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CHAPTER 1:

INTRODUCTION TO ENVIRONMENTAL ENGINEERING.

Engineering:

Engineering is a profession that applies mathematics and science to utilize the properties of matter and sources of energy to create useful structures, machines, products, systems and processes.

Engineer:

Engineers are professionals who invent, design, analyze, build and test machines, structures & system applying their field knowledge, creativity, and knowledge.

Environmental Engineering:

Environmental engineering is the application of engineering principles, under constraint, to the protection and enhancement and ~~prod~~ protection of public health and welfare.

(*): Focus of ENE:

(i): Controlling water, soil, atmospheric and sound pollution.
(ii) To design, build and operate waters and wastewater treatment plants.

(iii) To build and operate solid waste collection, transportation and disposal system.
(iv) To carry out environmental assessment of projects and products {EIA = Environmental Impact Assessment}
(v) To provide inputs in decision making regarding the environmental issues of development sector and welfare of people.

Engineering Projects:

Engineering projects is a product being designed or a service to be provided that encompasses series of decisions made by engineers for its implementation.

Engineering projects may be large or small and most engineering projects improve human civilization, protect the global environment and enhances integrity of the profession.

*) Projects in my Province:

1: Fast track — Cost: Rs 213 billion
Length: 72·5 km.

2: Nagdhunga Tunnel — Cost: Rs 22·14 billion.
{NEA govt: 5·85 billion
JICA: 16·5 billion.}
Length: 2680 m
(8·3 m high, 9·5 m wide)

Engineering Decision:

Engineering decision is a choice made by the engineer to solve the problem presented. While making engineering decisions, the following aspects have to be considered:

i) Technical Analysis
ii) Cost effective Analysis
iii) Cost Benefit Analysis
iv) Risk Analysis
v) Environmental Impact Analysis
vi) Ethical Analysis.

i) Technical Analysis:

The technical decisions made by engineers for solving a given problem must be quantifiable {suitable technical solutions}.
The technical decision can also be evaluated and checked by other professional engineers.

If we don't have complete data for during analysis, we make assumptions to build the best decision technically.

(ii): Cost Effective Analysis:

Engineering decisions must also consider cost effectiveness. Engineers must decide on the lowest total cost alternative.
Annual cost or present worth ~~is~~ are most ~~aff~~ accepted ways for comparing alternate action courses.

→ IRR: Internal Rate of Return.

IRR is an indicator that reflects profits of projects.
While deciding on final engineering decision on projects that have same investment cost, the highest IRR is considered better.

iii) Cost Benefit Analysis:

Cost Benefit analysis is checked by comparing the ratio of benefit with cost during engineering decision.

If (Benefit / Cost) = > 1.0, this means that the benefit of the project is greater than the initial loss caused by its cost. Hence, project is considered worthwhile.

iv) Risk Analysis:

Any engineering decision must inculcate risk analysis on different sectors of environment, human life, professions, etc.
Factors that are considered during risk analysis are : source of pollutants, type of pollutants, expose to health problems, expense on reducing risks, etc.

(v): Environmental Impact Analysis:

Any engineering decision must consider its impact upon the environment that could happen in planning, implementation and operational phase.

EIA is done through many methods of assessment.

If any engineering projects contribute more negative impact on the environment ~~during~~ overtime and which cannot be reversed, than the decision is not considered viable.

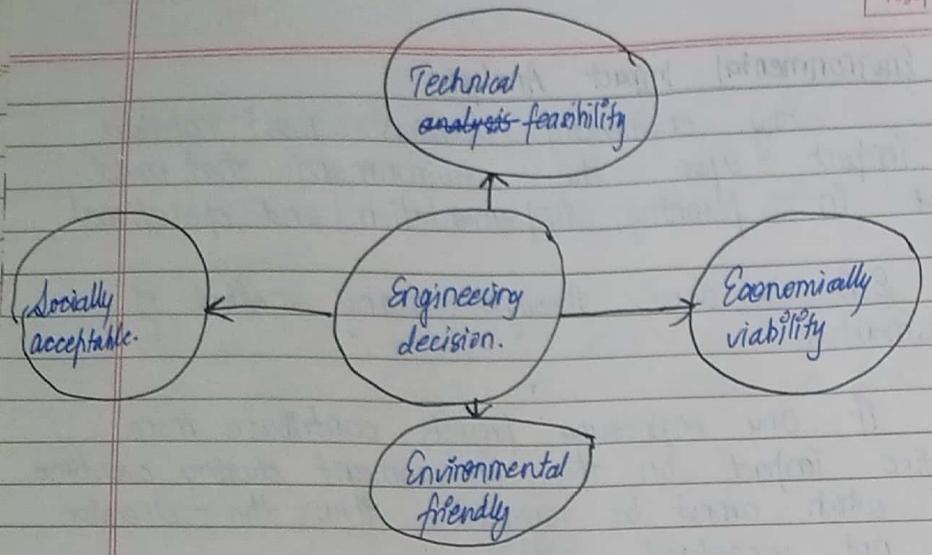
Hence, projects overally must not deteriorate the condition and negatively impact environmental conditions.

(vi): Ethical Analysis:

Any engineering decisions must also consider social impacts of the projects.

Hence, the projects impact on local communities, public health, cultural heritage, overally quality of life with understanding the needs of the people. So, decisions must be ethical and not violate ethics of society.

Thus, engineering decisions must consider all the above mentioned factors for viability and sustainability of any engineering projects.



<Q>: A town with 4000 residents wants to establish a municipally owned and operated garbage collection program. They can purchase one of the following trucks with capacities.

Truck A: $8\ m^3$
Truck B: $6\ m^3$
Truck C: $4\ m^3$

If truck collects truck everyday and is only allowed one trip per day, which truck is best and sufficient?

Sol^n:

Here, we don't have data on waste generation and the amount of waste truck can compact.

Thus, these values need to be assumed.

Given,

truck A = $8\ m^3$
truck B = $6\ m^3$
truck C = $4\ m^3$

Let us assume the per capita waste generation is 0.8 kg per person per day.

Then,

total waste generation of town = Total population x Per capita waste generation

$= 4000 \times 0.8$ kg
$= 3200$ kg/day

Let us assume the truck can compact waste upto 450 ~~385~~ kg/m^3.

Thus, the required truck capacity = $\frac{\text{Total waste generated}}{\text{Compact waste capacity}}$

$= \frac{3200}{\cancel{385}\ 450}$
$= 7.11\ m^3/\text{day}$

Conclusion: Thus, based on given assumptions, we can see that the truck A is the truck technically feasible.