Engineering Economics

G.C. Sapna

Assistant Professor, MTU

NET-JRF/ GOLD MEDALIST IN ECONOMICS

UNIT 1

Definitions, basic concepts of economics: cost, efficiency and scarcity, opportunity cost, types of economics: micro economics, macroeconomics and managerial economics, difference between micro economics and macroeconomics, application of managerial economics. 6 hours

UNIT 2 MICRO ECONOMIICS ANALYSIS;

DEMAND ANALYSIS, SUPPLY analysis, theories of utility and consumers choice, cost analysis, competition and market structures, application of micro economics theories. 8 hours.

UNIT 1

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- **The Origins of Engineering Economics:**

- EE technique is a relatively new development.
- **Arthur Wellington,** a civil engineer, was a pioneer in the field, addressing the function of economic analysis in engineering projects around the end of the **19th century** (his area of interest was railroad building in the USA).This early work was followed by later contributions that focused on strategies that relied on financial mathematics. Eugene Grant wrote a textbook in 1930 that was a turning point in the evolution of the engineering economy as we know it today (economic point of view of engineering).Woods and De Garmo released a book called "Engineering Economy" in 1942.

. **What is Economics?** A social science of how limited resources are used to satisfy unlimited human wants

- **Prof. Lionel Robbins** defines economics as "Science which studies human behaviour as a relationship between ends and scarce means which have alternative means"
- **Alfred Marshall** defined economics as "A study of mankind in the ordinary business life, it examines that part of individual and social actions which is most closely connected with the attainment and with the use of material requisites' of well being.
- A study of how limited resources are used to satisfy unlimited human wants.
- **OBJECTIVES OF ECONOMICS**
- ▪A high level of employment ▪Price stability ▪Efficiency ▪An equitable distribution of income ▪Growth

- **Eugene Grant** is considered as the father of engineering economy.
- The application of economic principles and computations to engineering projects is known as **engineering economics.** It is critical in all branches of engineering because no matter how technically excellent a project is, if it is not economically viable, it will fail. Engineering economic analysis is frequently used to evaluate several engineering project designs in order to select the best one, taking into account both technical and economic feasibility.

Why Do Engineers Study Engineering Economics?

Engineering is the profession in which knowledge of the mathematical and natural sciences gained by study, experience, and practise is applied with judgement to develop ways to efficiently utilise the materials and forces of nature for the benefit of mankind.

Students of engineering should prepare themselves with economic empowerment so that they can manage their wealth and help them start their own business or manage their period of managerial responsibility. It is because money is one of the most important factors in completing a project.

Furthermore, fresh graduates also need to manage their wealth well since a lot of graduates are facing problems because of a lack of information about the loans that they have taken. It is necessary to strike a balance between unlimited desire and a resource-constrained world in order to maximise output (worth) given input (cost) and to take the necessary steps to maximise efficiency (output/input or worth cost).

At the beginning of the 20th century, engineers were mainly concerned with the design, construction, and operation of machines, structures, and processes. Engineers are planners and builders. They are also problem solvers, managers, and decision-makers.

The Need for Engineering Economics

- **It may be categorised into 3 programs:**

1. Profit-boosting initiatives include, for example, the development of a new product, the expansion of new production capacity, and the enhancement of the customer service centre.
2. Cost control programmes such as defect reduction programmes (because each defect is costly), efficiency improvement, waste reduction, and liability reduction programs
3. Facilities/infrastructure programmes such as the construction of roads, bridges, playgrounds, etc. These programmes are not profit-oriented but rather focus on increasing convenience and comfort at a minimum cost.

- **Decisions are classified into 3:**

1. **Expansion**; production capacity, exploring new markets for products or services.
2. **Replacement:** replacing an existing method with the optimum and least costly method, equipment, process, or location.
3. **Closure is** usually the last resort, more towards investment decisions such as closing down factories, terminating projects and others.

Nature of Economics:

The Study of Economics as a Science:

To consider something as a science, we must first understand what science is.

