

**DIRECTORATE OF EDUCATION**  
**Govt. of NCT, Delhi**

**SUPPORT MATERIAL**  
**(2018-2019)**

**Class : XI**

**ECONOMICS**

Under the Guidance of

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### **PREFACE**

It gives me immense pleasure to present the Support Material for various subjects. The material prepared for students of classes IX to XII has been conceived and developed by a team comprising of the Subject Experts, Members of the Academic Core Unit and teachers of the Directorate of Education.

The subject wise Support Material is developed for the betterment and enhancement of the academic performance of the students. It will give them an insight into the subject leading to complete understanding. It is hoped that the teachers and students will make optimum use of this material. This will help us achieve academic excellence.

I commend the efforts of the team who have worked with complete dedication to develop this matter well within time. This is another endeavor of the Directorate to give complete support to the learners all over Delhi.

  
(SANDEEP KUMAR)  
SECRETARY

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**DIRECTOR'S MESSAGE**

Dear Students,

Through this Support Material, I am getting an opportunity to communicate directly with you and I want to take full advantage of this opportunity.

In Delhi, there are approximately 1020 other government schools like yours, which are run by Directorate of Education. The Head Quarters of Directorate of Education is situated at Old Secretariat, Delhi-54.

All the teachers in your school and officers in the Directorate work day and night so that the standard of our govt. schools may be uplifted and the teachers may adopt new methods and techniques to teach in order to ensure a bright future for the students.

Dear students, the book in your hand is also one such initiative of your Directorate. This material has been prepared specially for you by the subject experts. A huge amount of money and time has been spent to prepare this material. Moreover, every year, this material is reviewed and updated as per the CBSE syllabus so that the students can be updated for the annual examination.

Last, but not the least, this is the perfect time for you to build the foundation of your future. I have full faith in you and the capabilities of your teachers. Please make the fullest and best use of this Support Material.

**DIRECTOR (EDUCATION)**

**Dr. (Mrs.) Saroj Bala Sain**

Addl. Director of Edn. (School)/Exam



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Date : 16/07/2018

It gives me immense pleasure and a sense of satisfaction to forward the support material for classes IX to XII in all subjects. The support material is continuously revised redesigned and updated by a team of subject experts, members of Core Academic Unit and teachers from various schools of DOE.

Consistent use of support material by the students and teachers will make the year long journey seamless and enjoyable. The purpose of providing support material has always been to make available ready to use material which is matchless and most appropriate.

My commendation for all the team members for their valuable contribution.

Dr. Saroj Bala Sain  
Addl.DE (School)



**DIRECTORATE OF EDUCATION**  
**Govt. of NCT, Delhi**

**SUPPORT MATERIAL**  
**(2018-2019)**

**ECONOMICS**  
**Class : XI**  
**(English Medium)**

**NOT FOR SALE**

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# ECONOMICS

## Class XI (2018-19)

**Theory: 80 Marks**

**Project 20 Marks**

<b>Units</b>	<b>Marks</b>	<b>Periods</b>
<b>Part A      Introductory Microeconomics</b>		
Introduction	4	8
Consumer's Equilibrium and Demand	13	32
Producer Behaviour and Supply	13	32
Forms of Market and Price Determina- tion under Perfect competition with simple applications	10	28
	40	100
<b>Part B      STATISTICS FOR ECONOMICS</b>		
Introduction		07
Collection, Organisation and Presentation of Data	13	27
Statistical Tools and Interpretation	27	66
	40	100
<b>Part C      Project Work</b>	20	20

# **ECONOMICS (Code No. 030)**

## **(2018-19)**

### **Rationale**

Economics is one of the social sciences, which has great influence on every human being. As economic life and the economy go through changes, the need to ground education in children's own experience becomes essential. While doing so, it is imperative to provide them opportunities to acquire analytical skills to observe and understand the economic realities.

At senior secondary stage, the learners are in a position to understand abstract ideas, exercise the power of thinking and to develop their own perception. It is at this stage, the learners are exposed to the rigour of the discipline of economics in a systematic way.

The economics courses are introduced in such a way that in the initial stage, the learners are introduced to the economics realities that the nation is facing today along with some basic statistical tools to understand these broader economic realities. In the later stage, the learners are introduced to economics as a theory of abstraction.

The economics courses also contain many projects and activities. These will provide opportunities for the learners to explore various economic issues both from their day-to-day life and from issues, which are broader and invisible in nature. The academic skills that they learn in these courses would help to develop the projects and activities. The syllabus is also expected to provide opportunities to use information and communication technologies to facilitate their learning process.

### **Objectives:**

- Understanding of some basic economic concepts and development of economic reasoning which the learners can apply in their day-to-day life as citizens, workers and consumers.
- Realisation of learners' role in nation building and sensitivity to the economic issues that nation is facing today.
- Equipment with basic tools of economics and statistics to analyse economics issues. This is pertinent for even those who may not pursue this course beyond senior secondary stage.
- Development of understanding that there can be more than one view on any economic issue and necessary skills to argue logically with reasoning.

**ECONOMICS**  
**CLASS - XI (2018-19)**

### Project : 20 Marks

### 3 Hours

Unit		Marks	Periods
<b>Part A</b>	<b>Introductory Microeconomics</b>		
	Introduction	4	8
	Consumer's Equilibrium and Demand	13	32
	Producer Behavior and Supply	13	32
	Forms of Market and Price Determination under perfect Competition with simple application	10	28
		<b>40</b>	<b>100</b>
<b>Part B</b>	<b>Statistics for Economics</b>		
	1. Introduction		07
	2. Collection, Organisation and Presentation of data	13	27
	3. Statistical Tools and Interpretation	27	66
		<b>40</b>	<b>100</b>
<b>Part C</b>	<b>Project Work</b>	<b>20</b>	<b>20</b>

## Part A: INTRODUCTORY MICROECONOMICS

## Unit 1 : Introduction 8 Periods

Meaning of microeconomics and macroeconomics, Positive and Normative Economics.

What is an economy? Central Problems of an economy: what, how and for whom to produce; concepts of production possibility frontier and opportunity cost.

## Unit 2 : Consumer's Equilibrium and Demand 32 Periods

Consumer's equilibrium - meaning of utility, marginal utility, law of diminishing marginal utility, conditions of consumer's equilibrium using marginal utility analysis.

Demand, market demand, determinants of demand, demand schedule, demand curve and its slope, movement along and shifts in the demand curve; price elasticity of demand - factors affecting price elasticity of demand; measurement of price elasticity of demand; percentage-change method.

## Meaning of Production Function - Short-Run and Long-Run

## Returns to a Factor

Revenue - total, average and marginal revenue - meaning and their relationships.

Perfect competition - Features; Determination of market equilibrium and effects of shifts in demand and supply.

### Simple Applications of Demand and Supply : Price ceiling, price floor.

In this course, the learners are expected to acquire skills in collection, organisation and presentation of quantitative and

qualitative information pertaining to various simple economic aspects systematically. It also intends to provide some basic statistical tools to analyse, and interpret and economic information and draw appropriate inference. In this process, the learners and also expected to understand the behavior of various economic data.

**Unit 1 : Introduction 07 Periods**

What is Economics?

Meaning, scope, functions and importance of statistics in Economics

**Unit 2 : Collection, Organisation and Presentation of data**

**27 Periods**

**Collection of data:** Sources of data - primary and secondary; how basic data is collected, with concepts of Sampling; Sampling and Non-Sampling errors; methods of collecting data; some important sources of secondary data: Census of India and National Sample Survey Organisation.

**Organisation Data:** Meaning and types of variables; Frequency Distribution.

**Presentation of Data:** Tabular Presentation and Diagrammatic Presentation of Data : (i) Geometric forms (bar diagrams and pie diagrams), (ii) Frequency diagrams (histogram polygon and ogive) and (iii) Arithmetic line graphs (times series graph).

**Unit 3 : Statistical Tools and Interpretation 66 Periods**

(For all the numerical problems and solutions, the appropriate economic interpretation may be attempted. This means, the student need to solve the problems and provide interpretation for the results derived).

**Measures of Central Tendency:** Mean (simple and weighted), median and mode.

**Measure of Dispersion:** absolute dispersion (range, quartile deviation, mean deviation and standard deviation); relative dispersion (co-efficient of range, co-efficient of quartile - deviation, co-efficient of mean deviation, co-efficient of variation) : Lorenz

curve : Meaning, construction and its application.

**Correlation:** Meaning and properties, scatter diagram ; measures of correlation - Karl Pearson's method (two variables ungrouped data) spearman's rank correlation.

**Introduction to Index Numbers:** Meaning types - wholesale price index, consumer price index and index of industrial production, uses of index numbers ; inflation and index numbers.

### **Part C : Developing Project in Economics**

The studies may be encouraged to develop project, as per the suggested project guidelines. Case studies of a few organisations / outlets may also be encouraged. Under this the students will do **only ONE comprehensive project** using concepts from both part A and part B.

Some of the examples of the projects are as follows (they are not mandatory but suggestive):

- (i) A report on demographic structure of your neighborhood.
- (ii) Changing consumer awareness amongst households.
- (iii) Dissemination of price information for growers and its impact on consumers.
- (iv) Study of cooperative institution; milk cooperatives, marketing cooperatives, etc.
- (v) Case studies on public private partnership, outsourcing and outward Foreign Direct Investment.
- (vi) Global warming.
- (vii) Designing eco-friendly projects applicable in school such as paper and water recycle.

The idea behind introducing this unit is to enable the students to develop the ways and means by which project can be developed using the skills learned in the course. This includes all the steps involved in designing a project starting from choosing a title, exploring the information relating to the title, collection of primary and secondary data, analysing the data, presentation of the project and using various statistical tools and their interpretation and conclusion.

**SUGGESTED QUESTION PAPER DESIGN**  
**Economics (Code No. 030)**  
**Class-XI (2018-19)**  
**March 2019 (Examination)**

**Theory : 80 Marks + Project : 20 Marks**

**Duration : 3 hrs.**

S.No.	Typology of Questions	Very Short Answer MCQ 1 Mark	Short Answer II 3 Marks	Short Answer I 4 Marks	Long Answer 6 Marks	Total Marks	% age
1.	Remembering (Knowledge Based Simple recall questions, to know specific facts, terms, concepts, principles, or theories; identify, define, or recite, information)	2	.	2	2	22	27%
2.	<b>Understanding</b> (Comprehension to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase, or interpret information)	2	1	2	1	19	24%
3.	<b>Application</b> (Use abstract information in concrete situation, to apply knowledge to new situations; Use given content to interpret a situation provide an example, or solve a problem)	2	1	1	1	15	19%
4.	<b>High Order Thinking Skills</b> (Analysis & Synthesis - Classify compare, contrast, or differentiate between different pieces of information; Organize and/or integrate unique pieces of information from a variety of sources)	1	1	1	1	14	17%
5.	<b>Evaluation</b> : Appraise, judge and/or justify the values or worth of a decision or outcome, or to predict outcomes based on values).	1	1	1	1	10	13%
	<b>Total</b>	<b>8×1 = 8</b>	<b>4×3 =12</b>	<b>6×4 = 24</b>	<b>6×6 = 36</b>	<b>80+20</b>	<b>100%</b>

**Note** : There will be Internal Choice in questions of 3 marks, 4 marks and 6 marks in both sections (A and B).

Total 3 internal choices in section A and total 3 internal choices in section B).

# Content

<b>S.No.</b>	<b>Units</b>	<b>Page</b>
1.	Introduction	10
2.	Consumer's Equilibrium and Demand	21
3.	Producer Behaviour and Supply	44
4.	Forms of Market and Price Determination	69
5.	Introduction (Statistics)	86
6.	Collection, Organisation and Presentation of Data	92
7.	Statistical Tools and Interpretation	117
	(i) Measures of central Tendency	117
	(ii) Measures of Dispersion	125
	(iii) Correlation	136
	(iv) Introduction to Index Numbers	151
	Model Test Paper-I (with solution)	164
	Model Test Paper-II	173
	Model Test Paper-III	176
	Model Test Paper-IV	178
	Common Errors in Economics	180

## PART-A: INTRODUCTORY MICROECONOMICS

### UNIT 1

## INTRODUCTION

### Points to Remember

- ❑ Micro economics studies the behaviour of an individual economic unit.

Example : Demand of an individual consumer, Production of a firm etc.

- ❑ Macro economics studies the behaviour of the economy as a whole.

Example : Aggregate Demand, National Income etc.

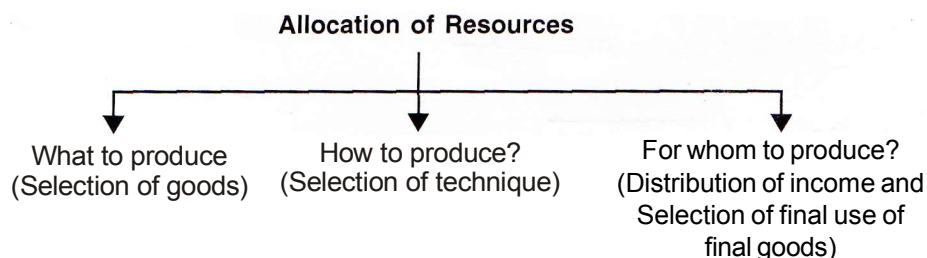
- ❑ An economy is a system that helps to produce good and services and enables people to earn their living.

