

Introduction to Engineering Economics

By
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Subject: 6ETC05: ENGINEERING ECONOMICS

▶ **Course Objectives:**

- ▶ 1. To familiarize the basic concepts and structure of Engineering Economics
- ▶ 2. To understand different principles of Engineering Economics
- ▶ 3. To learn the concepts Production and cost associated with it
- ▶ 4. To learn different types of cash flow
- ▶ 5. To learn depreciation analysis
- ▶ 6. To understand the concept of Banking system in India

▶ **Course Outcomes:**

- ▶ Upon successful completion of this course, the student will be able to:
- ▶ 1. Learn basics of Engineering Economics
- ▶ 2. Understand and compute the production cost
- ▶ 3. Study different cash flow methods
- ▶ 4. to evaluate Engineering alternatives
- ▶ 5. Understand depreciation analysis
- ▶ 6. Understand Indian Banking System

Subject: 6ETC05: ENGINEERING ECONOMICS

▶ Unit-1

- ▶ Definition and Scope of Engineering Economics , Subject Matter of Economics,
- ▶ Principles of Engineering Economics, Micro-economics Vs Macro-economics , Utility
- ▶ Analysis, Laws of diminishing utility analysis, derivation of demand curve and law of Demand, Elasticity of demand

6

▶ Unit-2

- ▶ Theory of Production: Theory, Importance, Isoquants and its properties, Marginal rate of Technical substitution, Law of variable proportions, Returns to Scale, Cost of Production and Cost of Curves, The law of supply, Price determination

6

▶ Unit-3

- ▶ Time value of Money, Techniques for adjusting time value of money, Uniform Gradient series factor, annuity, annuity due, calculation of deferred annuity , Types and components of cash flow, cash flow diagrams, principles of equivalence, Uses, significance and limitation of Cash flow statement

6

▶ **Unit-4**

- ▶ Evaluation of Engineering alternatives, Present worth method, Future worth Method,
- ▶ Equivalent annual worth comparison , Rate of return method, Project evaluation and Cost
- ▶ benefit analysis 6

▶ **Unit-5**

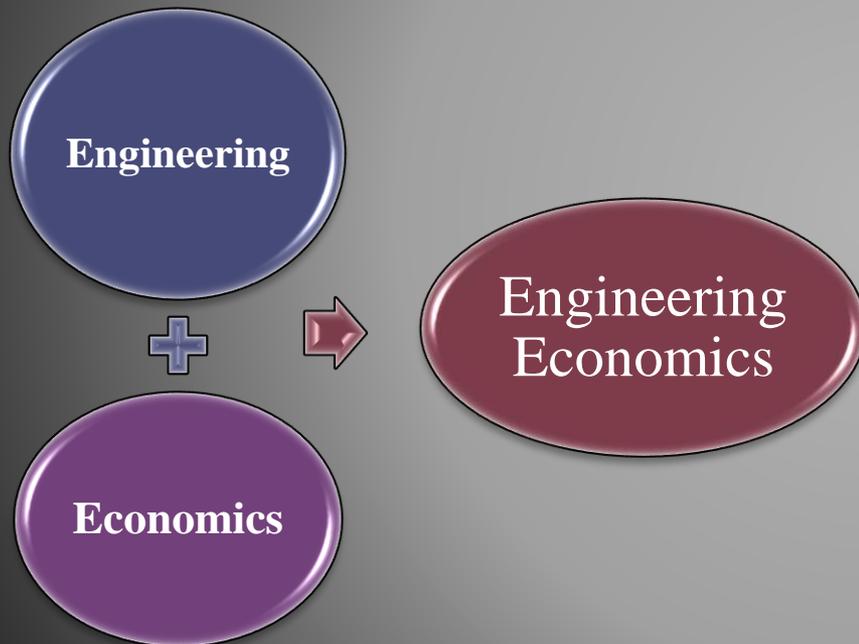
- ▶ Depreciation Analysis, Causes of depreciation, Depreciable property, depreciation methods, Digit method, Break even analysis, determination of breakeven point,
- ▶ Breakeven point in terms of quantity, sales and as percentage of capacity, Break even
- ▶ chart, Breakeven analysis assumptions, Managerial uses, Limitations 6

▶ **Unit-6**

- ▶ Commercial Banking, Functions of Commercial Banks , Role of Commercial banks in
- ▶ developing economy, sound baking system for under-developed countries, types of
- ▶ banks, balance sheet of a bank, New developments in banking system. 6

▶

ENGINEERING ECONOMICS



What is Economics ?

