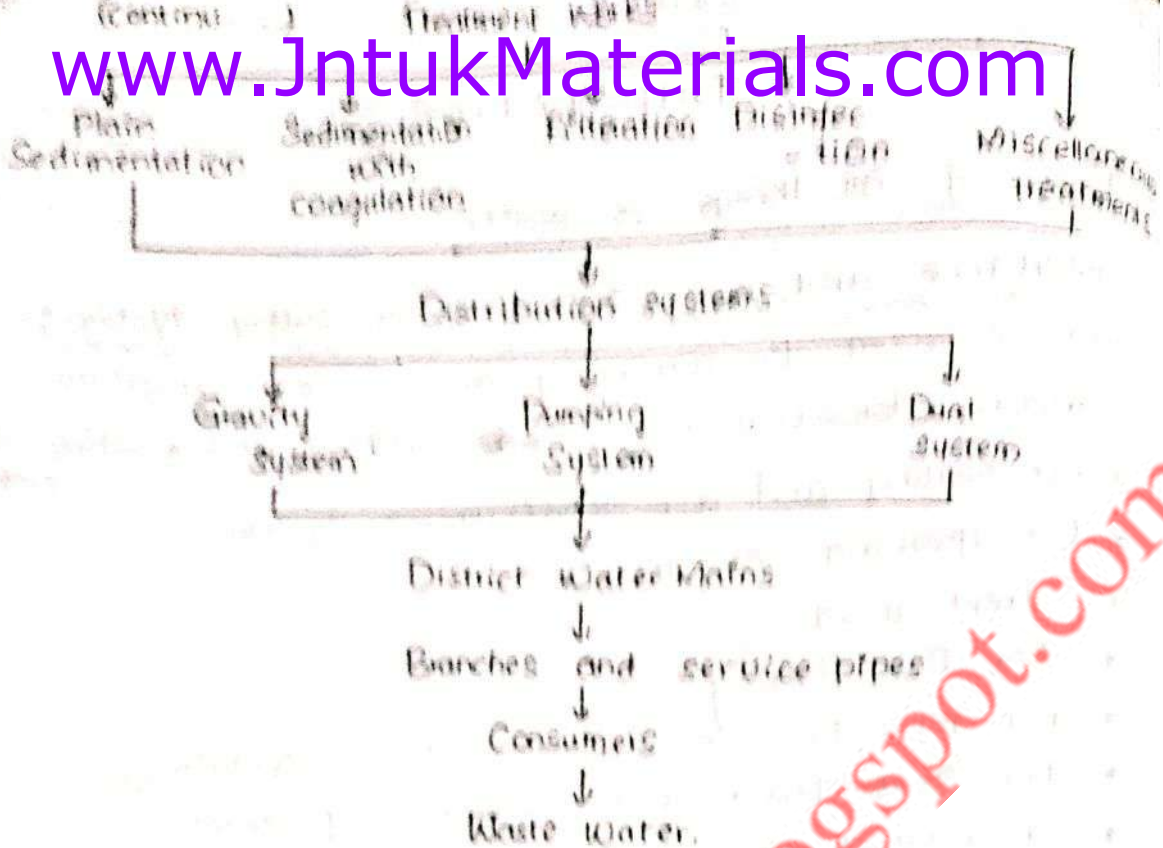
Importance and necessity of water supply system :-

Water is used for various purposes like irrigation, drinking, domestical uses. bathing and washings of clothes.

* For heating and air conditioning system.
* For growing of crops.
* Street washing
* For fire fighting.
* For recreation in swimming pools, fountains.
* For steam power and Industrial purposes.
* In civil engineering purpose the total knowledge of designing, construction, and maintanence of water supply system, treatment plants as a basic knowledge of enviornmental engineering.

Flow chart of public water supply system :-





Water borne diseases :-

① Bacterial Diseases ② Protogoal Diseases
③ Virus Diseases ④ Helminthic

① Bacterial Diseases :- few types

① Typhoid ② Para-typhoid ③ cholara
④ Bacillary dysentry

Typhoid :- this is caused by the bacterium "Salmonella typhi" which occationally continuous to proliferate in the gall bladder of a few patients have, even after recovery from the primary infection continuity to excrete the organisms in their faecal species, (or) Urin, for long period, even for life.