- ❑ Economic problem is the problem of making the choice of the use of scarce resources for satisfying unlimited human wants.

- ❑ Causes of economic problems are :

- (a) Unlimited Human Wants
- (b) Scarcity of Economic Resources
- (c) Alternative uses of Resources

- ❑ **Central Problems of an Economy**



- ❑ Opportunity cost of a given resource can be defined as the value of the next best use to which that resource could be put.

- ❑ Production possibility frontier shows all possible combinations of two goods that an economy can produce with given resources and available technology, assuming that all resources are fully and efficiently utilised.
- ❑ Economising of resources means use of resources in best possible manner.
- ❑ Features of Production Possibility Frontier
  - (a) Slopes downward from left to right because to increase the production of one good, some units of other good has to be sacrificed.
  - (b) Concave to the origin because of increasing Marginal Opportunity Cost (MOC) or Marginal Rate of Transformation (MRT). MRT is increasing because all resources are not equally efficient in the production of both goods.
- ❑ Rightward shift of PPF indicates increase in resources or improvement in technology of both goods.
- ❑ Leftward shift of PPF indicates decrease in resources or degradation in technology.
- ❑ PPC will shift rightwards due to all those reasons which enhances production potential, quantity and efficiency of resources in an economy.

<b>Resons for Rightwards shift</b>	<b>Reasons for Leftward Shift</b>	<b>No. Change in PPC</b>
1. Increase in Resources	1. Decrease in Resources	1. Transfer of Resources
2. Improvement in technology	2. Technological obsolescence	2. Unemployment Eradication Programme
3. Skill Development Programme (Training)	3. Natural Calamities (Flood, Earthquake, Tsunami, Drought etc.)	
4. Education for all (Health)	4. Migration	
5. Clean India Campaign (Health)	5. War, terrorism	
6. Yoga Enhancement Plans (Health).		
7. Beti Bachao, Beti Padhao (Education)		
8. Make in India (Investment)		
9. Increase in Foreign Capital (Foreign Investment)		

- ❑ Marginal Rate of Transformation (MRT) is the ratio of number of units of a good sacrificed to increase one more unit of the other good.
- $$\text{MRT} = \frac{\Delta Y}{\Delta X}$$
- ❑ MRT can also called Marginal Opportunity Cost. It is defined as the additional cost in terms of number of units of a good sacrificed to produce an additional unit of the other good.
  - ❑ When MOC increases, PPF is concave to origin. When MOC decreases PPF is convex to origin and when MOC remains constant, PPF is downward sloping straight line.
  - ❑ Positive Economic Analysis : It deals with the things 'as they are'. It represents facts like what was? What is? What will be? etc. Example : 'India is overpopulated', Prices have been rising in India'. It can be verified.
  - ❑ Normative Economic Analysis : It deals with things as 'they ought to be'. It deals with idealistic situation instead of actual situation. Example : 'Rich people should be taxed more'. Free education should be given to the poor'. It can't be verified.

### **MULTIPLE CHOICE QUESTIONS (1 MARK)**

1. Which of the following subject matter study in Micro Economics,
  - (a) Money supply
  - (b) Aggregate demand
  - (c) Market demand of a good
  - (d) National Income
2. Which subject matter does not study in macro economics,
  - (a) Employment Level
  - (b) Aggregate Supply
  - (c) National Income
  - (d) Determination of market price

3. Economic Problem arises due to
  - (a) High population of a country
  - (b) Competition among buyers
  - (c) Resources have alternative uses
  - (d) Producer wants maximum profit
4. Which of these is a central problem of an Economy?
  - (a) Deficit demand
  - (b) Equilibrium of an economy
  - (c) For whom to produce
  - (d) Decreasing return to a factor
5. Any point beyond the PPF shows:
  - (a) Under utilisation of Resource
  - (b) Unattainable combination of output
  - (c) Efficient utilisation of Resources
  - (d) Decrease in resources.
6. In which situation PPF shifts towards right
  - (a) Increase in foreign capital
  - (b) Resources are reduced
  - (c) Fully efficient use of resources
  - (d) Increase in employment
7. Production Possibility Frontier can be a straight line: when
  - (a) Decrease in production of both goods
  - (b) More of both goods can be produced
  - (c) All resources are equally efficient in production of both goods
  - (d) All resources are not equally efficient in production of both goods.

8. Which of the followings are assumptions of PPF
- (a) Available Resources are fully and efficiently utilized
  - (b) Technology remain stable
  - (c) Resources are not equally efficient in production of all goods
  - (d) All of the above
9. Which of these statement is correct about Opportunity cost?
- (a) Opportunity cost is always higher than the given price.
  - (b) Opportunity cost is always less than the given price.
  - (c) Opportunity cost is always calculated in money.
  - (d) Opportunity cost can be less than, more than or equal to given price.
10. Which of these is Normative Economics.
- (a) 25 percent population of India is below poverty line.
  - (b) Increase in FDI has increased the GDP of India.
  - (c) Equal distribution of income will make India poverty free.
  - (d) Higher welfare spending by government increases the Aggregate Demand.

**Ans.** 1. (c); 2. (d); 3. (c); 4. (c); 5. (b); 6. (a); 7. (c); 8. (d); 9. (d); 10. (c)

### **Short Answer Type Questions (3-4 Marks)**

1. Distinguish between microeconomics and macroeconomics. Give example.
2. Why does an economic problem arise? Explain the problem of 'How to Produce'?
3. Explain the problem of 'What to Produce' with the help of an example.
4. 'For whom to produce' is a central problem of an economy. Explain.

5. Define opportunity cost with the help of an example, how does it differ from marginal opportunity cost?
6. What is 'Marginal Rate of Transformation'? Explain with the help of an example.
7. Why is a production possibility curve concave? Explain.
8. What is PP Frontier? Write its assumptions.
9. Show the following situation with PPF (PPC).
  - (a) Fuller utilisation of resources
  - (b) Increase in the resources
  - (c) Under utilisation of resources.
10. Distinguish between positive economics and normative economics.
11. A lot of people died and many factories were destroyed because of a severe earthquake in a country. How will it affect the country's PPF?
12. Calculate MRT from following table. What will be the shape of PPF and why?

<b>Combinations</b>	<b>Green Chilly (Units)</b>	<b>Sugar Units</b>
A	100	1
B	95	1
C	85	2
D	70	3
E	50	4
F	25	5

13. Given that no resource is equally efficient in producing all goods. Write name of such curve which shows production potential of an economy. Explain features of this curve along with the reasons?
14. If an Economy is not able to utilise its available resources efficiently, what will be the effect on PPF? What will you suggest for economic growth?

15. Govt started employment generation program MGNREGA explain its impact on PPF.
17. 'Make in India' is a Govt. policy to attract foreign investment explain its impact on PPF.

### Hints (3 Marks Questions)

12.

<i>Combinations</i>	<i>MOC <math>\frac{\Delta Y}{\Delta X}</math></i>
A	–
B	5 : 1
C	10 : 1
D	15 : 1
E	20 : 1
F	25 : 1

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## Exam. Oriented Questions with Answer

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### Very Short Answer Question (1 Mark)

**Q. 1.** Define Economy.

**Ans.** An economy is a system that helps to produce goods and services and enables people to earn their living.

**Q. 2.** What is the meaning of scarcity of resources?

**Ans.** Scarcity of resources means shortage of resources as compared to its demand.

**Q. 3.** Write the meaning of Economic Problem.

**Ans.** Economic problem is the problem of making the choice of the use of scarce resources for satisfying unlimited human wants.

**Q. 4.** Define MRT.

**Ans.** Marginal Rate of Transformation (MRT) is the ratio of number of units of a good sacrificed to increase one more unit of the other

$$\text{good MRT} = \frac{\Delta Y}{\Delta X}$$

**Q. 5.** Define opportunity cost.

**Ans.** Opportunity cost of a resource is its value in next best alternative use.

**Q. 6.** Govt. has started promoting foreign investments. What will be its economic value in the context of PPF?

**Ans.** Production will increase with more foreign investments. Thus PPF will shift rightward.

**Q. 7.** What is the meaning of economising of resources?

**Ans.** Economising of resources means best possible use of available resources.

### 3 - 4 Marks Questions

**Q. 1.** Why is a production possibility curve concave? Explain.

**Ans.** The production possibility curve being concave means that MRT increases as we move downward along the curve. MRT increases because it is assumed that no resource is equally efficient in production of all goods. As resources are transferred from one good to another, less and less efficient resources have to be employed. This raises cost and raises MRT.

**Q. 2.** Explain properties of a production possibility curve.

**Ans.** There are two properties of a production possibility curve.

1. **Downward sloping :** It is because as more quantity of one good is produced some quantity of the other good must be sacrificed as resources are scarce. More of both goods can't be produced.
2. **Concave to the origin :** It is because the marginal rate of transformation increases as more of one good is produced.

**Q. 3.** Explain the problem of 'what to produce'.

**Ans.** An economy can produce different possible combinations of goods and services with given resources. The problem is that, out of these different combinations, which combination is produced. If production of one good increases then less resources will be available for other goods, because resources are limited and have alternative uses.

**Q. 4.** What is 'Marginal Rate of Transformation'? Explain with the help of an example.

**Ans.** MRT is the rate at which the units of one good have to be sacrificed to produce one more unit of the other good in a two goods economy. Suppose an economy produces only two goods X and Y. Further suppose that by employing these resources fully and efficiently, the economy produces 1X + 10Y. If the economy decides to produce 2X, it has to cut down production of Y by 2 units. Then 2Y is the opportunity cost of producing 1X. Then 2Y : 1X is the MRT.

**Q. 5.** Explain the problem 'How to produce'.

**Ans.** The central problem 'How to Produce' is the problem of choosing

the appropriate technique of production for producing goods. There can be more than one method for producing a good. More labour and less capital (i.e., labour intensive technique) or more capital and less labour (i.e., capital intensive technique) can be used for production of a good. Since resources are scarce, decision has to be taken about which technique should be used on the basis of availability of resources.

Example : A given quantity of cloth can be manufactured by combining factors of production in different proportions, making it capital-intensive or labour intensive method.

**Q. 6.** For labourers working under MGNREGA Govt has increased minimum employment from 100 to 150 days. How will this affect real and potential level of production.

**Ans.** Real level of production will be increased by improvement in employment. But potential level of production will not increase (No shifting of PPC will take place). Reason being PPC is based on the assumption that available resources are fully utilised.

**Q. 7.** Explain the central problem 'for whom to produce'.

**Ans.** For whom to produce means that who will buy the goods and services produced. Clearly those who have income will be able to buy. So, the problem amounts to how the national income is distributed in an economy.

**Q. 8.** Giving reason comment on the shape of Production Possibilities curve based on the following schedule :

Good X (units)	0	1	2	3	4
Good Y (units)	10	9	7	4	0

**Ans.**

Good X (units)	Good Y (Units)	MRT
0	10	—
1	9	1Y : 1X
2	7	2Y : 1X
3	4	3Y : 1X
4	0	4Y : 1X

Since MRT is increasing, the PP curve is downward sloping and concave to the origin.

**Q. 9.** Explain the effects of floods in Jammu and Kashmir on its production possibilities frontier.

**Ans.** Floods have damaged and reduced resources. Since potential production declines, the production possibility frontier shifts to the left.

## UNIT II

---

# CONSUMER'S EQUILIBRIUM & DEMAND

---

### Points to Remember

- ❑ **Consumer** : is an economic agent who consumes final goods and services to fulfill his basic needs.
- ❑ **Utility** : Wants satisfying capacity of goods and services is called utility.
- ❑ **Total utility** : It is the sum of satisfaction/utility a consumer gets from consumption of all the units of a commodity at a given time.
- ❑ **Marginal Utility** : It is a net increase in total utility by consuming an additional unit of a commodity.
- ❑ **Law of Diminishing Marginal Utility** : As consumer consumes more and more units of commodity the Marginal Utility derived from each successive units goes on declining.
- ❑ **Consumer's Bundle** : It is a quantitative combination of two goods which can be purchased by a consumer from his given income at given prices.
- ❑ **Budget set** : It is quantitative combination of those bundles which a consumer can purchase from his given income at prevailing market prices.  
  
Budget Set :  $P_x \cdot X + P_y \cdot Y \leq M$
- ❑ **Budget Line** : It is a line showing different combinations of two goods which a consumer can buy by spending his whole income at given price of the goods.  
  
Budget line :  $M = P_x \cdot x + P_y \cdot y$
- ❑ **Consumer Budget** : It states the real income or purchasing power of the consumer from which he can purchase the certain quantitative bundles of two goods at given price.