Science is concerned with scientific research that demonstrate a cause-and-effect link. In science, facts and numbers are carefully gathered and analysed in order to arrive at a specific conclusion.

Economics can be regarded a science because of these characteristics. However, economics is considered a social science due to the following characteristics:

1. It entails the systematic gathering of data and information.
2. It is founded on the formation of theories and laws, just like science.
3. It is concerned with the link between cause and effect.

These facts support the notion that economics is linked to science. Various economic theories, like science, are based on logical reasoning.

The Study of Economics as an Art:

The use of theories, concepts, and results to attain goals is what economics is as an art.

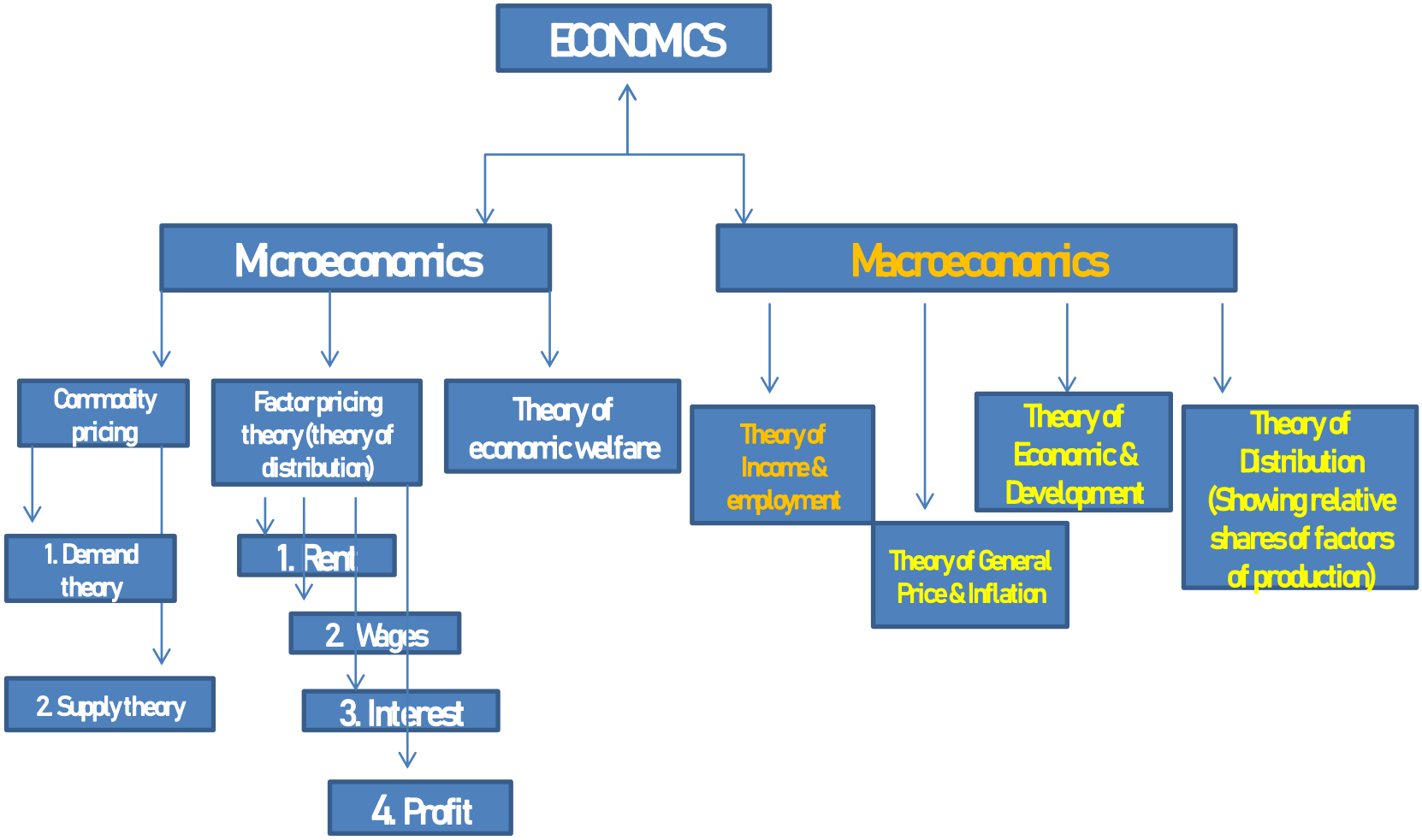
As a result, "**Economics as an Art**" refers to the practical application of scientific economic conclusions.