A social science of how limited resources are used to satisfy unlimited human wants

What is Engineering ?

Engineering is the application of scientific, economic, social, and practical knowledge, in order to design, build, and maintain structures, machines, devices, systems, and materials

Why?

- ▶ To learn way of thinking.
 - a. Opportunity cost–Trade off
 - b. Marginal cost
 - c. Working of efficient market.
- ▶ To understand society.
- ▶ To understand global affairs
- ▶ To be an informed citizen.

Resources

LAND OR NATURAL RESOURCES

All gifts of nature, such as: water, air, minerals, sunshine, plant and tree growth, as well as the land itself which is applied to the production process.



LABOR

The efforts, skills, and knowledge of people which are applied to the production process.



CAPITAL



Real Capital (Physical Capital)

Tools, buildings, machinery -- things which have been produced which are used in further production

Financial Capital

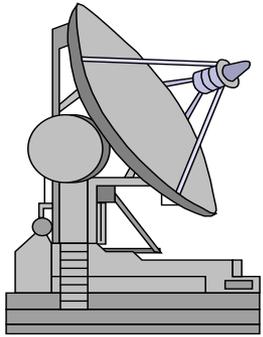
Assets and money which are used in the production process

Human Capital

Education and training applied to labor in the production process.

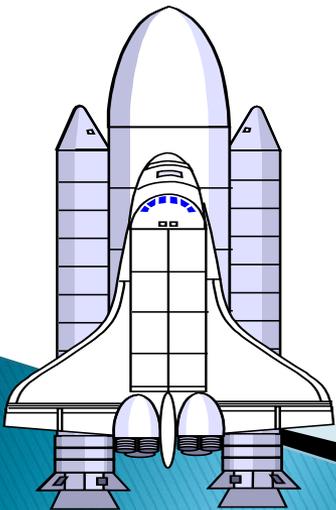


Engineering Economics, previously known as engineering economy, is a subset of economics for application to engineering projects

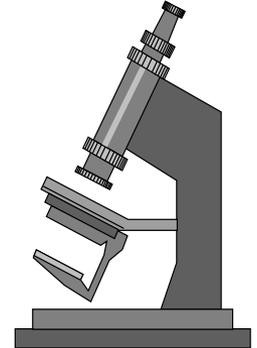
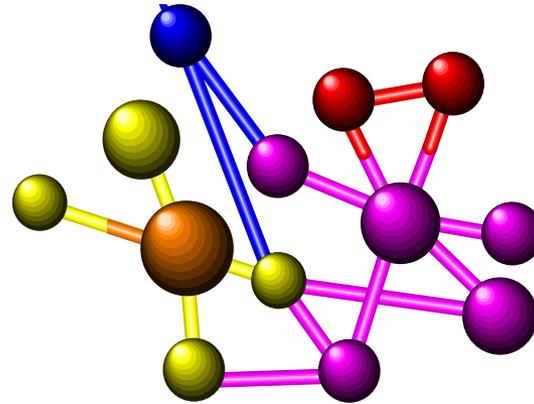


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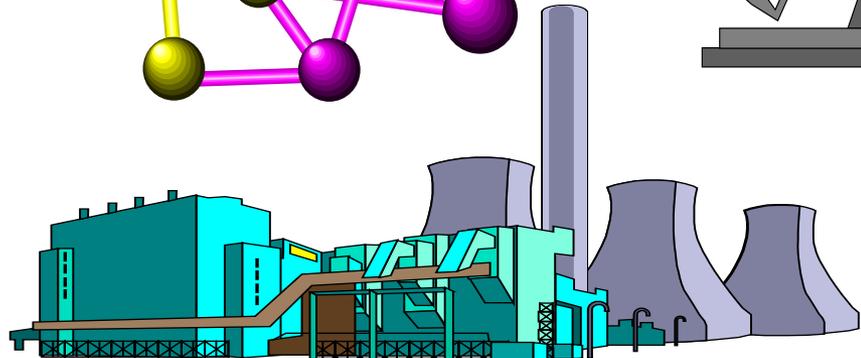
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WHY DO ENGINEERS NEED TO LEARN ABOUT ECONOMICS?