- ❑ **Monotonic Preferences** : Consumer's preferences are called monotonic when between any two bundles, consumer always choose a bundle having more of one good and no less of other goods.
- ❑ **Change in Budget Line** : There can be parallel shift (leftwards or rightwards) due to change in income of the consumer and change in price of goods.
- ❑ **Marginal Rate of Substitution (MRS)** : It is the rate at which a consumer is willing to substitute good Y for good X.

$$\text{MRS} = \frac{\text{Loss of Good Y}}{\text{Gain of Good X}} \text{ or } - \frac{\Delta Y}{\Delta X}$$

- ❑ **Indifference Curve** : is a curve showing different combination of two goods, each combinations offering the same level of satisfaction to the consumer.
- ❑ **Indifference Map** : It refers to a set of indifference curves placed together in a diagram.
- ❑ **Characteristics of Indifference Curve**
  1. **Indifference curves are negatively sloped** : because to increase quantity of one good some units of other has to be sacrificed to remain on same satisfaction level.
  2. **Indifference curves are convex to the point of origin** : due to decreasing MRS. MRS decreases due to law of diminishing marginal utility.
  3. **Indifference curves never touch or intersect each other** : each indifference curve shows different level of satisfaction. Intersection point shows same satisfaction level which is not possible.
  4. **Higher Indifference curve represents higher level of satisfaction** : due to monotonic preference. Higher indifference curve shows bundles having more of one commodity and not less of other good in comparison of lower indifference curve.
- ❑ **Consumer's Equilibrium** : It is a situation where a consumer is

spending his income in such a way that he is getting maximum satisfaction and has no tendency to change.

❑ **Condition of Consumer's Equilibrium**

- (a) **Cardinal approach (Utility Analysis)** : According to this approach utility can be measured. "Utils" is the unit of utility.

Conditions of Equilibrium :

- (i) In case of one commodity

$$MU_m = \frac{MU_x}{P_x} \left[ \text{If } MU_m = 1, MU_x = P_x \right]$$

Where,  $MU_m$  = Marginal utility of money

$MU_x$  = Marginal utility of 'x',  $P_x$  = Price of 'x'.

- (ii) In case of two commodity :  $\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = MU_m$

and MU must be decreasing.

- (b) **Ordinal approach (Indifference Curve Analysis)** : According to this approach utility can't be measured but can be expressed in order or ranking.

**Condition of Equilibrium :**

- (i)  $MRS_{xy} = \frac{P_x}{P_y} \left[ \begin{array}{l} P_x = \text{Price of 'x'} \\ P_y = \text{Price of 'y'} \end{array} \right]$

or budget line must be tangent to indifference curve.

- (ii) MRS must be decreasing or

Indifference curve must be convex to the origin.

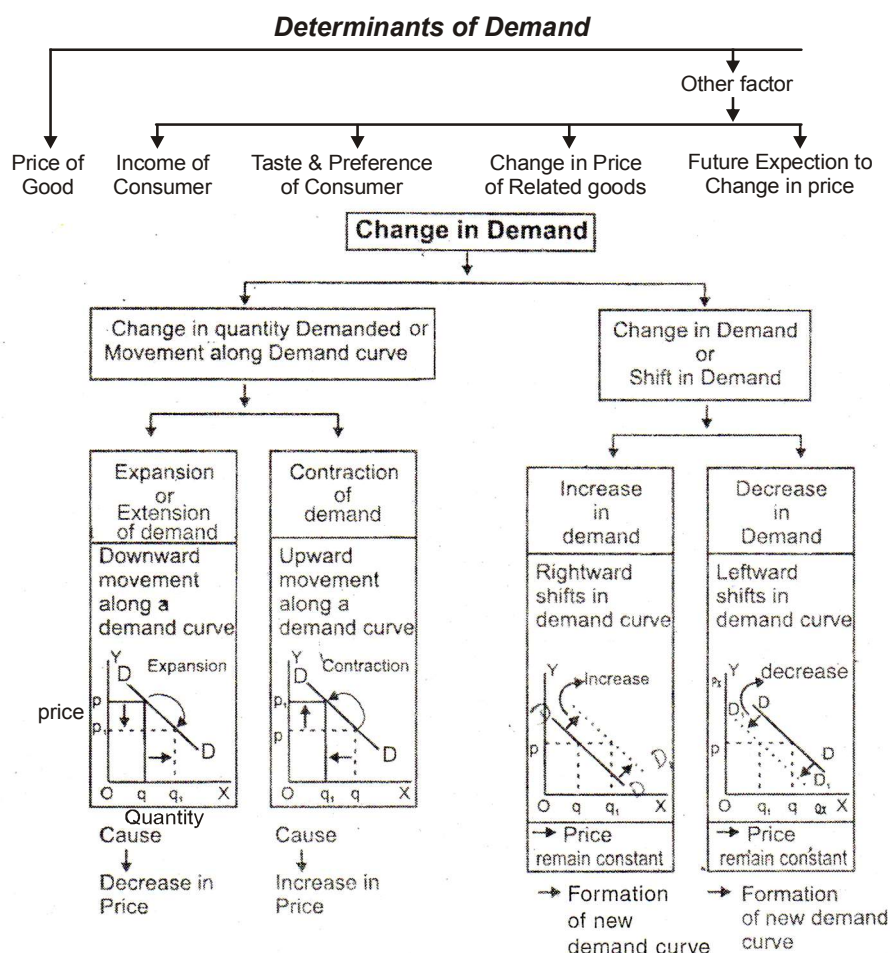
- ❑ **Quantity Demanded** : It is that quantity which a consumer is able and is willing to buy at given price and in a given period of time

- ❑ **Market Demand** : It is the total quantity purchased by all the consumers in the market at given price and in a given period of time.

- ❑ **Demand Function** : It shows the functional relationship between the demand of a good and factors affecting demand.

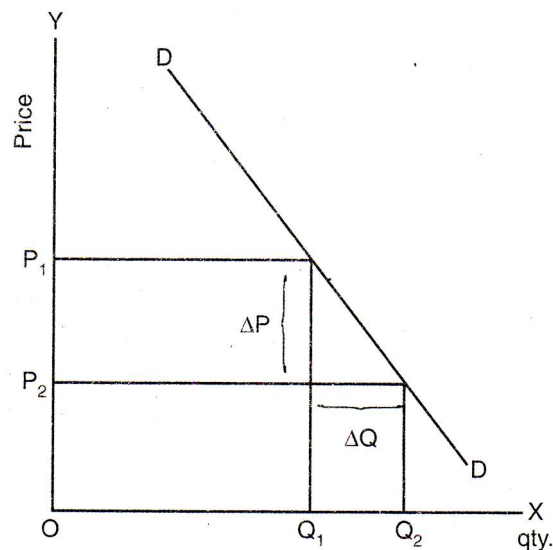
$$D = f(P_x, P_r, Y, T, E, N, Y_d).$$

- ❑ **Demand Schedule** : Demand schedule is a table which shows the quantity demanded of a commodity at various prices.
- ❑ **Law of Demand** : If remaining things are being constant as price of a commodity increases quantity demanded of the commodity decreases and as price of a commodity decreases quantity demanded of the commodity increases, it is called law of demand.



- ❑ **Change in Demand** : When demand changes due to change in any one of its determinants other than the price.

- ❑ **Change in Quantity Demanded** : When quantity of demand changes due to change in own price of commodity while other factors remain constant.
- ❑ **Demand Curve** : It is a graphical presentation of demand schedule, which shows quantity demanded at various prices of commodity. There is inverse relation between price and quantity demanded of commodity.
- ❑ Demand curve and its slope :



$$\begin{aligned}\text{Slope of demand curve} &= \frac{\text{Change in price}}{\text{Change in quantity demanded}} \\ &= \frac{\Delta P}{\Delta Q}\end{aligned}$$

- ❑ **Price Elasticity of Demand** : Price Elasticity of Demand is a measurement of change in quantity demanded in response to a change in price of the commodity.
- ❑ **Percentage Method** :

$$Ed. = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

Ed. → Elasticity of Demand

$\Delta Q$  → Change in quantity demanded

$\Delta P$  → Change in Price

P → Initial Price

Q → Initial Quantity

Percentage Change in Quantity demanded

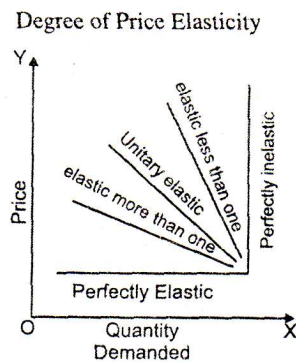
of a commodity

$$\text{Ed.} = \frac{\text{Percentage Change in Quantity demanded of a commodity}}{\text{Percentage Change in Price of commodity}}$$

$$\text{Percentage change in quantity demanded} = \frac{\Delta Q}{Q} \times 100$$

$$\text{Percentage change in price} = \frac{\Delta P}{P} \times 100$$

❑ Degrees of Price Elasticity of demand



❑ Factors affecting Price elasticity of Demand

- (a) Nature of the Commodity.
- (b) Availability of Substitute goods.
- (c) Income of the consumer.
- (d) Possibility of postponement of commodity
- (e) Time Period.
- (f) Different use of the commodity.
- (g) Habit of the consumer.

### **MULTIPLE CHOICE QUESTIONS (1 MARK)**

1. Total Utility of a commodity is maximum when-
  - (a) Consumption of goods is maximum
  - (b) Marginal utility is maximum
  - (c) Average utility is maximum
  - (d) Marginal utility is zero
2. Marginal Utility of a commodity
  - (a) Always decreases with increase in quantity
  - (b) Decreases only when total utility decreases
  - (c) Decrease but always remain positive
  - (d) First increase and start decreasing after reaching maximum point
3. A consumer gets maximum satisfaction, when?
  - (a) The price of commodity is minimum
  - (b) Total Utility is maximum
  - (c) Total utility he gets is equal to total utility he give up in terms of money.
  - (d) Utility he gets from last unit is equal to utility he give up in terms of money.
4. A consumer consumes two goods. Consumer is said to be in equilibrium, when:
  - (a) Marginal utility of two goods is equal.
  - (b) Total utility of two goods is equal.
  - (c) Price of two goods is equal.
  - (d) Per rupee marginal utility is equal.

5. When marginal utility is negative, total utility\_\_\_\_\_
- Total utility increase at decreasing rate
  - Total utility starts diminishing
  - Average utility becomes zero
  - Total utility becomes negative
6. If price of commodity is zero. The consumer will consume-
- Unlimited units of commodity
  - Till Marginal utility reaches maximum
  - Till Marginal utility becomes zero
  - till total utility becomes zero
7. Which of the following condition is necessary for consumer equilibrium in case of one commodity?
- $\frac{MU_m}{MU_x} = P_x$
  - $MU_x = MU_m \times P_x$
  - $\frac{P_x}{MU_x} = MU_m$
  - $\frac{MU_m}{P_x} = MU_x$
8. As per consumer's equilibrium theory, to reach consumer's equilibrium a consumer can\_\_\_\_\_
- Decrease the price of the commodity
  - Increase the Income of the consumer.
  - Change the quantity of the commodity
  - Increase the consumption of both goods.
9. The situation of consumer's disequilibrium  $\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$  arise
- due to increase in consumption of good X,
  - due to decrease in the price of good Y.
  - due to increase in the price of good X
  - due to increase in the price of good Y.

10. In case of two commodities a consumer strikes equilibrium when

(a)  $\frac{P_x}{MU_x} = \frac{P_y}{MU_y} = MU_m$

(b)  $\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = MU_m$

(c)  $\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = MRS_{xy}$

(d)  $MU_m = \frac{MU_x}{P_x}$

11. Number of Budget sets of a consumer are

- (a) Unlimited, but within budget line
- (b) Limited, depends upon the Income of consumer
- (c) Limited, depends upon price of commodities
- (d) Limited, depends upon price and income of consumer.