It comprises graphs, figures, tables, and equations, among other things. With the use of graphical representations, all of the theories in it are thoroughly described.

Furthermore, all of these theories are thoroughly described, including the definition of the relationship between economic factors and the application of theories, among other things.

Many economists have changed over time, giving their differing perspectives on economics. Some people believe that economics belongs in the category of science, while others believe it belongs in the category of art.

Scope/Subject Matter of Economics



Microeconomics and Macroeconomics

Microeconomics is the study of a single individual, organisation, or household's economic behaviour, in other words, a single unit.

Microeconomics, in other words, is the area of economics that studies the behaviour and performance of individual units, such as consumers, families, industries, and businesses.

Demand is important in deciding the quantity and price of a product, as well as the price and quantity of related items (complementary goods) and substitute products, so that a wise decision may be made about the allocation of scarce resources to alternative purposes.

Individual demand, product pricing, and so on are examples.

Macroeconomics, on the other hand, is the study of the economy as a whole, that is, the combination of all enterprises, households, nations, and so on.

Macroeconomics is an economics branch that focuses on the behaviour and performance of aggregate variables as well as issues that influence the entire economy.

It covers major aspects of the economy such as unemployment, poverty, general price level, GDP (Gross Domestic Product), imports and exports, economic growth, globalisation, monetary and fiscal policy, and so on. It aids in the resolution of the economy's numerous difficulties, allowing it to function effectively.

A few examples include aggregate demand, national income, and so on.

Theory of demand

Demand theory is a principle that emphasises the relationship between consumer demand and the factors affecting demand within a market.

What is Demand?

The quantity of a commodity or service that a buyer is willing to buy at a specified price during a given time period is known as demand. The willingness to pay and expectations of consuming a product at a specific price are often reflected in the demand for that commodity at that price.

QUANTITY DEMANDED: It refers to a specific quantity of a commodity that a consumer that a consumer is ready to buy at a particular price at a given period of time.

LAW OF DEMAND: it states that the quantity demanded of a commodity increases when its price decreases and vice versa other things remaining constant. It states there is negative relationship between quantity demanded of good X and price of good X other things remaining constant.

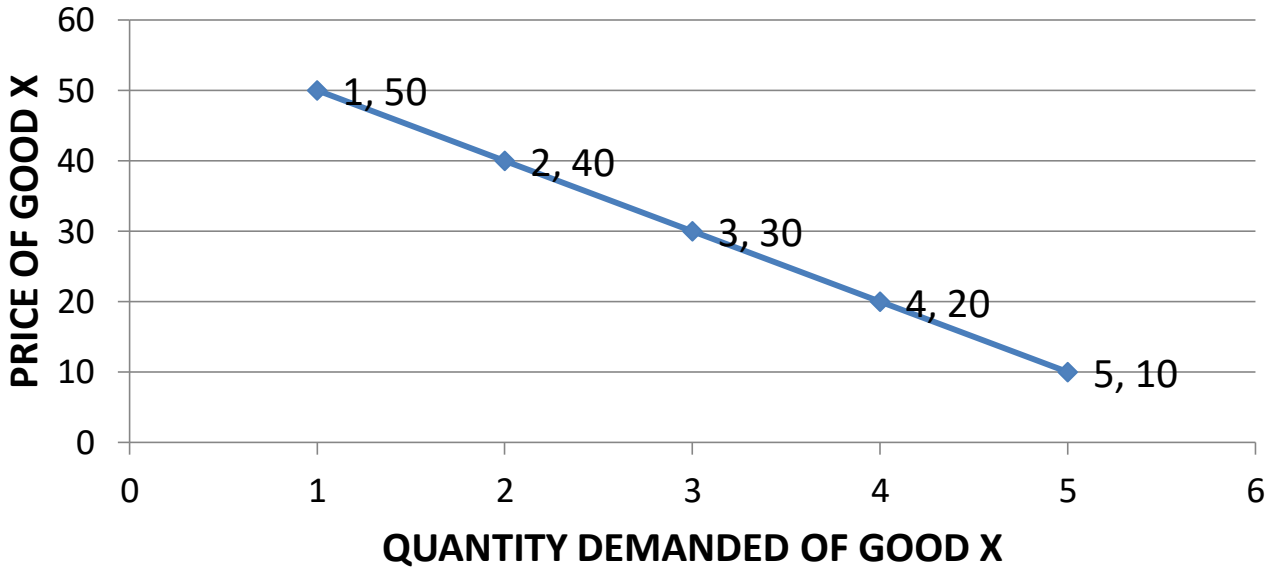
DEMAND FUNCTION: it shows a functional relationship between demand for goods and its determinants.