- ▶ Ages ago, the most significant barriers to engineers were technological. The things that engineers wanted to do, they simply did not yet know how to do, or hadn't yet developed the tools to do. There are certainly many more challenges like this which face present-day engineers
 - *Natural resources (from which we must build things) are becoming more scarce and more expensive*
 - *Negative side-effects of engineering innovations (such as air pollution from automobiles)*
- ▶ Engineers must decide if the benefits of a project exceed its costs, and must make this comparison in a unified framework. The framework within which to make this comparison is the field of engineering economics, which strives to answer exactly these questions, and perhaps more.

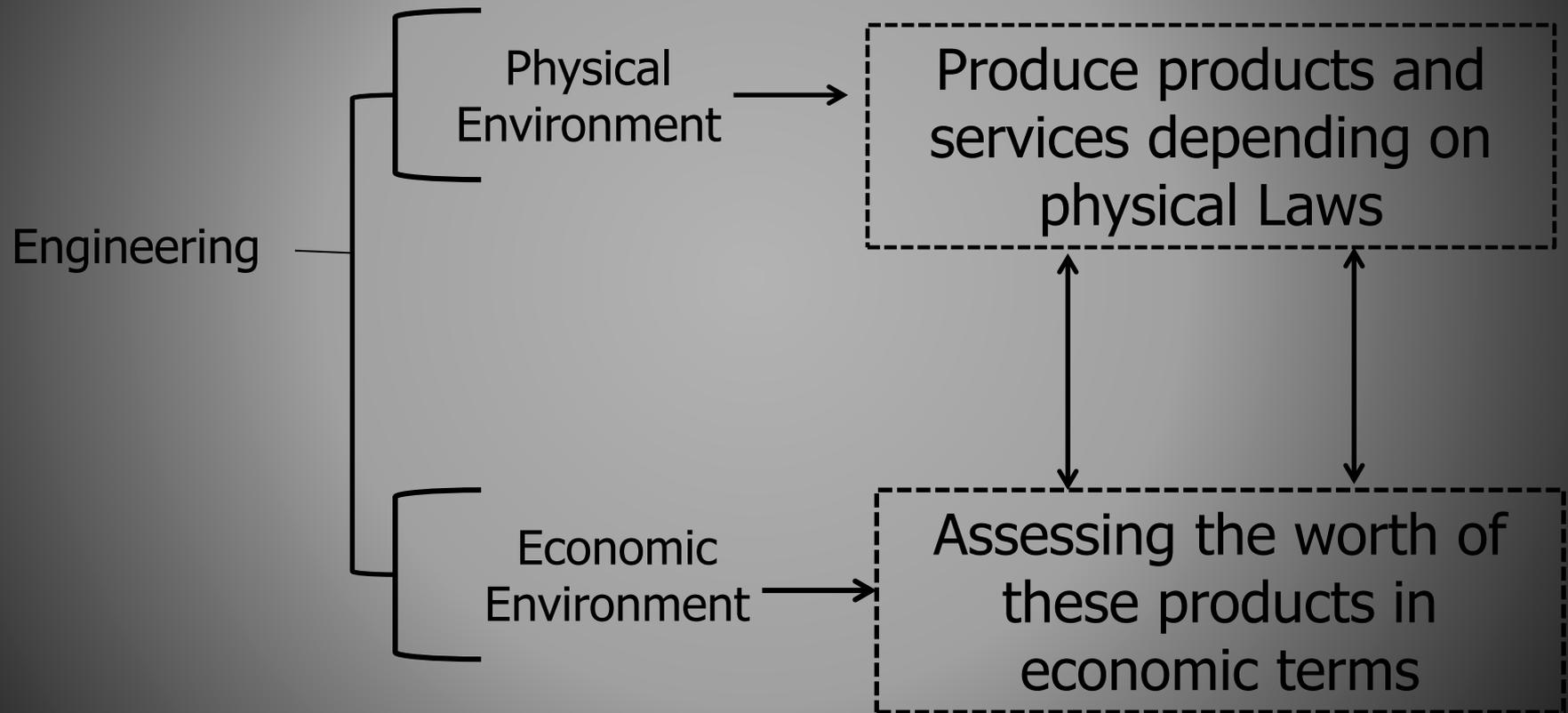
Reasons

- ▶ Market
- ▶ Demand
- ▶ Balance of Demand & Supply
- ▶ Efficiency

What is Engineering Economics?