12. Which of the following is not a characteristic of indifference curve

- (a) Indifference Curve is convex to the origin
- (b) Higher Indifference Curve indicates higher level of satisfaction
- (c) Indifference Curve do not intersect each other
- (d) Indifference Curve is concave to the origin

13. Which of the following is not a determinants of individual demand function

- (a) Distribution of Income
- (b) Price
- (c) Income of Consumer
- (d) Taste and preferences

14. A consumer demands more quantity of a commodity when price decreases because

- (a) Total utility increases and become more than the price
  - (b) Marginal utility becomes more than price
  - (c) Marginal utility of money increases with decrease in the price
  - (d) Marginal utility decreases with decrease in price
15. Demand curve shifts rightward in case of
- (a) Decrease in price of the commodity
  - (b) Decrease in the price of substitute good.
  - (c) Increase in the price of complementary good.
  - (d) Increase in the number of buyers
16. Price elasticity of demand of a commodity is - 2.5. Price of commodity increased by 20 percent. What will be the change in quantity demanded?
- (a) Decrease by 50 units
  - (b) Increase by 50 units
  - (c) Decrease by 8 percent
  - (d) decrease by 50 percent
17. A consumer has monotonic preferences, find the most preferred bundle by him
- (a) 4 units of X good and 6 units of Y good
  - (b) 6 units of X good and 5 units of Y good
  - (c) 6 units of X good and 6 units of Y good
  - (d) 4 units of X good and 5 units of Y good
18. What is the maximum number of Indifference curves of a consumer?
- (a) Unlimited numbers of Indifference curves
  - (b) Upto his maximum satisfaction level
  - (c) Depends upon his Budget line
  - (d) Equal to various bundles of budget sets.
19. Slope of the demand curve is zero, its elasticity of demand is

- (a) Elasticity of demand is zero
  - (b) Elasticity of demand is inelastic
  - (c) Elasticity of demand is infinity
  - (d) Elasticity of demand is elastic
20. Which of these is not a factor effecting elasticity of demand
- (a) Nature of goods
  - (b) Number of uses of the commodity
  - (c) Availability of substitute goods
  - (d) Quantity of the commodity demanded

### **ANSWERS**

**1. (d); 2. (a); 3. (d); 4. (d); 5. (b); 6. (c); 7. (b); 8. (c); 9. (d); 10. (b); 11. (d); 12. (d); 13. (a); 14. (b); 15. (d); 16. (d); 17. (c); 18. (a); 19. (c); 20. (d)**

### **SHORT ANSWER TYPE QUESTION (3-4 MARKS)**

1. Explain the relation between total utility and marginal utility with the help of schedule?
2. Explain consumers equilibrium with utility approach in case of single good.
3. What do you mean by budget line? What are the reasons of change in budget line?
4. Explain the relationship between total utility and marginal utility with the help of schedule.

### **OR**

What changes will take place in total utility when –

- (a) Marginal utility curve remains above X-axis
  - (b) Marginal utility curve touches X-axis
  - (c) Marginal utility curve lies below X-axis
5. State three features of indifference curve.

6. Why do two indifference curves not intersect each other?
7. Under what situations will there be a parallel shift in the budget line?
8. Explain the effect of a rise in the prices of 'related goods' on the demand for good X.
9. Why does the demand for a normal good increase due to an increase in consumer's income?
10. Explain the following factors affecting Price Elasticity of Demand
  - (a) Nature of commodity
  - (b) Availability of substitutes
  - (c) Postponement of the use
11. Distinguish between expansion of demand and increase in demand with the help of a diagram.
12. Distinguish between change in demand and change in quantity demanded.
13. What will be the effect of the following on elasticity of demand?
  - (a) Income level of buyers
  - (b) Habit of the consumer
14. What will be the slope of the demand curve under the following situations?
  - (a) Perfectly elastic demand
  - (b) Perfectly inelastic demand
  - (c) Unit elastic demand
15. State the factors of rightward shift of the demand curve. Explain any one.
16. State the factors of leftward shift of the demand curve. Explain any one.
17. How does 'a proportion of income spent on the good' affect elasticity of demand?
18. When the price of a good is Rs. 7 per unit, a consumer buys 12 units. When the price falls to Rs. 6 per unit, he spends Rs. 72 on the goods.

Calculate price elasticity of demand by using the percentage method. Comment on the likely shape of demand curve based on this measure of elasticity.

19. A consumer buys 20 units of a good at a price of Rs. 5 per unit. He incurs an expenditure of Rs. 120 when he buys 24 units. Calculate price elasticity of demand by using the percentage method. Comment on the likely shape of demand curve based on this information.
20. Price elasticity of good X is known to be thrice that of Good Y. If price of the Good X increases by 20% and price of the Good Y decreases by 40% then calculate percentage changes in quantity demanded in both the cases.
21. The price elasticity of good X or Y are equal. The demand of X rises from 100 units to 250 units due to 20 percent fall in its price. Calculate the percentage rise in demand of Y, If its price falls by 8 percent.
22. Explain any four factors/determinantes affecting price elasticity of demand.
23. Fill in the gaps in the following equations :
  - (i)  $MRS = \frac{\Delta ?}{?}$
  - (ii)  $? = \Sigma MU$
  - (iii)  $MU_n = TU_n - ?$
  - (iv)  $e_d = \frac{\Delta Q}{?} \times \frac{P}{Q}$
24. Differentiate between :
  - (i) Normal goods and Inferior goods
  - (ii) Complementary goods and substitute goods.
25. Why should the budget line be tangent to the indifference curve at the point of consumer's equilibrium.
26. Why does consumer stop consumption in case where marginal utility is less than price of a good?

27. What is budget line? Why is it negatively sloped?
28. A consumer consumes only two goods X & Y State and explain the conditions of consumer's equilibrium with the help of utility analysis.
29. Explain the conditions determining how many units of a good the consumer will buy at a given price.
30. Define marginal rate of substitution. Explain why is an indifference curve convex?

### **LONG QUESTIONS (6 MARKS)**

1. Explain the conditions of consumer's equilibrium with the help of the indifference curve analysis. Represent the same on a diagram.
2. Explain the determination of consumers equilibrium with the help of a schedule in case of two commodities by using utility approach.
3. Why does demand curve slope downward?
4. Explain the determinants of price elasticity of demand.
5. With the help of diagrams, explain the effect of following changes on the demand of a commodity.
  - (a) A fall in the income of its buyer.
  - (b) A rise in price of complementary good.
6. What are the conditions of consumer's equilibrium under the indifference curve approach? What changes will take place if the conditions are not fulfilled to reach equilibrium?
7. Explain three properties of indifference curve.
8. Whether the following statements are true or false? Give reasons.
  - (i) Income effect of inferior good is positive.
  - (ii) Change in quantity demanded is the explanations of law of demand.

9. Explain the concept of marginal rate of substitution (MRS) by giving an example. What happens to MRS when consumer moves downwards along the indifference curve? Give reasons for your answer.
10. Following statements are true or false give reasons :
- (i) Increase in number of consumers shifts the demand curve rightward.
  - (ii) The demand of a commodity becomes elastic if its substitute good is available in the market.

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## Exam. Oriented Questions with Answer

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### VERY SHORT ANSWER QUESTION (1 MARK)

**Q. 1.** When does a good is called 'Normal Good'?

**Ans.** If the income effect of a commodity is positive and price effect is negative, it is called 'Normal Good'.

**Q. 2.** When does a good is called 'Inferior Good'?

**Ans.** If the income effect of a commodity is negative, it is called 'Inferior Good'.

**Q. 3.** Why the demand of water is Inelastic?

**Ans.** Because water is a necessary good.

**Q. 4.** Define Market Demand.

**Ans.** Market Demand refers to various quantities that all the consumers in a market are ready and able to purchase at various prices in a given period of time.

**Q. 5.** What is the meaning of Marginal Rate of Substitution?

**Ans.** MRS is the rate at which a consumer is willing to substitute good Y for good X, assuming that there is no change in the level of satisfaction.

**Q. 6.** What is the meaning of 'Monotonic Preference'.

**Ans.** Consumer's preference is called monotonic when between any two bundles, consumer give preference to that bundle, which contains more quantity of at least one commodity and not less quantity of other commodity.

**Q. 7.** Write equation of Budget line

**Ans.**  $M = P_x \cdot X + P_y \cdot Y$

**Q. 8.** Write equation of Budget set

**Ans.**  $P_x \cdot X + P_y \cdot Y \leq M$

### 3-4 MARKS QUESTIONS

**Q. 1.** Distinguish between increase in demand and increase in quantity demanded of a commodity.

**Ans.** When demand increase at given price due to the change in other factor. It is called increase in demand. On the other hand when other things remain constant and demand increase by decrease in the price of a commodity then, it is called increase in quantity demanded.

**Q. 2.** Given price of a good, how does a consumer decide as to how much of that good to buy?

**Ans.** Consumer purchases upto the point where marginal utility is equal to the price ( $MU = P$ ). So long as marginal utility is greater than price, he keeps on purchasing. As he makes purchases MU falls and at a particular quantity of the good MU becomes equal to price. Consumer purchases upto this point.

**Q. 3.** A consumer consumes only two goods X and Y. State and explain the conditions of consumer's equilibrium with the help of utility analysis.

**Ans.** There are two conditions of consumer equilibrium.

Explain :

$$(i) \frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

When  $\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$ . In this case, the consumer is getting more marginal utility per rupee in case of good x as compared to good y. Therefore, he will buy more of x and less of y. This will lead to fall in  $MU_x$  and rise in  $MU_y$ . The consumer will continue

$$\text{to buy more of x till } \frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

When  $\frac{MU_x}{P_x} < \frac{MU_y}{P_y}$ . In this case the consumer is getting more

marginal utility per rupee in case of good y as compared to x. Therefore, he will buy more of y and less of x. This will lead to fall in  $MU_y$  and rise in  $MU_x$ . The consumer will continue to buy

more of y till  $\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$ .

- (ii) **MU falls as consumption increases** : If MU does not fall as consumption increases the consumer will end up buying only good which is unrealistic or consumer will never reach the equilibrium position.

**Q. 4.** Explain how the demand for a good is affected by the price of its substitute goods. Give examples.

**Ans.** Related goods are either substitutes or complementary.

**Substitute Goods** : When price of a substitute falls, it becomes cheaper than the given good. So the consumer substitutes it for given good then demand of given good will decrease.

Similarly, a rise in the price of substitute will result in increase in the demand for given good. For example : Tea and Coffee.

**Q. 5.** Distinguish between Normal Goods and Inferior Goods. Explain with Example.

**Ans.** **Normal Goods** : These are the goods the demand for which increase as Income of the buyers rise. There is a positive relationship between Income and demand or in case of normal goods income effect is positive.

**Inferior Good** : There are the goods the demand for which decreases as income of buyer rises. Thus, there is negative relationship between income and demand or income effect is negative.

**Q. 6.** Explain any four factors that affect price elasticity of demand.

**Ans.**

1. **Nature of Commodity** : Necessaries like Salt, Kerosene oil etc. have inelastic demand and luxuries have elastic demand.

2. **Availability of substitutes** : Demand for goods which have close substitute is relatively more elastic and goods without close substitutes have less elastic demand.
3. **Different uses** : Commodities that can be put to different uses have elastic demand for instance electricity has different uses.
4. **Habit of the consumer** : Goods to which consumer become habitual will have inelastic demand.

*Example* : Liquor and Cigarette.

**Q. 7.** Explain relationship between total utility and marginal utility with help of a schedule.

**Ans.**

<i>Quantity (Units)</i>	<i>Total Utility</i>	<i>Marginal Utility</i>
0	0	—
1	8	8
2	14	6
3	18	4
4	20	2
5	20	0
6	18	–2

- (1) As long as MU decreases but is positive, TU increases at decreasing rate.
- (2) When marginal utility is equal to zero then total utility is maximum.
- (3) When marginal utility is negative. Total utility starts diminishing.

**Q. 8.** Define marginal utility. State the law of diminishing marginal utility.

**Ans.** **Marginal Utility** : It is addition to the total utility as consumption is increased by one more unit of the commodity.

**Law of Diminishing Marginal Utility** : It states that as consumer consumes more and more units of a commodity, the utility derived from each successive unit goes on decreasing. According to this law TU increases at decreasing rate and MU decreases.

## 6 MARKS QUESTIONS

**Q. 1.** Explain the three properties of indifference curves.

**Ans.** Three properties of indifference curves are as follows :

1. **Slopes downward from left to right** : To consume more of one good the consumer must give up some quantity of the other good so that satisfaction remains at the same level.
2. **Convex towards the origin** : MRS declines continuously due to the operation of the law of diminishing marginal utility.
3. **Higher indifference curves represents higher utility** : Higher indifference curve represent large bundle of goods. Which means more utility because of monotonic preference.

**Q. 2.** Explain the conditions of consumer's equilibrium using indifference curve analysis. Use diagram.

**Ans.** There are two conditions for consumer's equilibrium.

(i)  $MRS = P_x/P_y$

(ii) MRS is continuously falling.

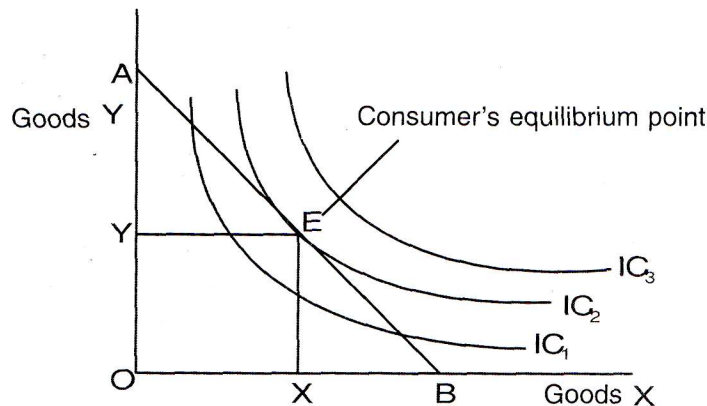
Explanation

Suppose there are two goods X and Y the first condition of consumer's equilibrium is MRS must be equal to the ratio of prices of two goods  $\frac{P_x}{P_y}$

If  $MRS > P_x/P_y$ , It means consumer values X more than what market values and willing to give more price than market price, he will purchase more of X this cause fall in MRS and it will continue upto that when  $MRS = P_x/P_y$ .