Para typhoid :- this is caused by the bacterium "Salmonella para typhi". "A, B and C", number and infectivity of organism released to environment are generally smaller than the typhoid water

Cholara :- this is caused by the bacterium "Vibrio cholera" the infection is contracted by ingestion of water contaminated by infected human feacal material. as Comparated typhoid, cholara is much more voilent.

Bacillary dysentry :- this is caused by "Genus shigella", "Sh. dysentriae", "Sh. flexneri", "Sh boydii", "Sh. sonn

② Protozoal Diseases :- This is caused by "protozoon entamoeba histolitica". They live in the human large intestine forming schist which are excreated in the bowl discharge infected person and which will lives for long period.

③ Virus Diseases :-

① Coxsakie viruses ② Echo viruses
③ Polio viruses ④ The viruses of infectius
⑤ Hepatities ⑥ Adino viruses ⑦ Reo viruses.
⑧ The Common diseases schistosomiasis and swimmer itch.

Role of environmental engineer :-

The environmental engineers designing construction and maintenance of diff water supply systems (or) schemes. They have some knowledge of above particulars.

* An environmental engineer is to make public aware about the environmental degradation and also to impart training in such a way so that people participate in the programmes of keeping enviromental clean.
* They also protect natural resources from the effect of disposal of hazardous waste.

Agency Activities :-

① designing waste water treatment plants.
② monitoring air pollution & operating control equipment.
③ Developing pollution Control technologies for diff industries.
④ Predicting moment of contaminents in air water and soil.

Types of Demands :- While designing the water supply scheme for a town (or) City, it is necessary to determine the quantity of water require for various purposes by the City. There are diff types of demands for determining water demand of a town (or) City by using the formules of empherical formule and thumb rules.

→ Domestic Water Demand
→ Commercial & Industrial demand.
→ fire demand
→ Demand for public use
→ Compensate losses of demands.

Public use - 25 Litre/day/capita.
Losses and wastage - 55 Litre/capita/day.
Total/capita/day 270 Litres.

Design period :- The No of years per which the designs of the water work have been done is known as "design Period" following factors should be kept in view while fixing the design period.

(a) Funds available for completion of project. If more funds are available the design period shall be less.
(b) Life of the pipe and other structural materials used in the water supply scheme.
(c) The design period should be equal to the material used in the water supply works.
(d) Rate of imprest on the loans take into complete the project If the rate of interest is less it will be good to keep design period is more
(e) Anticipated expansion rate of the town.

Population Forecasting :- The future development of town depends on trade expansion, development of Industries and Surrounding countries etc.
The following are the standard methods by which the forecasting of population is done.

* Arthemetical increase method.
* Geometrical increase method.
* Incremental increase method.
* Decreasing rate method.
* Simple graphical method.
* Comparative graphical method
* Master plan method. / Zoning method.
* Logistic Curve method.
* The apportionment method / Graphical method.

Arthemetical increase method :-

$$\therefore P_n = P + nI$$

Where P = Present population.
P_n = population at the end of n_{es} where n = no of decade years

Problems:- I = Average increase per year. (population)

(*) The following data have been collected from the census development.

Year	1940	1950	1960	1970
population	8000	12000	17000	22500

Calculate probable population in the years 1980, 1990, 2000 ?

Sol:- Here n = 1 decade

S.NO	Years	population
1	1940	8000
2	1950	12,000
3	1960	17000
4	1970	22,500

8000 - 12000 = 4000

= 5000

= 5500

14500

∴ Average total = $\frac{14500}{3}$ = 4833.3

Arthematic increase method :-

We know that $P_n = P + nI$

1980 = 22500 + (1 x 4833.3)

Inc. population in → 1980 = 27333

$P_n = P + nI$

1990 = 27333 + (1 x 4833.3)

∴ 1990 = 32166

Increase population in 2000 = 32166 + (1 x 4833)

∴ 2000 = 36999

(*) The present population of city is 100000 the bass population to the last three decades were as follows. Compute the expected population after one, two and three decades by arthematical increase method ?

Sol:- Present population = 100000

One decade before = 95,000

two decade before = 90,500

three Decade before = 86,500

Sol:-

S.No	No of Decades	Population	Difference	Average
1	Present year	1,00,000		
2	one decade	95000	5000	$\frac{13500}{3}$
3	two decades	90500	4500	$= 4500$
4	three decades	86500	4000	

Arthematic Increase method:-

W.K. that $p_n = p + nI$

∴ One decade = 100000 + 1 × 4500

= 104500

∴ Two decades = 1,04500 + 1 × 4500

= 109000

∴ Three decades = 109000 + 1 × 4500

= 113500

⊛ Estimate the population of the year 2011 for the town whose census data are given below by applying the Arthematic increasing method.