Demand for X = f (Price of X, Price of related goods, Income, Taste and Preferences, Expectation about price change in future, etc.)

DEMAND SCHEDULE or just Demand: it is a tabular presentation of different prices of a commodity and its corresponding quantity demanded per unit of time.

DEMAND CURVE: it is a graphical presentation of the demand schedule.

Price of good X	Quantity Demanded of good X
10	5
20	4
30	3
40	2
50	1



- **WHY DEMAND CURVE SLOPES DOWNWARD:**
- 1. Law of diminishing marginal utility: demand of a commodity depends upon its utility. So consumer buys more only if he has to pay less price for it and buys less if he has to pay more price for it.
- 2. Income effect: fall in price leads to increase in real income and accordingly more demand and vice versa.
- 3. Substitution effect: a rise in price of commodity X would cause more substitution of Y and demand for X would fall and vice versa.

- **UTILITY** is the want satisfying power of a commodity. It refers to the amount of satisfaction a consumer receives from consumption of a good or service. It is a subjective concept but economist has been trying to objectified it in the following approaches.
- ***THERE ARE TWO APPROACHES TO MEASURE UTILITY:***
- **Cardinal utility analysis:** This is given by Marshall which measures utility in quantitative by assigning units called utils which is measured in numbers.
- **Ordinal utility analysis:** This is also known as indifference curve analysis. This is given by Hicks and Allen. It measures utility in qualitative order like first preference, second preference, third preference etc. It is measured in ranks.
- Utility is not useful as drugs may give utility to a drug addict but are not useful otherwise.
- ***CONCEPTS OF UTILITY: TWO TYPES***
- 1. **Total utility (TU):** It is defined as total psychological satisfaction which a consumer derives from consumption of a certain amount of a commodity. Mathematically, it is an aggregate of marginal utility (MU) derived from consumption of different units of the commodity.
- $TU = \sum MU$
- 2.**Marginal utility (MU):**It is an addition made to TU by consuming an additional unit of the commodity or it is the additional utility derived from consumption of one more unit of the given commodity. $MU_X = dTR/dQ$ or $MU_n = TU_n - TU_{n-1}$
- **LAW OF DIMINISHING MARGINAL UTILITY (DMU):** Also called Gossen's first law of consumption. This law states that as a consumer consumes more and more units of a commodity, marginal utility derived from additional units goes on falling.

Theory of Supply

Supply theory is a principle that emphasises the relationship between seller/supplier/producer and the factors affecting supply within a market.

The quantity of an item or service that producers are willing and able to deliver at a particular price during each time period is described as **supply.**

According to the **law of supply**, as a product's price rises, businesses grow their supply. Firms are more likely to expand production when prices are higher. In other words, the law of supply states that, other things remaining constant, an increase in the price of a product leads to an increase in the quantity supplied of it and vice versa. There is a positive relation between price and quantity supplied of a commodity, other things being equal.