If  $MRS < \frac{P_x}{P_y}$ . It means consumer values X less than what market values. Consumer is willing to give less price than market price and he will purchase less of X, by this MRS will increase and it will continue till  $MRS = \frac{P_x}{P_y}$ .

(ii) MRS is continuously falling unless the equality between the MRS and  $P_x/P_y$  will not be reached.



Consumer is in equilibrium at point E. OX of X and OY of Y is optimum bundle of both goods.

**Q. 3.** Why does demand curve slope downwards?

**Ans.** Following is the cause why demand curve slope downward –

- (i) **Law of Diminishing Marginal Utility** : According to this law, as consumption of the commodity increases, marginal utility of successive unit goes on diminishing to a consumer. Accordingly, for every additional unit, consumer is willing to pay less and less price.

**Q. 4.** Explain the effect of change in Income of the consumer on the demand for a good.

**Ans.** **Normal Goods** : In the situations when the income increases consumer will increase the demand of Normal goods and if the Income decreases consumer will decrease the demand of normal good, because in normal goods, income effect is positive.

**Inferior Goods** : In the situations when the Income decreases consumer will increase the demand of inferior goods and if the income increases a consumer will decrease the demand of inferior good because in inferior goods, income effect is negative.

**Q. 5.** A consumer consumes only two goods X and Y both priced at Rs. 3 per unit. If the consumer chooses a combination of these two goods with Marginal Rate of Substitution equal to 3, is he consumer in equilibrium? Give reason. What will a rational consumer do in this situation? Explain.

**Ans.** Given  $P_x = 3$ ,  $P_y = 3$  and  $MRS = 3$ , A consumer is said to be in

equilibrium when

$$MRS = \frac{P_x}{P_y}$$

Substituting values we find that

$$3 > \frac{3}{3}$$

$$\text{i.e., } MRS > \frac{P_x}{P_y}$$

Therefore consumer is not in equilibrium.  $MRS > \frac{P_x}{P_y}$  means that

consume is willing to pay more for one more unit of x as compared to what market demands. The consumer will buy more and more of x. As a result MRS will fall due to the law of Diminishing Marginal

Utility. This will continue till  $MRS = \frac{P_x}{P_y}$  and consumer is in equilibrium again.

**Q. 6.** A consumer consumes only two good x and y whose prices are Rs. 4 and Rs. 5 per unit respectively. If the consumer chooses a combination of the two goods with marginal utility of X equal to 5 and that of Y equal to 4, is the consumer in equilibrium? Give reason. What will a rational consumer do in this situation? Use utility analysis

**Ans.** Given  $P_x = 4$ ,  $P_y = 5$  and  $MU_x = 5$ ,  $MU_y = 4$ , and consumer will be in equilibrium when

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

Substituting values, we find that

$$\frac{5}{4} > \frac{4}{5} \text{ or } \frac{MU_x}{P_x} > \frac{MU_y}{P_y}$$

Since per rupee  $MU_x$ , is higher than per rupee  $MU_y$ , consumer is not in equilibrium.

The consumer will buy more of x and less of y, As a result  $MU_x$  will fall and  $MU_y$  will rise. The reaction will continue till  $\frac{MU_x}{P_x}$  and  $\frac{MU_y}{P_y}$  are equal and consumer is in equilibrium again.

### UNIT III

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## PRODUCER BEHAVIOUR & SUPPLY

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### Points to Remember

- ❑ **Production Function :** It shows the functional relation between physical inputs and physical output of a good. It can be expressed as  $Q = (f_1, f_2, f_3 \dots f_n)$ . Where  $Q$  = Physical output of a good;  $f_1, f_2, f_3, \dots, f_n$  = Physical inputs. Technology remains constant
- ❑ **Types of Production Function :**

There are two types of Production Function.

  1. **Short-run Production Function :** In this production function one factor of production is variable and all others are fixed. So, law of return to a factor is applied. It is also called variable proportion type production function.
  2. **Long-run Production Function :** In this production function all the factors of production are variable. So, law of returns to scale is applied. It is also called constant proportion type production function.
- ❑ Total production refers to total amount of a good which is produced by a firm in a given period of time.
- ❑ Average production is the per unit output of variable factor (labour) employed.

$$AP = \frac{TP}{\text{Units of Variable input}}$$

- ❑ Marginal product is the change in total product resulting from employing one additional unit of variable input.

$$MP = \frac{\Delta TP}{\Delta L} \text{ or } MP_n = TP_n - TP_{n-1}$$

❑ **Relation between Total, Average and Marginal Product**

1. As long as marginal product rises, total product increases at increasing rate.
2. When marginal product starts falling but remains positive, total product rises at diminishing rate.
3. When  $MP = 0$ , TP is maximum.
4. When marginal product becomes negative, then total product starts falling.

❑ **Relation between MP and AP**

1. When  $MP > AP$ , AP rises.
2. When  $MP = AP$ , AP is maximum and constant.
3. When  $MP < AP$ , AP falls.

❑ **Returns to a factor** : In a short period when additional unit of variable factor are employed with fixed factors, then returns to a factor operates. Returns to a factor shows the changes in total product of a good when only the quantity of one input is increased, while other inputs kept constant.

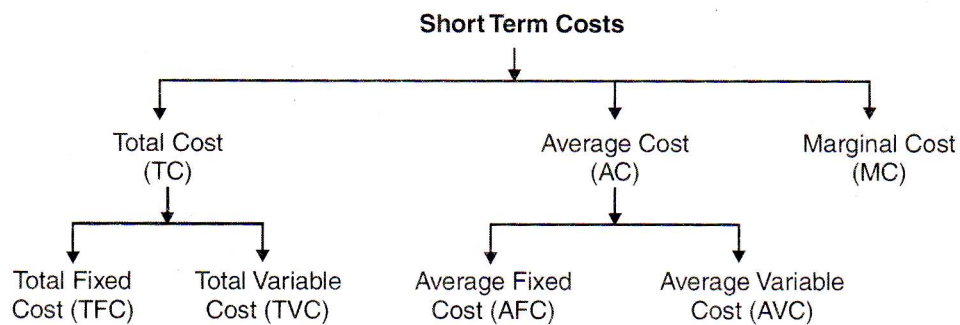
❑ **Law of variable proportion** : The law states that as we increase the quantity of only one variable input, keeping other inputs fixed, the total product increases at increasing rate in the beginning, then increases at decreasing rate and finally TP falls. According to this law, change in TP and MP are classify into three phases.

❑ **Phase I : TP Increases at increasing rate** : In the initial phase as more and more units of variable factor are employed with fixed factor total physical production increases at increasing rate, MP increases.

❑ **Phase II : TP increases at decreasing rate** : As more and more units of variable factors are employed with fixed factors then total product increases at diminishing rate, MP decreases but remains positive. At the end of this phase TP maximum and MP becomes zero.

❑ **Phase III : TP falls** : As more and more units of variable factors are employed with fixed factors, total production starts decreasing and marginal product becomes negative.

- ❑ **Cost** : It is the sum of direct (explicit cost) and indirect cost (implicit cost), including Normal profit.
- ❑ **Cost** : Explicit cost + implicit cost + Normal Profit.
- ❑ **Explicit Cost** : Actual money expenditure incurred by a firm on the purchase and hiring the factor inputs for the production is called explicit cost. For example-payment of wages, rent, interest, purchases of raw materials etc.
- ❑ **Implicit cost** is the estimated cost of self owned resources of the production used in production process, by the producer or estimated value of inputs supplied by owner itself.



- ❑ Total cost refers to total expenditure incurred by a firm on production of a given quantity of output.
- ❑ Total cost is the sum of total fixed cost and total variable cost  

$$TC = TFC + TVC \quad \text{or} \quad TC = AC \times Q$$
- ❑ Total fixed costs is the cost which remains constant at all levels of output. It is not zero even at zero output level. Therefore, TFC curve is parallel to OX-axis.  

$$TFC = TC - TVC \quad \text{or} \quad TFC = AFC \times Q$$
- ❑ Total variable cost is the cost which vary with the quantity of output produced. It is zero at zero level of output. TVC curve is parallel to TC curve.  

$$TVC = TC - TFC \quad \text{or} \quad TVC = AVC \times Q.$$
- ❑ Average cost is per unit cost of production of a commodity. It is the sum of average fixed cost and average variable cost.

$$AC = \frac{TC}{Q} \text{ or } AC = AFC + AVC$$

- ❑ Average fixed cost is per unit fixed cost of production of a commodity.

$$AFC = \frac{TFC}{Q} \text{ or } AFC = AC - AVC$$

AFC goes on decreasing as the level of output increase. Shape of AFC is rectangular hyperbola.

- ❑ Average variable cost is per unit variable cost of production of a commodity.

$$AVC = \frac{TVC}{Q} \text{ or } AVC = AC - AFC$$

- ❑ **Marginal Cost** : It refers to change in TC, due to an additional unit of a commodity is produced.  $MC = \Delta TC / \Delta Q$  or  $MC_n = TC_n - TC_{n-1}$   
But under short run, it is calculated from TVC.

$$MC_n = \frac{TVC}{Q_n} - \frac{TVC}{Q_{n-1}} \text{ or } MC = \frac{\Delta TVC}{\Delta Q}$$

### Relation Between Short-Term Costs

- ❑ Total cost curve and total variable cost curve remains parallel to each other. The vertical distance between these two curves is equal to total fixed cost.
- ❑ TFC curve remains parallel to X-axis and TVC curve remains parallel to TC curve.
- ❑ With increase in level of output, the vertical distance between AFC curve and AC curve goes on increasing. On contrary the vertical distance between AC curve and AVC curve goes on decreasing because their difference is AFC which keep decreasing with increase in output but these two curves never intersect because average fixed cost is never zero.
- ❑ Relation between MC and AVC.
  - ❑ When  $MC < AVC$ , AVC falls.
  - ❑ When  $MC = AVC$ , AVC is minimum and constant
  - ❑ When  $MC > AVC$ , AVC rises.
- ❑ Relation between MC and ATC

- ❑ When  $MC < ATC$ ,  $ATC$  falls.
- ❑ When  $MC = ATC$ ,  $ATC$  is minimum and Constant
- ❑ When  $MC > ATC$ ,  $ATC$  rises.
- ❑ Money received from the sale of product is called revenue.
- ❑ Total revenue is the total amount of money received by a firm from the sale of given units of a commodity at a market price.

$$TR = AR \times Q \quad \text{or} \quad TR = \sum MR$$

$$TR = \text{Price} \times \text{Quantity Sold.}$$

$$\text{Price} = AR$$

- ❑ Per unit revenue received from the sale of given units of a commodity is called average revenue. Average revenue is equal to price. Per unit price of a commodity is also called AR.

$$AR = \frac{TR}{Q} \quad \text{or} \quad \frac{P \times Q}{Q} = P = \text{Price}$$

- ❑ Marginal revenue is net addition to total revenue when one additional unit of output is sold.

$$MR = \frac{\Delta TR}{\Delta Q} \quad \text{or} \quad MR_n = TR_n - TR_{n-1}$$

- ❑ Relation between  $TR$ ,  $AR$  and  $MR$  when more quantity sold at the same price : under perfect competition.

(a) Average revenue and marginal revenue remains constant at all levels of output and  $AR$  and  $MR$  curves are parallel to  $ox$ -axis.  $AR = MR$ .

(b) Total revenue increases at constant rate  $MR$  is constant and  $TR$  curve is positively sloped straight line passing through the origin.

- ❑ Relation between  $TR$ ,  $AR$  and  $MR$  when more quantity by sold at the lower price or there is monopoly or monopolistic competition in the market.

(a) Average revenue and marginal revenue curves have negative slope.  $MR$  curve lies below  $AR$  curve.  $AR > MR$ .

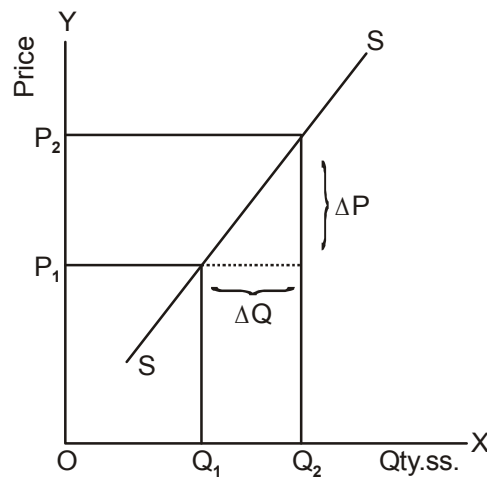
- (b) Marginal revenue falls, twice the rate of average revenue.
- (c) So long as marginal revenue decreases and positive, total revenue increases at diminishing rate. When marginal revenue is zero, total revenue is maximum and when marginal revenue becomes negative, TR starts falling.
- ☐ Relation b/w AR and MR (General)
  - ☐ When  $MR > AR$ , AR rises.
  - ☐ When  $MR = AR$ , AR is maximum and constant.
  - ☐ When  $MR < AR$ , AR falls.
- ☐ **Concept of Producer's Equilibrium** : It refers the stage where producer is getting maximum profit or suffering minimum losses with given cost and he has no incentive to increase or decrease the level of output.
- (A) **MR and MC Approach** : Conditions of producer equilibrium according to this approach are :
  - (a)  $MC = MR$
  - (b) MC curve should cut the MR curve from below at the point of equilibrium.