Year	1931	1941	1951	1961	1971	1981
Population	187440	210890	245450	291120	347900	415790

Sol:-

S.NO	No of years	Population	Difference (population)	population Average (I)
1	1931	187440	23450	
2	1941	210890	34560	A_I = 45670
3	1951	245450	45670	
4	1961	291120	56780	
5	1971	347900	67890	
6	1981	415790		

Arthematic Increase method:-

W.K. that $p_n = p + nI$

2011 population = 415790 + 3 * 45670

Increased in 2011 → 55 2800

Geometrical Increase method :-

It is calculated by

$$P_n = P\left[1 + \frac{IG}{100}\right]^n$$

where P_n = Increased population at the end of ye..

IG = Avg'. % growth

P = present population

(*) The following data have been noted from the census development. Calculate population in 1980, 1990, 2000?

year	1940	1950	1960	1970
population	8000	12000	17000	22500

by using Geometrical Increase method?

Sol:-

year	population	Increase in population	Percentage increase in population
1940	8000		
1950	12000	4000	$\frac{4000}{8000} * 100 = 50\%$
1960	17000	5000	$\frac{5000}{12000} * 100 = 41.6\%$
1980	22500	5500	$\frac{5500}{17000} * 100 = 32.3\%$

Avg = 4833.33 Avg :- 41.3%.

Geometrical increase method :-

$$P_n = P\left[1 + \frac{IG}{100}\right]^n$$

$\therefore P_{1980} = 22500\left[1 + \frac{41.3}{100}\right] = 31794.7$.

$\therefore P_{1990} = 31794.7\left[1 + \frac{41.3}{100}\right]^1 = 44925.48$

$\therefore P_{2000} = 44925.48\left[1 + \frac{41.3}{100}\right]^1 = 63479.5$

(*) Incrimental increase method :-

It is Calculated by

$$P_n = P + n\,[I_a + I_c]$$

Where I_a = Arthemetic increase.

I_c = Average incremental increase.

* The population figures of a town as per the census records are given below for the years 1911 to 1971. assuming that the scheme of water supply will be commence to function from 1976. It is required to estimate the population after 30 years. i.e; in 2006 and also intermidiate population, i.e; 15 years after 1976.

Year	1911	1921	1931	1941	1951	1961	1971
population	40185	44522	60395	75614	98886	124230	158800

Sol:-

Year	population	Increase in population (I_a)	Incremental (I_c) Increase
1911	40185		
		4335	(15873 - 4335)
1921	44522		11536
		15873	
1931	60395		655
		15218	
1941	75614		8054
		23272	
1951	98886		2072.
		25344	
1961	124230		9226
		34570	
1971	158800		

I_a = 19769 I_c = 6046.6

Incremental Increase Method:-

We know that

$$P_n = P + n[I_a + I_c]$$

$$P_n = 158800 + 0.5[19769 + 6046.6]$$

$$P_{1976} = 171707.8$$

for 30 years

$$P_{2006} = 171707.8 + 3[19769 + 6046.6]$$

$$P_{2006} = 249154.6$$

Intermidiate after 1971 + 15 years

$$P_{1991} = 249154.6 + 9.5[19769 + 6046.6]$$

$$P_{1991} = 287878$$

Decreasing rate method :-

* The population of 5 decades from 1940 to 1980 as given. find out the population 1990, 2000 and 2010. by using decreasing rate of growth method ?

