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Leading Institute for ESE, GATE & PSUs

**ENVIRONMENTAL
ENGINEERING**

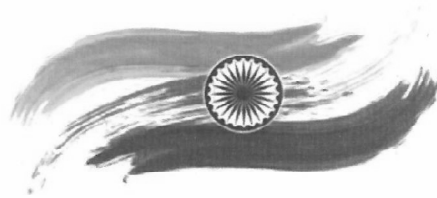
**CLASSROOM
NOTES**

~ Session : 2027-28 ~

Faculty : Sagar Dodeja (Ex. IES)

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5 RULES OF PREPARATION

1. *Jaan Laga Do Ya Jaane Do*
2. *Practice & Revise Not Until You Are Right, Do It Until You Cannot Get It Wrong*
3. *The Key to Effective Time Utilisation is to Follow The Teacher As It Is*
4. *A Systematic Approach Is Always The Right Approach*
5. *Pray Daily*

JAI HIND



ENVIRONMENTAL ENGINEERING FOR ESE AND GATE

BY
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SR. FACULTY, MADE EASY

INSTRUCTIONS

These interactive notes are designed exclusively for Made Easy Classroom Students and Made Easy Online Students. While these notes provide a comprehensive overview of the fundamental concepts, it is essential to attend lectures regularly for in-depth explanations and the resolution of Workbook questions.

All blank spaces within the notes are intentionally left for students to fill in during lectures, facilitating active participation and retention of the material.

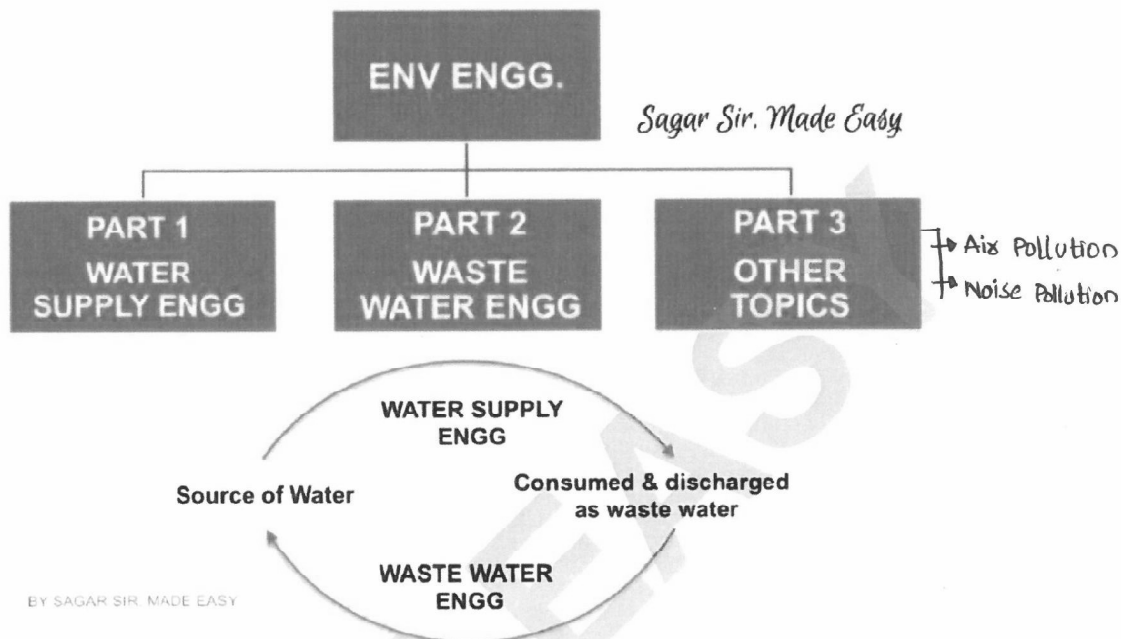
It is strongly recommended that students maintain a separate notebook which span approximately 200 pages. This separate notebook will serve as a valuable resource for solving Workbook questions and ensuring comprehensive understanding of the subject matter.

These notes have been extensively tested and proven effective on thousands of students, demonstrating their ability to enhance academic performance and reduce time spent on problem-solving.