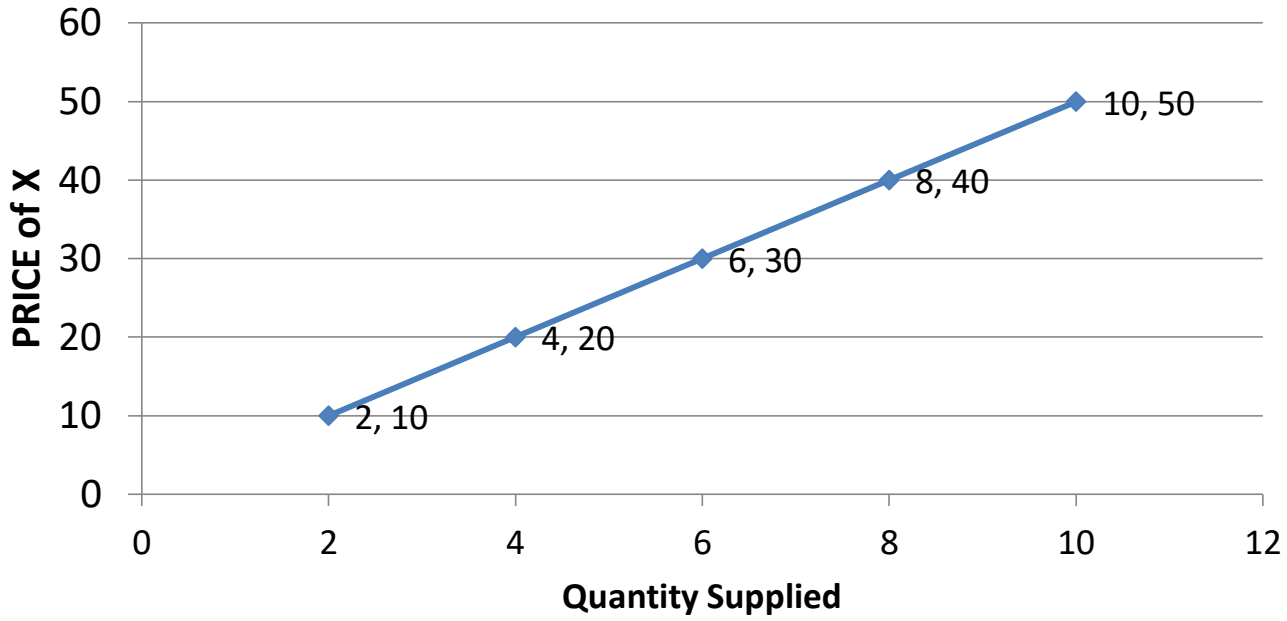
Supply function:

Sx= f(Price of commodity X, Technological changes, Price of Inputs, Taxation and subsidy policy and government, Price of other goods)

Individual supply schedule is a tabular presentation of positive relation between price and quantity supplied of a commodity by an individual seller, other things being equal.