Year	1940	1950	1960	1970	1980
Population	25000	28000	32500	40,000	45000

Sol:-

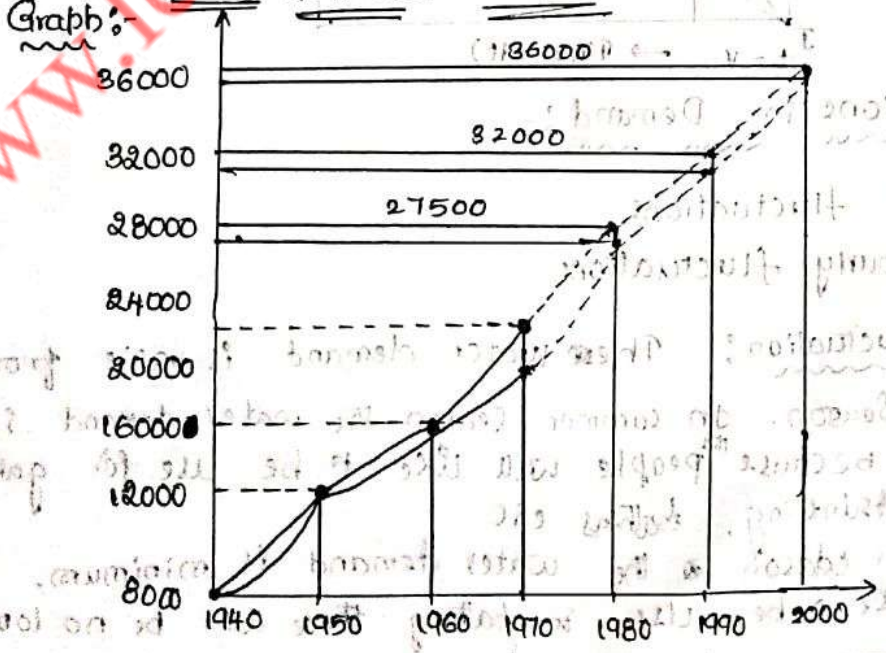
Year	Population	Increase in Population	% increase in population	decreasing in increasing pop
1940	25000			
		3000	12 %	
1950	28000			- 4.1 %
		4500	16.07 %	
1960	32500			- 7.1 %
		7500	23.07 %	
1970	40,000			+ 10.6 %
		5000	12.5 %	
1980	45,000			
Total	20,000	← 18000	63.7 %	- 0.6 %
Avg	5,000		16 %	- 0 %

to Calculating 1980, 1990, 2000 we know

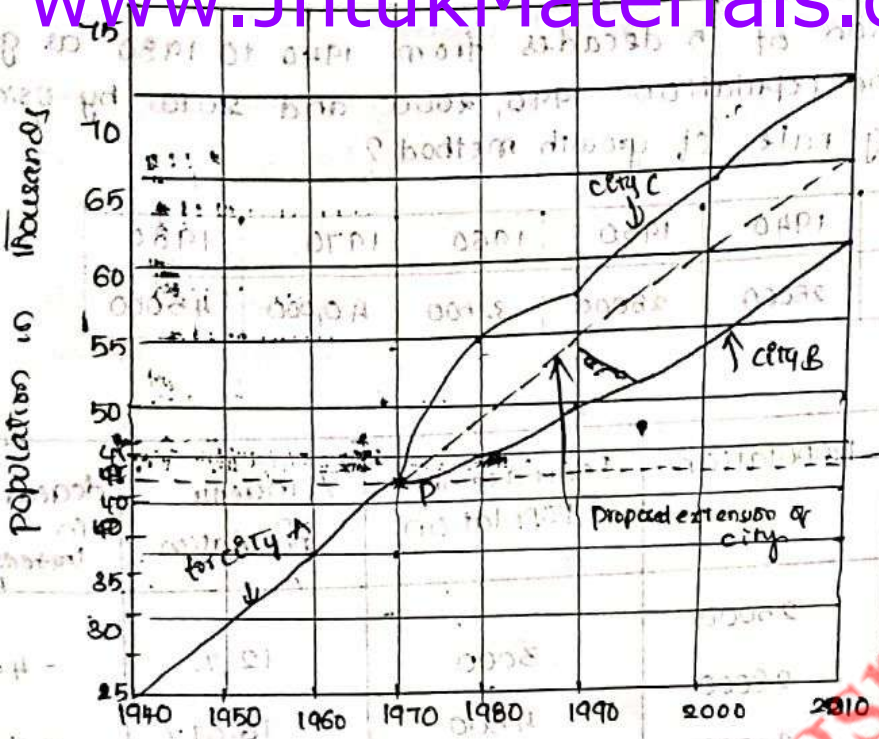
Year	Net % of population	Population
1990	12.5 - (-0.2 %) = 12.7 %	$45000 + \frac{12.7}{100} \times 45000$ = 50715
2000	12.7 - (-0.2 %) = 12.9 %	$50715 + \frac{12.9}{100} * 50715$ = 101430.12
2010	12.9 - (-0.2 %) = 13.1 %	$101430.12 + \frac{13.1}{100} \times 101430.12$ = 114717.46