**Or**

MC should be more than MR after the equilibrium point, with increase in output.

- ☐ **Supply** : Refers to the amount of the commodity that a firm or seller is willing to offer or ready to sell at a certain price, over a given period of time.
- ☐ **Factors affecting supply of a commodity** :
  - ☐ Price of the commodity.
  - ☐ Prices of other related goods.
  - ☐ Level of Technology.
  - ☐ Prices of inputs.
  - ☐ No. of firms.

- ❑ Government policy regarding Taxation and subsidies.
- ❑ Goals of the firm.
- ❑ **Individual Supply** : Refers to quantity of a commodity that an individual firm is willing and able to offer for sale at a certain price during a given period of time.
- ❑ **Market supply** : It is the sum total of quantity supplied of a commodity by all sellers or all firms in the market at a certain price during a given period of time.
- ❑ **Stock** : Refers to the total quantity of a particular commodity available with the firm at a particular point of time.
- ❑ **Supply Schedule** : Refers to a tabular presentation which shows various quantities of a commodity that a producer is willing to supply at different prices, during a given period of time.
- ❑ **Supply curve** : Refers to the graphical representation of supply schedule which represents various quantities of a commodity that a producer is willing to supply at different prices during given period of time.
- ❑ Slope of supply curve =  $\Delta P / \Delta Q$



- ❑ **Law of Supply** : States the direct relationship between price and quantity of supply of a commodity, keeping other factors constant.
- ❑ **Price Elasticity of Supply** : It refers to the degree of responsiveness of quantity supplied of a commodity with

reference to a change in price of the commodity. It is always positive due to direct relationship between price and quantity supplied.

Price Elasticity of Supply (Es)

$$= \frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$$

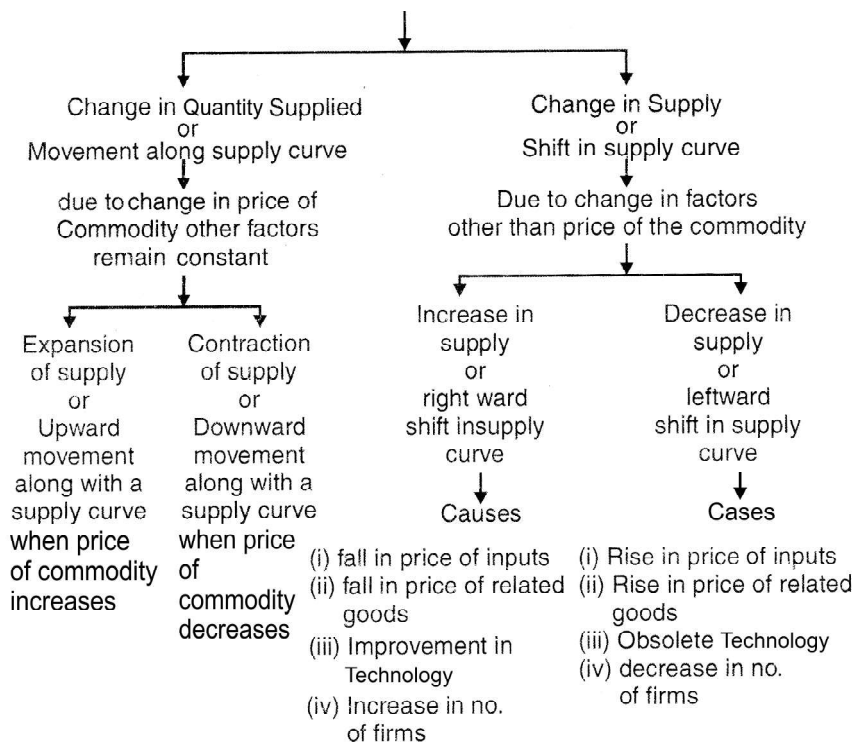
□ **Methods for measuring price elasticity of supply :**

Percentage Method

$$Es = \frac{\% \text{ change in a quantity supplied}}{\% \text{ change in price}}$$

$$\text{Or } Es = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

**Change in Quantity Supplied Vs change in Supply**



### **MULTIPLE CHOICE QUESTIONS (1 MARK)**

1. The cause of upward movement along a supply curve is  
(a) Decrease in Price                      (b) Increase in Income  
(c) Decrease in Income                  (d) Increase in Price
2. When Total Revenue is maximum, marginal Revenue is :-  
(a) Minimum                                  (b) Maximum  
(c) Zero    (d) Constant
3. When percentage change in Price is equal to percentage change in supply :  
(a)  $E_s > 1$                                   (b)  $E_s = 1$   
(c)  $E_s < 1$                                   (d)  $E_s = 0$
4. The behaviour of Average Revenue when Total Revenue increases at constant rate is  
(a) Constant                                  (b) Increasing  
(c) Decreasing                                (d) Zero
5. The Behaviour of Total Product when Marginal Product is zero is :  
(a) Minimum                                  (b) Maximum  
(c) Constant                                  (d) Zero
6. Which cost curve is parallel to x-axis :  
(a) AFC    (b) TVC  
(c) TFC    (d) TC
7. If supply curve is parallel to Y-axis :  
(a)  $E_s = 0$                                   (b)  $E_s = \infty$   
(c)  $E_s = 1$                                   (d)  $E_s > 1$
8. When per unit price remains constant

- (a)  $AR > MR$                       (b)  $AR < MR$
- (c)  $AR = MR$                       (d) TR is constant
- 9. When Total Product is falling then
  - (a) MP is maximum                      (b) MP = zero
  - (c) MP becomes negative              (d) MP is falling
- 10. When Average Product is maximum then
  - (a)  $MP > AP$                       (b)  $MP = AP$
  - (c)  $MP < AP$                       (d) MP is also maximum

### **Answers**

**1. (d); 2. (c); 3. (b); 4. (a); 5. (b); 6. (c); 7. (a); 8. (c); 9. (c); 10. (b).**

### **SHORT ANSWER TYPE QUESTION (3-4 MARKS)**

1. State the relation between AP and MP.
2. How does total product behave with change in marginal product?
3. Briefly explain the causes of increasing returns to a factor with the help of marginal product.
4. Explain the likely behaviour of total product. When only the units of a variable factor is increased and keeping all other factor fixed. Use numerical example.
5. Distinguish between total fixed cost and total variable cost.
6. Explain with the help of a diagram the relationship between Average cost, Average variable cost and Marginal cost.
7. Why is short run average cost curve 'U' shaped?
8. What changes will take place in total revenue when
  - (a) Marginal revenue is falling but is positive
  - (b) Marginal revenue is zero
  - (c) Marginal revenue is negative

9. Define marginal revenue. Explain the relationship between average and marginal revenue when price is constant at all levels of output.
10. What do you mean by producers equilibrium? State and briefly explain the conditions of producer's equilibrium with Marginal Revenue and Marginal Cost approach. Use diagram.
11. Explain producers equilibrium with the help of a numerical example using marginal revenue and marginal cost approach.
12. Draw in a single diagram the average revenue and marginal revenue curves of a firm which can sell any quantity of the good at a lower price. Explain.
13. Complete the following table :

<i>Units of Variable input</i>	<i>TP (Units)</i>	<i>AP (Units)</i>	<i>MP (Units)</i>
1	–	–	20
2	–	–	26
3	66	–	–
4	–	19	–
5	–	–	4

14. Identity the three phases in the law of variable proportion from following information :

<b>Units of Variable Input</b>	<b>Total Products (Units)</b>
0	0
1	4
2	14
3	22
4	28
5	32
6	34

7	34
8	32

15. If the total fixed cost of a firm is Rs. 24, Complete the following table :

<b>Output (Units)</b>	<b>AVC (Rs.)</b>	<b>TVC (Rs)</b>	<b>MC (Rs)</b>
1	50		
2	40		
3	45		

16. Distinguish between 'Change in Supply' and 'change in quantity supplied'.
17. Differentiate between 'contraction in supply' and 'decrease in supply'.
18. How does change in price of inputs affect the supply of a good.
19. Complete the following table :

<b>Output</b>	<b>Price (Rs.)</b>	<b>MR (Rs.)</b>	<b>TR (Rs.)</b>
1	—	—	10
2	—	4	—
3	—	—	15
4	—	(-)3	—

20. When the price of commodity rises from 10 to 11 per unit, its quantity supplied rises by 100 units. If its price elasticity of supply is 2. Then find out its quantity supplied at increased price.
21. How does change in price of related goods affect the supply of given goods.
22. What is a supply schedule? Explain how does change in technology of producing a good affect the supply of that good.
23. Following statements are true or false. Give reason :
- (a) At the stage of producer's equilibrium, marginal cost will be decreasing.

(b) AR curves always remain above MR curve.

24. Whether following statements are true or false. Give reasons.
- (a) When average revenue falls marginal revenue falls faster than average revenue.
  - (b) Average cost starts increasing when marginal cost, starts increasing.
25. Following statements are true or false. Give reasons :
- (a) Diminishing returns to a factor is applicable only when average product starts falling.
  - (b) AC and AVC curves do not intersect each other.
26. Following statements are true or false. Give reasons.
- (a) Supply remains constant in market period.
  - (b) When MP falls, AP falls.

### LONG ANSWER TYPE QUESTIONS (6 MARKS)

1. Explain diagrammatically the effect on total output when units of one factor is increased and all other inputs are held constant.
2. On the basis of following information, identify level of output at which producer will be in equilibrium using MR-MC approach and also give reasons :

Output (Units) :	1	2	3	4	5	6
AR (Rs.)	7	7	7	7	7	7
TC (Rs.)	8	15	21	26	33	41

3. What is producer's equilibrium? Explain the condition of producer's equilibrium through the 'marginal cost and marginal revenue' approach. Use diagram.
4. State whether true or false. Give reasons.
  - (a) Total product is the area under the marginal product curve.

- (b) When MR falls, AR falls.
  - (c) For the first unit of output  $MC = AVC$ .
5. State whether True or False. Give reasons.
- (a) When marginal revenue is constant and not equal to zero, then total revenue will also be constant.
  - (b) As soon as marginal cost rises, average variable cost also starts rising.
  - (c) Total product always increases whether there is increasing returns or Diminishing return to a factor.
6. State whether the following statements are true or false. Give reasons for your answer.
- (a) When total revenue is constant average revenue will also be constant.
  - (b) Average variable cost can fall even when marginal cost is rising.
  - (c) When marginal cost rises, average cost rises.

### SHORT ANSWER TYPE QUESTION

### SOLUTION

13.

<i>Units of Variable input</i>	<i>TP (Units)</i>	<i>AP (Units)</i>	<i>MP (Units)</i>
0	0	0	–
1	20	20	20
2	46	23	26
3	66	22	20
4	76	19	10
5	80	19	4

14.

Units of Variable Input	TP (Units)	MP (Units)	
0	0	0	First Phase
1	4	4	
2	14	10	
3	22	8	Second Phase
4	28	6	
5	32	4	
6	34	2	
7	34	0	
8	32	-2	Third Phase

15.

Output (Units)	AVC (Rs.)	TVC (Rs)	MC (Rs)
1	50	50	50
2	40	80	30
3	45	135	55

19.

Output	Price (Rs.)	MR (Rs.)	TR (Rs.)
1	10	10	10
2	7	4	14
3	5	1	15
4	3	(-3)	12

20.  $Es = \frac{\% \text{ change in Quantity}}{\% \text{ change in Price}}$

$$2 = \frac{\% \text{ change in Quantity}}{10\%} \left\{ \because \% \text{ change in Price} = \frac{1}{10} \times 100 \right\}$$

20% = % change in Quantity

20% of  $Q_0 = 100$

$$Q_0 = \frac{100}{20\%}$$

$$Q_0 = 500$$

New Quantity Supplied  $Q_1 = 500 + 100 = 600$  units

## LONG ANSWER TYPE QUESTIONS SOLUTION

2.

Output	AR (Rs.)	TR (Rs.)	TC (Rs.)	MC (Rs.)	MR (Rs.)
1	7	7	8	8	7
2	7	14	15	7	7
3	7	21	21	6	7
4	7	28	26	5	7
5	7	35	33	7	7
6	7	42	41	8	7

The producer will be in equilibrium at 5th units of output because here all conditions of producer's equilibrium is satisfied i.e., (i)  $MR = MC$  and (ii)  $MC > MR$  after  $MR = MC$  level of output.