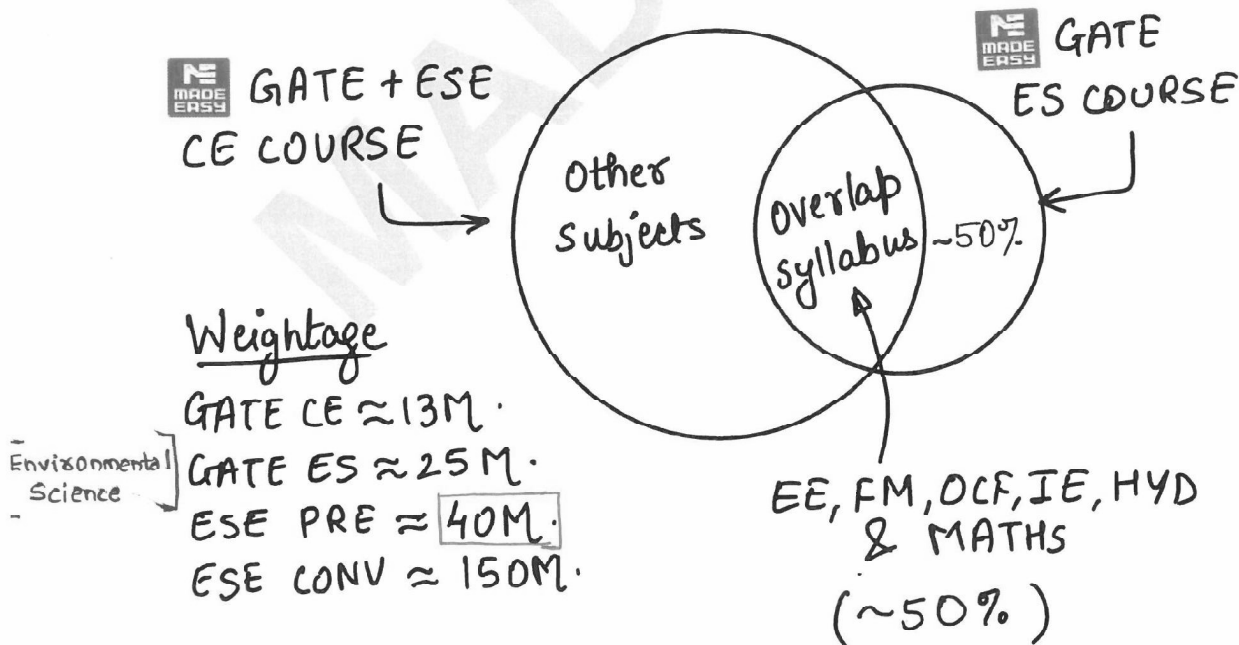
By utilizing these notes, students can concentrate solely on concept development and problem-solving skills. The clear and concise presentation of basic theory, diagrams, and facts in the notes minimizes the likelihood of errors during writing and facilitates a deeper understanding of the subject matter.

Let's Begin

INTRODUCTION



SYLLABUS OF GATE CE AND ES COURSE



WHAT IS ENVIRONMENTAL ENGINEERING ?

- Environmental Engineering is a multi disciplinary branch of Engineering which deals with the interaction between Biotic & Abiotic components of the Environment.
- The Biotic Components includes Humans, Animals, Plants, insects, Microorganisms etc.
- The Abiotic Components include Air, soil, Water & Rocks.
- In India, the rules & Regulations are given in various IS Codes & G.O.I (govt. of India) Manuals.
- Various Ministries and agencies are responsible for formulating & enforcing these rules.

AGENCIES:

- 1) MOEFCC → Ministry of Environment, Forest & Climate Change
 - 2) M.O.U.D → Ministry of Urban Development
 - 3) CPCB → Central Pollution Control Board
 - 4) SPCB → State Pollution Control Board
 - 5) CPHEED → Central Public Health Environmental Engineering Organisation
 - 6) SPHE → State Public Health Education (Urban Local Bodies)
 - 7) PCC → Pollution control Committees.
- } * Inspector like Posts

ACTS:

- ① Water Act, 1974 → Regulated factories causing Water Pollution
- ② Air Act, 1981 → Regulated factories causing Air Pollution.
- ③ Environment (Protection) Act, 1986 →
 - Umbrella Act for both Water & Air
 - Did not consider Role of Public
 ↳ EPA, 1991 [Modified] →
 - Considered the Role of Public
 - Pan & Aadhar gets fined if caught littering [1 April, 2026]
- ④ National Green Tribunal (NGT) Act, 2010 → All members are from Env. engg. background.

REMEMBER

APPENDIX

I. Useful Elements, Atomic Numbers & Masses.

| Element | Atomic Number | Atomic Mass | Element | Atomic Number | Atomic Mass |
|-----------|---------------|-------------|------------|---------------|-------------|
| Aluminium | 13 | 27 | Nitrogen | 7 | 14 |
| Boron | 5 | 11 | Oxygen | 8 | 16 |
| Calcium | 20 | 40 | Phosphorus | 15 | 31 |
| Carbon | 6 | 12 | Potassium | 19 | 39 |
| Chlorine | 17 | 35.5 | Silicon | 14 | 28 |
| Copper | 29 | 63.5 | Silver | 47 | 108 |
| Fluorine | 9 | 19 | Sodium | 11 | 23 |
| Hydrogen | 1 | 1 | Sulphur | 16 | 32 |
| Iodine | 53 | 127 | Zinc | 30 | 65 |
| Iron | 26 | 56 | | | |
| Magnesium | 12 | 24 | | | |
| Manganese | 25 | 55 | | | |

II. SI Units

1. Length - m
2. Mass - kg
3. Time - s
4. Electric current - A (Ampere)
5. Temperature - K
6. Amount of substance - mol (mole)
7. Force - N ($\text{kg} \cdot \text{m} / \text{s}^2$)