Simple Graphical method :-

Graph :-

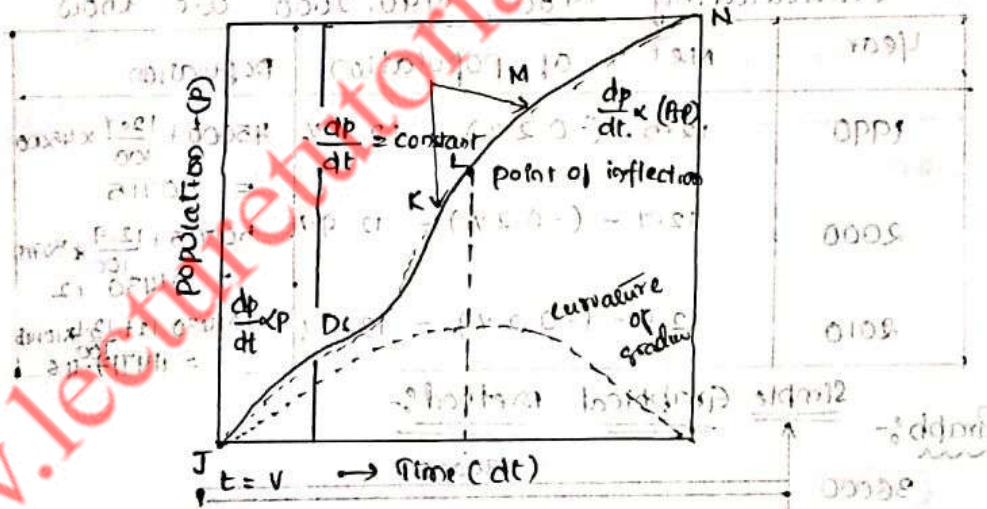


Comparitive graphical method :-



Simple Grabhical method is used for population forecasting to plot the suitable scale graph with respect to indicat

LOGISTIC Method :-



fluctuvations in Demand :-

① Seasonal fluctuations
② Daily/hourly fluctuations

Seasonal Fluctuation :- There water demand is varie from Season to Season. In summer season the water demand is maximum. because the people will like to be use for gardening washing, drinking, bathing etc

* In winter season the water demand is minimum. the people like to be use in bathing there will be no looming.

Daily / fluctuation (or) hourly fluctuation :-

Max. Daily (or) hourly fluctuations = 1.5* Avg hourly consumption of the max. day

* In sunday's and other holydays the peak hours about 8am due to late awakening where as it may be 6am - 10am

Factors effecting of water demand :-

① climatic conditions ② size of community
③ Living standards of people ④ Industrial & commercial activities
⑤ Pressure in the distribution system
⑥ System of Sanitation ⑦ Cost of water.

LOGISTIC CURVE :-

The point of fluctuation is "L"

$$\log_e\left(\frac{P_s - P}{P}\right) - \log_e\left[\frac{(P_s - P_0)}{P_0}\right] = -K \cdot P_s \cdot t$$

Where

P_s = Saturation population,
P_0 = The population of the town at point "j"
K = Constant
T = population at the time from the origin

(*)

Year	1960	1970	1980
Population	35000 (P_0)	78000 (P_1)	115000 (P_2)

Sol:- Given data is

$t_0 = 0$, $t_1 = 10$ and $t_2 = 20$

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

$$P_s = \frac{2 * 35000 * 78000 - (78000)^2 (35000 + 115000)}{(35000 * 115000) - (78000)^2}$$

$\therefore P_s = 138271.0053$

$$m = \frac{138271.005 - 35000}{35000} = 2.95$$

$$n = \frac{2.3}{t_1} \log_{10}\left[\frac{P_0 (P_s - P_1)}{P (P_s - P_0)}\right]$$

$$n = \left[\frac{35000\,(138271.0053 - 78000)}{78000\,(138271.0053 - 35000)}\right] \frac{2.3}{t_1} \log_{10}$$

$$n = 0.23 \log_{10} (0.2619)$$

$$\boxed{n = 0.42}$$

$$P = \frac{P_s}{1 + m \log_e^{-1} (n \cdot t)}$$