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## Exam. Oriented Questions with Answer

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### VERY SHORT ANSWER QUESTION (1 MARK)

- Q. 1.** Define production function.
- Ans.** The function showing relationship between inputs and output is called production function.
- Q. 2.** State the changes in marginal product when total product increases at decreasing rate.
- Ans.** When total product increases at increasing rate, marginal product increases but remains positive.
- Q. 3.** What is breakeven point?
- Ans.** The point where TR is equal to TC or  $AR = AC$  is called breakeven point.
- Q. 4.** When with the change in price there will be no change in quantity of supply what will be the elasticity of supply.
- Ans.** Elasticity of supply will be equal to zero  $E_s = 0$ .
- Q. 5.** Define cost.
- Ans.** Cost refers to the sum of explicit cost, Implicit cost and Normal profit.
- Q. 6.** Define Marginal Cost.
- Ans.** Marginal cost refers to change in total cost due to additional unit of a commodity is produced.
- Q. 7.** Define Market Supply.
- Ans.** Market Supply refers to the sum total of quantity supplied of a commodity by all sellers or all firms in the market at a certain price and in a given period of time.

### 3–4 MARKS QUESTIONS

- Q. 1.** Explain the likely behaviour of total product under the phase of increasing return to a factor with the help of numerical example.

**Ans.** Increasing return to a factor is the first phase of the Law of return to a factor. When more and more units of a variable factor is combined with fixed factor up to a certain level total physical product increases with increasing rate.

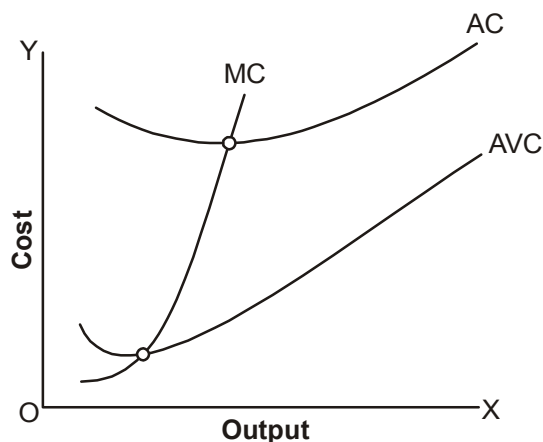
Machine	Unit of Labour	Total Physical Product
1	1	10
1	2	24
1	3	42

**Q. 2.** With the help of example distinguish between total fixed cost and total variable cost.

<b>Ans.</b>	<b>Total fixed cost</b>	<b>Total Variable Cost</b>
1.	Fixed cost remains constant at each level of output i.e., it does not change with change in level of output.	1. Variable cost changes with the changes in level output, it increases or decrease as the output change.
2.	It can not be zero when output is zero.	2. It is zero when output is zero.
3.	Its curve is parallel to x-axis.	3. It curve is parallel to the curve of total cost.
4.	Example : Rent, wages of permanent staff.	4. Example : cost of raw material, wages of casual labourer.

**Q. 3.** Draw average cost, average variable cost and marginal cost curves on a single diagram and explain their relations.

**Ans.**



For evaluating curves these points should be kept in mind :

1. MC cuts AC and AVC from their lowest points.
2. As output increases, the difference between AC and AVC decreases.
3. Lowest point of AC is right to the lowest point of AVC.

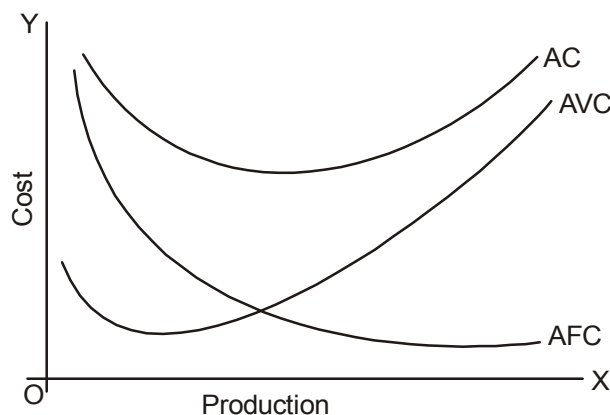
Relation between AC, AVC and MC

When  $MC < AC/AVC$ ,  $AC/AVC$  decreases

$MC = AC/AVC$ ,  $AC/AVC$  constant

$MC > AC/AVC$ ,  $AC/AVC$  increases

**Q. 4.** Draw average cost, average variable cost and average fixed cost curves on a single diagram and explain their relation.



1. AC is the vertical summation of AVC and AFC.
2. The difference between AC and AVC falls as output increases but the difference of AC and AFC increase.
3. As output increases AC and AVC tends to be closer but their curves do not intersect each other because AFC always remains more than zero.

**Q. 5.** Explain the relation between average revenue and marginal revenue when a firm can sell an additional unit or a good by lowering the price.

**Ans.**

1. AR and MR both decreases.
2. MR decrease at the rate of twice than AR.

3. MR become zero and negative but AR can never be zero.

**Q. 6.** Distinguish between 'change in quantity supplied' and 'change in supply'.

**Ans.** *Change in Quantity Supplied* *Change in Supply*

- |  |  |
|--|--|
| 1. It refers to the change in supply due to change in price of the good      | 1. It refers to the change in supply due to the change in the determinants of supply other than price. |
| 2. Determinants of supply other than price remains unchanged.                | 2. Price of the good remains unchanged.  |
| 3. Law of supply apply.  | 3. Law of supply does not apply.   |
| 4. There is upward and downward movement along with curve in this situation. | 4. Supply curve shifted to leftward or rightward under this supply condition.                          |

**Q. 7.** Explain how does change in price of input affect the supply of a good.

**Ans.** **Increase in price of Input :** Increase in price of input is a cause of a decrease in the supply of a good because the production cost of a good will increase due to increase in price of input. It will reduce the profit. So producer will decrease the supply of the good.

**Decrease in the good :** Decrease in price of input is a cause of increase in supply because when the price of input decreases the production cost of a good also decreases. Decreases in cost increase the profit margin. It motivates producer to increase the supply of the good.

**Q. 8.** Explain how changes in prices of other products influence the supply of a given product.

**Ans.** The supply of a good is inversely influenced with the change in price of other product which can be explained as follows :

**A. Rise in Price of Other product :** When there is a rise in the price of other product the production of these products becomes more profitable due to unchanged cost in comparison of the production of given product. As a result the producer will produce more quantity of other product so the supply of given good will decrease.

B. **Fall in the price of Other Product** : When there is fall in the price of other product the production of these product become less profitable due to unchanged cost in comparison of the production of given product. As a result producer will produce less quantity of other product so the factors of production shifted for the production of given good. It cause an increase in supply of given good.

**Q. 9.** Explain how technology advancement bring a positive impact in the supply of a given product.

**Ans.** Technology advancement reduces per unit cost and increase the productivity of given factors of production. Due to these reasons production of given product becomes more profitable.

**Q. 10.** What is the behaviour of average fixed cost as output is increased? Why is it so?

**Ans.** AFC falls continuously as output is increased. It is because, even when output is increased TFC remains unchanged.

**Q. 11.** An individual is both the owner and the manager of a shop taken on rent. Identify implicit cost and explicit cost from this information. Explain.

**Ans.** Implicit cost : Estimated salary of the owner. Because the owner would have earned this salary if he had worked with a firm not owned by him.

Explicit cost : Rent paid. Because it is actual money expenditure on input.

**Q. 12.** What is a supply schedule? What is the effect on the supply of a good when Government gives a subsidy on the production of that good? Explain.

**Ans.** A supply schedule is a schedule that shows the quantity supplied of a commodity at different prices during a period of time.

Due to Subsidy, Cost remaining unchanged, profit rise.

As a result supply increases.

## 6 MARKS QUESTIONS

- Q. 1.** Explain the law of variable proportion with the help of diagram/schedule.

**OR**

What is the likely behaviour of total product/marginal product when only one input is increased for increasing production? Used diagram/Schedule.

- Ans.** Law of variable proportion state the impact of change in unit of a variable factor on the physical output. When more and more unit of a variable factor combined with fixed factor then total product increases at increasing rate in the beginning, Then increases at decreasing rate and finally it starts falling.

Phase I : TP increase at an increasing rate

Phase II : TP increases at diminishing rate

Phase III : TP falls

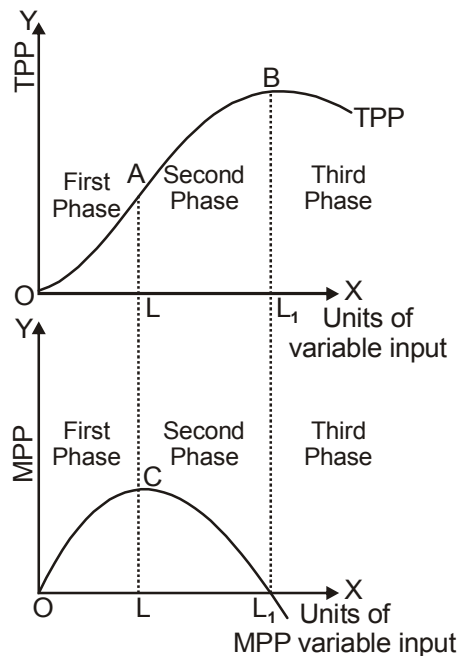
### Behaviour of MP

Phase I MP increases and becomes maximum.

Phase II MP decreases and becomes zero.

Phase III MP becomes negative

<i>Machine</i>	<i>Unit of Labour</i>	<i>TPP (Unit)</i>	<i>MPP (Unit)</i>
1	1	3	3
1	2	7	4
1	3	12	5
1	4	16	4
1	5	19	3
1	6	21	2
1	7	22	1
1	8	22	0
1	9	21	-1



**First Phase :** TPP increases with increasing rate upto A point. MPP also increase and becomes maximum at point C.

**Second Phase :** TPP increases with diminishing rate and it is maximum at point B. MPP start to decline and becomes zero at D point.

**Third Phase :** TPP starts to decline and MPP becomes negative.

❑ Important instruction for giving the answer of above question.

- Do not use diagram for the explanation of this question if it is instructed to use schedule and do not use schedule if the explanation of this question asked with the help of diagram.
- Do not explain the behaviour of marginal product with the help of schedule and diagram. If there is instruction to explain only the behaviour of total product.
- Do not explain the behaviour of total product with help of schedule and diagram if there is instruction to explain only the behaviour of marginal product.

**Q. 2.** What is producer's equilibrium? Explain the conditions of producer's equilibrium through the 'marginal cost and marginal revenue' approach. Use diagram/schedule.

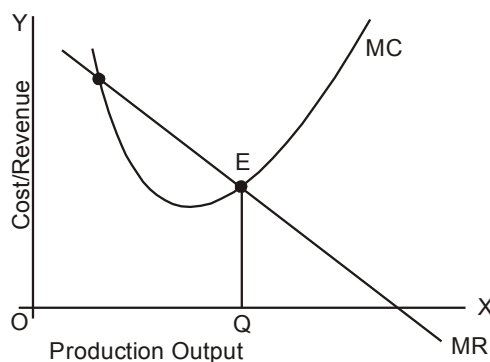
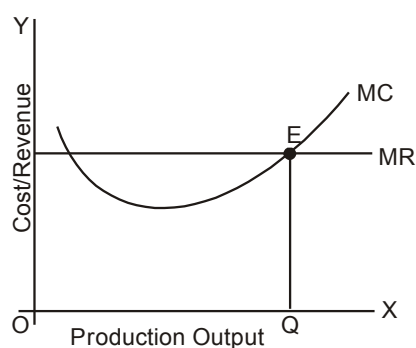
**Ans.** Producer's equilibrium refers to the stage under which with the help of given factors of production, the producer attains the level of production at which he is getting maximum profit. The conditions of producer's equilibrium through the marginal cost and marginal revenue approach are as follows.

1. Marginal cost should be equal to marginal revenue.
2. With the increase in output after equilibrium, marginal cost should be greater than marginal revenue.

Output (units)	MR (Rs.)	MC (Rs.)
1	4	5
2	4	4
3	4	3
<b>4</b>	<b>4</b>	<b>4</b>
5	4	5

**OR**

Output (Units)	MR (Rs.)	MC (Rs.)
1	10	5
2	8	4
3	6	3
4	4	4
5	2	5



**Explanation of Conditions**

- (i) So long as MC is less than MR, it is profitable for the producer to go on producing more because it adds to its profits. He stops producing more when MC becomes equal to MR.
- (ii) When MC is greater than MR after equilibrium it means the profit will decline if producer will produce more units of the good.

**Important instruction for giving the answer of the above question :**

- (i) Use only one schedule/diagram given as above for the explanations.
- (ii) Do not use diagram for the explanation of this question if it is instructed to use schedule and do not use schedule if the explanation of this questions is asked with the help of diagram.