- Engineering Economics is about making decisions
- Engineering Economics assesses the appropriateness of a given project, estimates its value, and justifies it from an engineering standpoint
- Engineering Economics is the application of economic techniques to the evaluation of design and engineering alternatives

How Engineering is composed of physical and economic components



Physical Efficiency = System Output / System Input

Economic Efficiency = System Worth / System Cost

Engineering Economics: Origins

- ▶ The development of EI methodology is relatively recent
- ▶ A pioneer in the field was Arthur Wellington, a civil engineer, who at the end of 19th century addressed the role of economic analysis in engineering projects (his area of interest was railroad building in the USA)
- ▶ This early work was followed by other contributions in which the emphasis was put on techniques that depended on financial mathematics. In 1930, Eugene Grant published a textbook which was a milestone in the development of engineering economy as we know it today (economic point of view of engineering)
- ▶ In 1942 Woods and DeGarmo wrote a book, later titled Engineering Economy

SCOPE OF ENGINEERING ECONOMICS

- ▶ 1. Engineering economics plays a very major role in all engineering decisions.
- ▶ 2. It is concerned with the monetary consequences, financial analysis of the projects, products and processes that engineers design.
- ▶ 3. Engineering economics helps an engineer to assess and compare the overall cost of available alternatives for engineering projects.
- ▶ 4. According to the analysis an engineer can take decision from the alternative which is more economic.
- ▶ 5. Engineering economics concepts are used in the fields for improving productivity, reducing human efforts, controlling and reducing cost.
- ▶ 6. Engineering economics helps to understand the market conditions general economic environment in which the firm is working.
- ▶ 7. It helps in allocating the resources.
- ▶ 8. Engineering economics helps to deal with the identification of economic choices, and is concerned with the decision making of engineering problems of economic nature.

Principles of Engineering Economy

1. Develop the Alternatives

- Creativity and innovation are essential to the process
- The alternatives need to be identified and then defined for subsequent analysis
- Consider the status quo, but do not focus on it(i.e., doing nothing)

2. Focus on the Differences

- Only the differences among alternatives are relevant to comparison and decision

3. Use a Consistent Viewpoint (perspective)

4. Use a Common Unit of Measure

- Use it for enumerating as many possible outcomes as possible, since it simplifies the analysis of alternatives

5. Consider All Relevant Criteria

- Consider both those that can be measured in monetary terms and “non-monetary” criteria

6. Make Uncertainty Explicit

7. Revisit Your Decisions: compare initial projected outcomes with actual results achieved

Micro-economics Vs Macro-economics

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Microeconomics vs Macroeconomics

Analyzes demand and supply of labor

01

Analyzes total employment in the economy

Study of decisions made by individuals and businesses

02

Study of decisions made by governments in a country

Deals with household and firm decisions

03

Deals with performance and behavior of the entire economy

Examines the individual market's behavior

04

Analyzes the sum total of the economic activity

Bottom-up approach

05

Top-down approach

Investors generally focus in-depth on microeconomics

06

Seasoned investors pay little attention to macroeconomics

Value and Utility

- ▶ **Value** is the worth that a person attaches to a good or service
- ▶ Value is inherent in a regard a person has for it, not in the item itself
- ▶ Value is not the cost of the item

- ▶ **Utility** is a power to satisfy human wants and is determined subjectively
- ▶ Utility is the satisfaction that a person derives from an item

Exchange

- ▶ Without the subjectivity of the concepts “value” and “utility” there would hardly be any room for exchange between people. **Why?**
- ▶ Through exchange we can increase the total utility of the goods and services. **How?**
- ▶ Exchange is possible when it is mutually beneficial

Utility Analysis

- ▶ The primary focus of utility analysis is on the satisfaction of wants and needs obtained by the consumption of goods. This is technically termed utility.
- ▶ **Concept of utility** There are three concept of utility:
- ▶ Initial utility:
- ▶ Marginal Utility:
- ▶ Total Utility:

- ▶ 1. Initial Utility: The utility derived from the first unit of a commodity is called initial utility. Utility of the first bread is called initial utility. It is always positive.
- ▶ 2. Marginal Utility: Marginal Utility means the addition made to the total utility by the marginal unit. Suppose four loaves of bread gives $10+9+7+4=30$ units of utility, while the three loaves had given $10+9+7=26$ units, the addition made by the fourth loaf is $30-26=4$. therefore the marginal utility of fourth loaf is equal to 4.