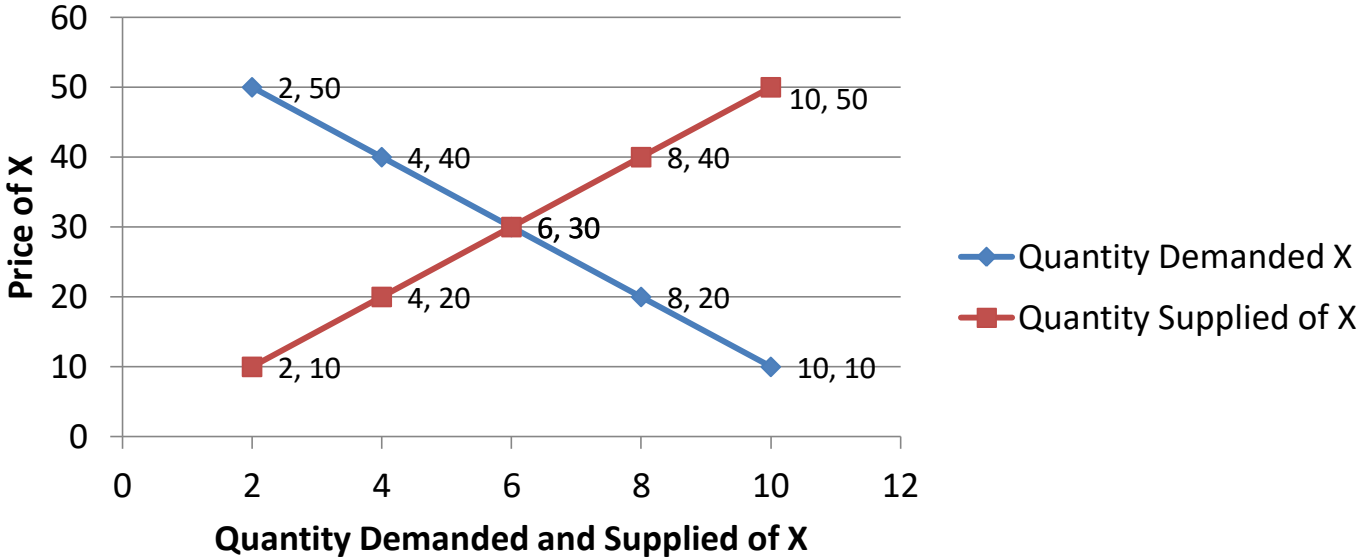
A **supply curve depicts** the link between market price and the amount of product a company is willing and able to sell.

Price of X	Quantity Supplied of X
10	2
20	4
30	6
40	8
50	10



Equilibrium between demand and supply

Price of X	Quantity Supplied of X	Quantity Demanded X
10	2	10
20	4	8
30	**6**	**6**
40	8	4
50	10	2



The following are some of the reasons for an upward-sloping supply curve:

1. Profit motive: A producer's primary goal is to maximise profits. As a result, when the price rises while the cost stays the same, profits grow, and manufacturers increase the supply of the item. Due to a drop in profitability, they curtailed supply when prices fell.
2. Change in the number of firms: When prices rise, more manufacturers are enticed to enter the market in order to make large profits. It will boost market supply and vice versa.
3. Stock change: when prices rise, sellers are willing to supply more goods from their stock; and when prices decrease, sellers prefer to keep the goods with the intention of selling them later.

ELASTICITY OF DEMAND

- **ELASTICITY OF DEMAND:** it refers to measure of degree of responsiveness of demand of a commodity due to change in any factors affecting demand of that commodity.
- Types of elasticity of demand are:
- **Income elasticity of demand**: it is the measure of degree of responsiveness of demand of a commodity due to change in income of the consumer.
- **Cross elasticity of demand**: it is the measure of degree of responsiveness of demand of a commodity due to a change in the price of a related good (complementary good or substitute good)
- **Price elasticity of demand:** it is the measure of degree of responsiveness of demand of a commodity due to change in its price.

METHODS TO MEASURE PRICE ELASTICITY OF DEMAND:

Percentage or proportionate or ratio method: according to this method, price elasticity of demand is measured by the ratio of percentage change in quantity demanded of a commodity to the percentage change in its price.

Ep=(Percentage change in Quantity Demanded X) ÷ (Percentage change in Price of X)