8. Pressure - Pa ($\text{kg}/\text{m}\cdot\text{s}^2$)
9. Energy or work - J ($\frac{\text{kg}\cdot\text{m}^2}{\text{s}^2}$ or N-m)
10. Power - W ($\frac{\text{kg}\cdot\text{m}^2}{\text{s}^3}$ or J/s)
11. Electric Charge - C (A-s)
12. Dynamic Viscosity - Pa-s or $\frac{\text{N}\cdot\text{s}}{\text{m}^2}$ [Absolute Viscosity]
13. Kinematic Viscosity - $\frac{\text{m}^2}{\text{s}}$

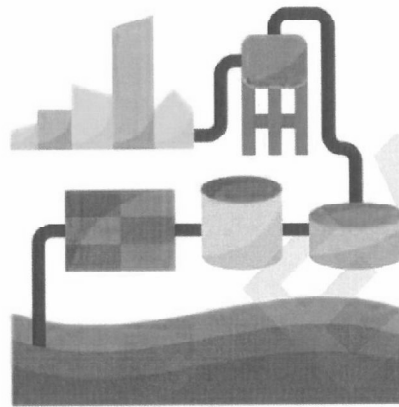
III. Some Standards

1. $g = 9.81 \text{ m/s}^2 = \underline{32.174 \text{ ft/s}^2} \approx [32.2 \text{ ft/s}^2]$
2. 1 bar = 10^5 N/m^2
3. 1 atm = 101.325 kN/m^2
= 101.325 kPa
= 1.013 bar
= 10.333 m of water
4. 1 HP = 746 W
1 W = 0.0013 HP
5. 1 ha = 10^4 m^2
6. 1 acre = 4046.86 m^2
7. 1 kW-h = 3600 kJ
8. 1 Cal = 4.184 J
9. 1 MLD = 10^6 l/d
10. 1 MGD = $3.785 \times 10^6 \text{ l/d}$

[1 Gallon = 3.785 litres]
11. 1 day = 86400 seconds (s)

- Ch ① → Water Demand
- Ch ② → Sources of Water
- Ch ③ → Water Quality Parameters
- Ch ④ → Water Treatment
- Ch ⑤ → Water Distribution

(in sequence)
↓



START OF
WATER SUPPLY ENGINEERING

CHAPTER 1 WATER DEMAND

* Introduction

- Water demand implies water quantity estimation.
- Water demand computation requires the following data:-

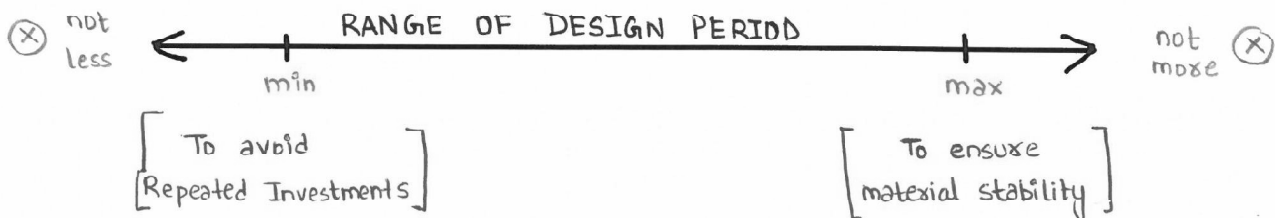
1. Forecasted Population
2. Rate of Consumption (litres per capita per day or lpcd or l/c/d or $\frac{l}{c \times d}$)

Unit of Water Demand is MLD usually. (1MLD = 10^6 l/d)

* Design Period

- The quantity of water is worked out with due provision for requirement of future.
- The future period for which the water supply scheme is designed to cater for the future population is referred as DESIGN PERIOD.
- Design Period should always be in a range.

Note :-



PART 1

Population Forecasting $\begin{cases} \nearrow \text{Mathematical Methods} \\ \searrow \text{Graphical Methods.} \end{cases}$

* Mathematical Methods

1. Arithmetic Increase Method
2. Geometric Increase Method.
3. Incremental Increase Method.
4. Decreasing Rate of Growth Method.

ARITHMETIC INCREASE METHOD (AIM)

- Assumption \rightarrow population increases at a constant rate.
- It is used for those cities which are sufficiently large and are already established.

Process :-

| Year | Population (thousands) | Increase in Population (α) |
|------|------------------------|-------------------------------------|
| 1981 | 60 | 15 (α_1) |
| 1991 | 75 | 23 (α_2) |
| 2001 | 98 | 32 (α_3) |
| 2011 | 130 | |

$P_0 \rightarrow$ Last known Population

$P_1 \rightarrow$ Population after 1 step after P_0

(the step can be Decade, year, month, so on.)

$$P_n = P_0 + n \cdot \bar{\alpha}$$

$$n = \frac{\text{Asked year} - \text{last known year}}{\text{Year Gap}}$$

$\bar{\alpha} =$ Average Past increase