- ▶ 3) Total Utility: the total utility derived by a person from the total number of units of a commodity consumed by a person is called total utility. In simple words, if a person consumes four loaves of bread, then the total amount of utility will be equal to the sum total of the utility derived from the 1st, 2nd, 3rd, 4th, loaf.

Laws of diminishing utility analysis

- ▶ It is a psychological fact that when a person acquires more and more units of the same commodity during a particular time, the utility he derives from the successive units will diminish.
- ▶ In other words, the additional satisfaction derived from the additional units of a commodity goes on decreasing .
- ▶ H Gossen was the first economist to explain the law of diminishing marginal utility, and the law of equi marginal utility in 1854. W.S Jevons named them as Gossen first and second laws of consumption (1871). In 1890 Marshall in his “Principle of Economics” developed this analysis in a refined manner

Cont...

- ▶ The law of diminishing marginal utility is based on the cardinal measurement of utility.
- ▶ Utility is measured in terms of money.
- ▶ The law assumes that the marginal utility of money is constant.
- ▶ There should not be any time gap between the consumption of one unit and the other unit.
- ▶ The units of the commodity are homogeneous.
- ▶ The consumer is assumed to be a rational economic man. He has the knowledge about the market.

Demand

- ▶ Demand is an economic principle referring to a consumer's desire to purchase goods and services and willingness to pay a price for a specific good or service.
- ▶ Holding all other factors constant, an increase in the price of a good or service will decrease the quantity demanded, and vice versa.
- ▶ Demand is the number of goods or commodities, which a consumer is both, willing, and able to buy, at each possible price during a given period of time.

Demand Curve



Elasticity of Demand

- ▶ Elasticity of demand is an important variation on the concept of demand. ... An elastic demand is **one in which the change in quantity demanded due to a change in price is large**. An inelastic demand is one in which the change in quantity demanded due to a change in price is small.
- ▶ On the basis of different factors affecting the quantity demanded for a product, elasticity of demand is categorized into mainly three categories:
- ▶ **Price Elasticity of Demand (PED)**
- ▶ **Cross Elasticity of Demand (XED)**
- ▶ **Income Elasticity of Demand (YED).**

Elasticity Demand Curve

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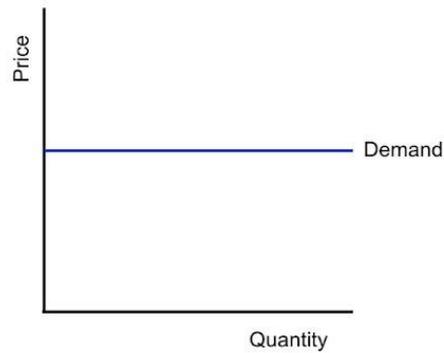


Figure 1: Perfectly Elastic Demand

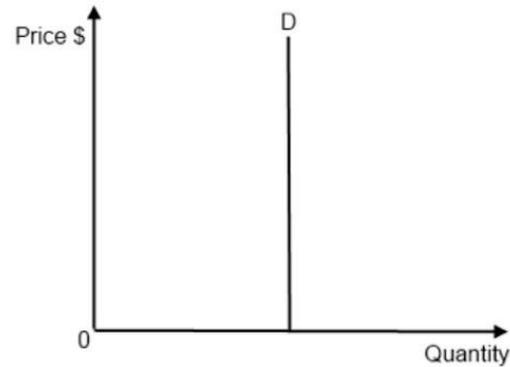


Figure 2: Perfectly Inelastic Demand

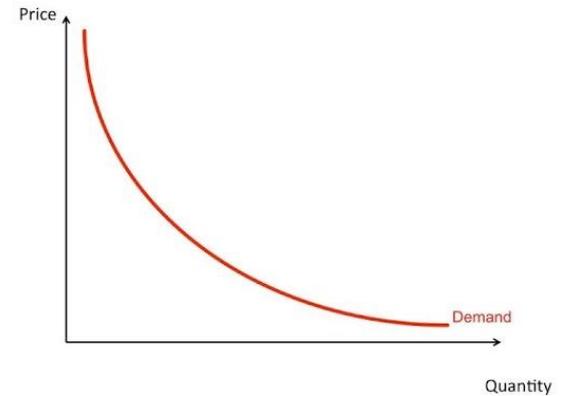


Figure 3: Unitary Elastic Demand

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