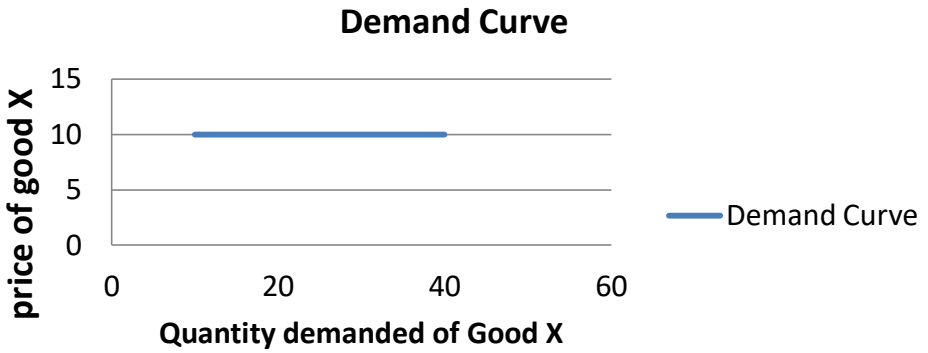
= $[(\Delta Q/Q)x100]\div[(\Delta P/P)x100]$

= $(\Delta Q/\Delta P)(P/Q)$

KINDS OR DEGREE OF PRICE ELASTICITY OF DEMAND: Five main degree of elasticity of demand:

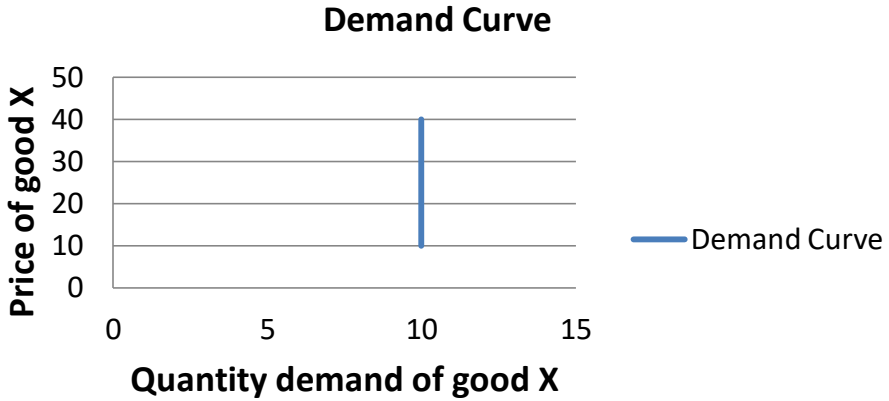
1. **Perfectly elastic demand. e = ∞**, imaginary situation. It implies that the quantity demand of the commodity is infinite at the prevailing price.

Price of good X	Demand of Good X
10	10
10	20
10	30
10	40



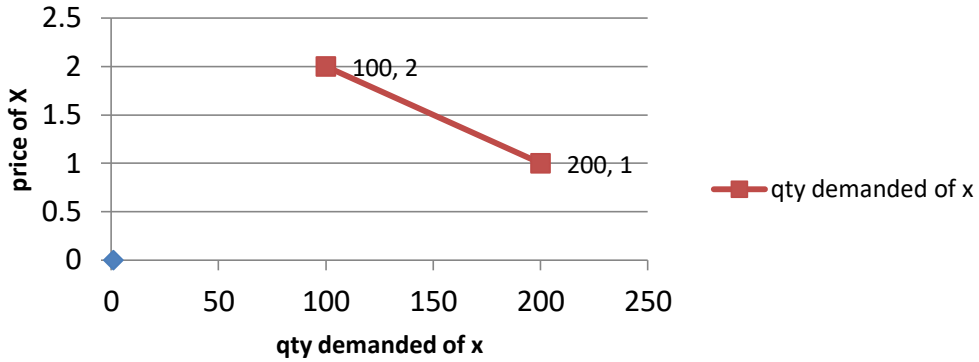
2. Perfectly inelastic demand, e = 0; e.g. Essential goods like saving drugs, salt, textbooks etc. In this case, the demand curve is parallel to the Y axis.

Price of good X	Demand of Good X
10	10
20	10
30	10
40	10



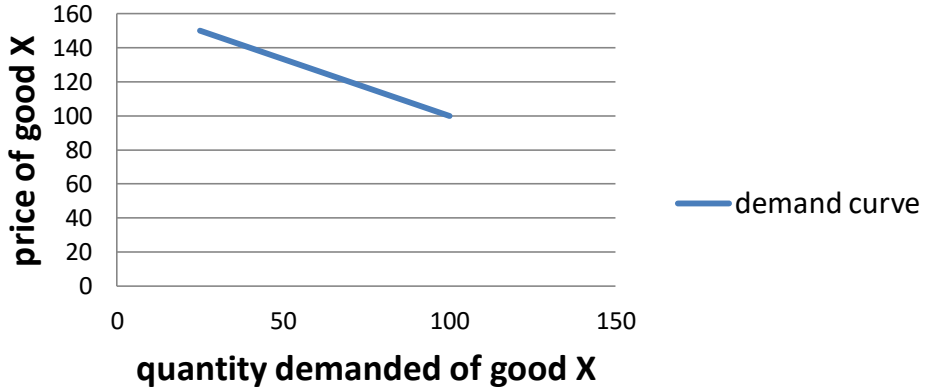
3.Unitary elastic demand, e = 1 e.g. normal goods like fans. According this case, the percentage change in quantity demanded of good X is equal to the percentage in price of good X.

Price of good X	Demand of Good X
1	200
2	100



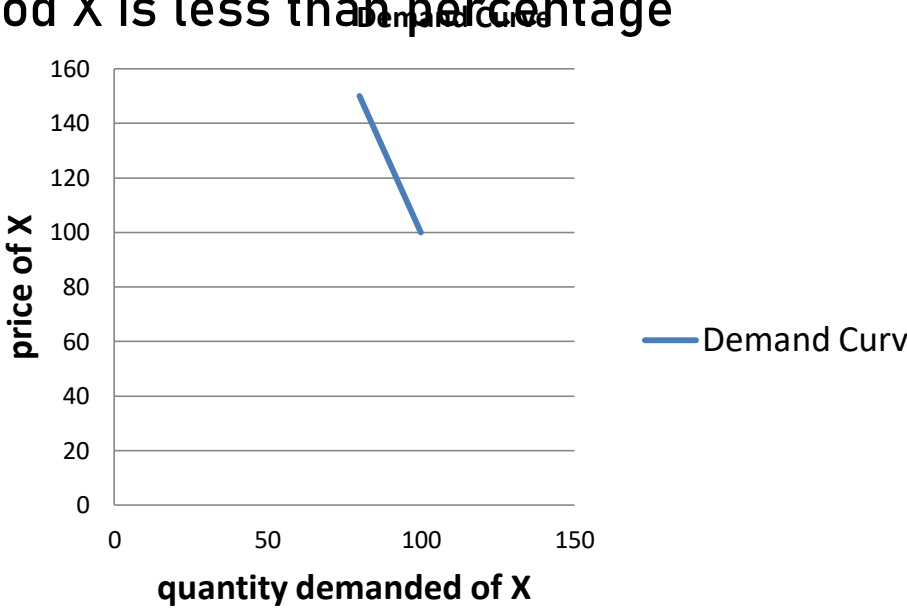
4. Greater than unitary elastic demand or elastic demand, e > 1 e.g. luxuries goods like plasma TV. In this case, percentage change in quantity demanded of a commodity X is greater than percentage change in the price of the commodity X. if price rises by 50% then demand falls by 75%. So, the demand curve is flatter.

Price of good X	Demand of Good X
100	100
150	25



5. **Less than unitary elastic demand or inelastic demand**, e < 1 e.g. necessities like fuel, food etc. In this case, percentage change in quantity demanded of good X is less than percentage change in price of good X.

Price of good X	Demand of Good X
100	100
150	80



Q. A consumer buys 10 units of a commodity at Rs 5 per unit. She buys 12 units, when price falls to Rs 4 per unit; calculate Ep answer: e_p=1

Q. If price of a good rises from Rs 46 to Rs 50 per unit, the demand decreases from 30 units to 15 units. Calculate the price elasticity of demand. (e_p= 5.75)

Q. A person buys 10 units of a good at Rs 6 per unit. When the price falls Rs 5 per unit he buys 14 units. Calculate the price elasticity of demand. (e_p = 2.4)