## UNIT IV

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# FORMS OF MARKET & PRICE DETERMINATION

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### Points to Remember

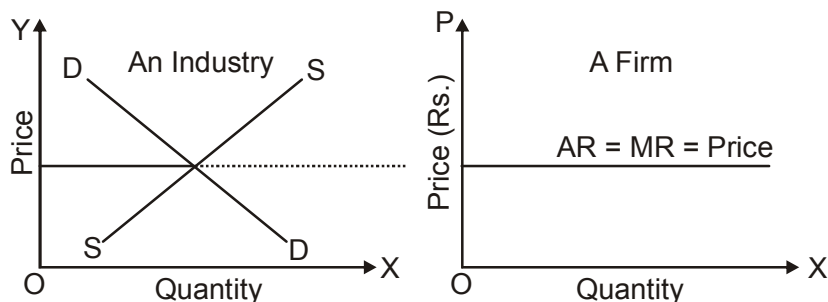
- ❑ Market is a system through which the buyers and sellers of a commodity or service comes in contact of one another for sale and purchase of the commodity or service on specific price.
- ❑ Markets are differentiated on the basis of :
  - (i) Number of buyers & Sellers
  - (ii) Nature of the product
  - (iii) Freedom to entry & exit of firm
  - (iv) Price determination

### **Types of Market**

1. Perfect Competition
2. Monopoly
3. Monopolistic competition
4. Oligopoly

### **PERFECT COMPETITION**

- ❑ Perfect competition is that type of market in which there are very large no. of buyers and sellers selling homogenous product at same price.
- ❑ Under perfect competition, per unit price remains constant therefore, average and marginal revenue curves coincide each other and becomes parallel to x-axis.



- ❑ Under perfect competition price is determined by the market forces of demand and supply in an industry. No individual firm or buyer can influence the price of the product. So industry is price maker and firm is price taker.

Features of Perfect Competition and their implication :

S.No.	Feature	Implication
1.	Very large number of buyers and sellers.	No firm can effect/ change the price, all firm are price taker because insignificant share of firm in market supply
2.	Homogeneous product	Uniform price prevails in the market
3.	Free entry and exit of firms in the market.	All firm earn normal profit in long run.
4.	Perfect knowledge	Uniform price prevails in market.

## MONOPOLY MARKET

- ❑ Monopoly is that type of market where there is a single seller, selling a product which does not have close substitutes and there are restrictions/barriers to enter into the industry. The monopoly firm is itself an industry and can set the price to its maximum advantage.

**Features :**

- Single Seller
- Restrictions on the entry and exit of new firms.
- No close substitute of product available.

- (d) Firm is a Price Maker
- (e) Price discrimination  
different price from different customers for same product or service.
- ☐ AR (Demand) curve is left to right downward sloping curve and less elastic than that of monopolistic competition.

## **MONOPOLISTIC COMPETITION**

Monopolistic competition is that type of market under which there are large number of buyers and sellers, Selling differentiated product to the consumer who have imperfect knowledge about the product.

- ☐ Each seller is the sole producer of a particular brand and with the help of marketing and advertisement represent their product as unique and best.

### **Features :**

- (a) Large No. of buyers and sellers
- (b) **Product Differentiation** : In this feature every firms make its product different on the basis of colour, taste, packing, size and shape.
- (c) **Selling Cost** : Cost on advertisement and sales promotion.
- (d) Freedom of entry and exit of new firm.
- (e) Lack of perfect knowledge.
- (f) Demand curve is more elastic.

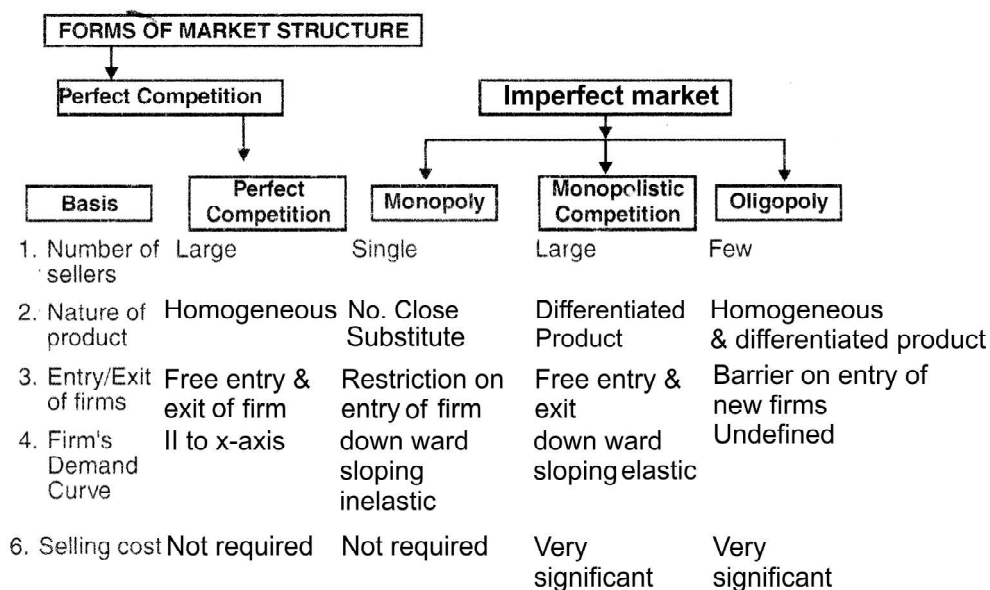
## **OLIGOPOLY**

- ☐ Oligopoly is the form of market in which there are few large firms, mutually dependent for taking price and output decisions.

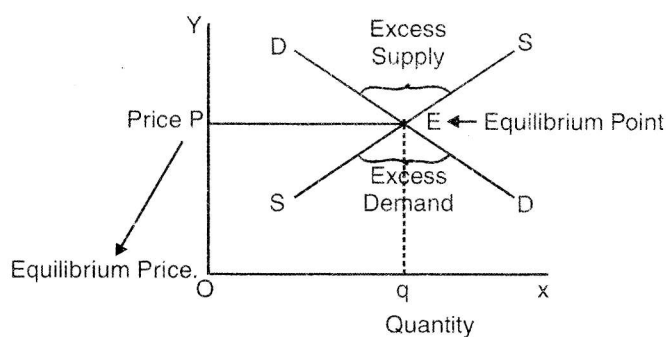
### **Features of Oligopoly**

- (a) Few large firms

- (b) All the firms under oligopoly produce homogeneous or differentiated product.
  - (c) Under oligopoly demand curve is undefined/indeterminate.
  - (d) Economic Barriers to the entry of firm into industry. e.g., huge investment requirements, economies of scale etc.
  - (e) All the firms are interdependent in respect of price and output determination under oligopoly market. Any action of a firm in terms of change in price, gets reaction from other firms.
- ❑ Oligopoly can be categorised in two categories in the following ways.
- Collusive oligopoly and Non-collusive oligopoly :
    - (i) Collusive oligopoly is that form of oligopoly in which all the firms determine price and quantity of output on the basis of cooperative behaviour.
    - (ii) Non-collusive oligopoly is that form of oligopoly in which all the firms determine the price and quantity of output according to the action and reaction of the other firms.
  - Perfect oligopoly and Imperfect oligopoly
    - (iii) **Perfect Oligopoly** : If firms produce homogeneous product then it is called perfect oligopoly.
    - (iv) **Imperfect Oligopoly** : If firms produce heterogeneous product it is called imperfect Oligopoly.



- ❑ **Equilibrium Price :** Refers to the price at which market demand and market supply of a commodity are equal.
- ❑ Market equilibrium is a state in which market demand is equal to market supply. There is no excess demand or excess supply in the market.



- ❑ **Price determination in perfect competition market :**

In perfect competition market price always remain at equilibrium level. Market demand and market supply decide the market price at a point where they intersect each other or become equal. Any change in market demand or market supply or both change the equilibrium price.

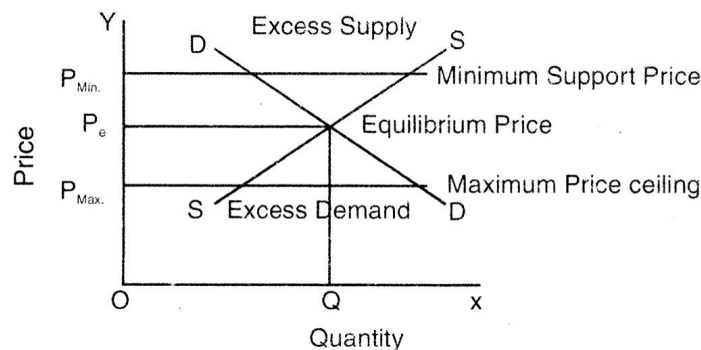
- ❑ Chain effect of the change in demand on equilibrium (market) price and equilibrium quantity.

(i) Increase in demand :

- Demand curve shifts rightward.
- Situation of excess demand arises at given market price.
- Competition among the buyers.
- Consumers are willing to pay more.
- Increase in price results in contraction in demand and extension in supply till market reach equilibrium point i.e., demand = supply. Equilibrium price increased and equilibrium quantity also increased.

### Application of Demand and Supply

- (a) **Maximum Price Ceiling** : It mean the maximum price the producers of goods or service are allowed to charge. Government imposes such a ceiling below the equilibrium price when it finds that the demand for necessary goods exceeds its supply. That is, when consumers are facing shortages and equilibrium price is too high. Government does it in the interest of consumers.



- (b) **Minimum Price Ceiling** : Government imposes lower limit on the price, which is higher than the equilibrium price to safe guard the interest of producers. The price is also called minimum support price.

## MULTIPLE CHOICE QUESTIONS (1 MARK)

1. In which market  $MR = \text{Price}$ 
  - (a) Monopoly
  - (b) Perfect Market
  - (c) Monopolistic Market
  - (d) Oligopoly
2. In which market, restrictions on entry of new firms
  - (a) Perfect Competition
  - (b) Monopolistic competition
  - (c) Monopoly
  - (d) None of the above.
3. Under which market, firm is a price taker
  - (a) Perfect Competition
  - (b) Monopoly
  - (c) Monopolistic Competition
  - (d) Oligopoly
4. Under Oligopoly
  - (a) Large no. of sellers
  - (b) Few sellers
  - (c) Single seller
  - (d) None of above
5. A price at which a consumer is willing to buy and a seller is willing to sell the commodity is called.
  - (a) Minimum Price
  - (b) Maximum Price
  - (c) equilibrium price
  - (d) None of the above.
6. When a monopoly firm charges different prices from different consumers for the same product is called
  - (a) Quantity discrimination
  - (b) Product differential
  - (c) Price discrimination
  - (d) Consumer differentiation.
7. Quantity of a commodity which is bought and sold at the equilibrium price is called?
  - (a) Maximum quantity
  - (b) Minimum quantity
  - (c) Both (a) and (b)
  - (d) Equilibrium quantity

8. At a given price, when demand for commodity is more than supply of the commodity then it is called excess demand. Here given price is :
  - (a) less than equilibrium price
  - (b) more than equilibrium price
  - (c) less than or equal to equilibrium price
  - (d) More than or equal to equilibrium price
9. Price ceiling refers to :
  - (a) Max. retail price
  - (b) Max. price the buyer is willing to pay
  - (c) Max. price at which seller is willing to sell.
  - (d) Max. price the producer is legally allowed to charge.
10. Fixation of minimum wage below the equilibrium wage rate leads to :
  - (a) Unemployment
  - (b) Over employment
  - (c) Neither (a) nor (b)
  - (d) Either (a) or (b)
11. Which feature distinguished oligopoly from other market forms
  - (a) Interdependence among firms.
  - (b) Homogenous product
  - (c) Perfect knowledge
  - (d) Large number of buyers
12. Which market form does not exist in real life.
  - (a) Perfect competition
  - (b) Monopoly
  - (c) Oligopoly
  - (d) Monopolistic competition

### Answers

1. (b); 2. (c); 3. (a); 4. (b); 5. (c); 6. (c); 7. (d); 8. (a); 9. (d); 10. (c); 11. (a); 12. (a).

### **Short Answer Type Questions (3-4 Marks)**

1. How is the demand curve under monopolistic competition different from demand curve of a firm under perfect competition?
2. How does 'Free entry and exit feature of Perfect competition market affect the profit of a firm.
3. What will happen if the price prevailing in the market is above the equilibrium price.
4. Explain the concept of excess demand with the help of diagram.
5. Differentiate between :
  - (a) Collusive and Non-collusive oligopoly.
  - (b) Perfect and Imperfect oligopoly.
6. Explain the determination of equilibrium price under perfect competition with the help of schedule.
7. Explain why is the equilibrium price determined only at the output level at which market demand and market supply are equal.
8. In perfect competition  $AR = MR$  but in monopoly and monopolistic competition  $AR > MR$ , why?
9. In which condition decrease in demand can not change the price of commodity?
10. Explain how firms are interdependent in an oligopoly market.
11. In which competition the availability of close substitutes is present? How does it effect the price?
12. Explain the implication of 'freedom of entry and exit to the firms' under perfect competition.

### **LONG ANSWER TYPE QUESTIONS (6 MARKS)**

1. Explain the characteristics of monopolistic competition.
2. Market for a good is in equilibrium. There is 'increase' in supply of that good. Explain the chain of effects of this change. Use a numerical example.
3. Explain the term market equilibrium. Explain the series of changes

that will take place if market price is higher than the equilibrium price.

4. How will a fall in the price of tea affect the equilibrium price of coffee? Explain the chain of effects.
5. Explain the following features and their implication of perfect competition.
  - (i) Large number of firms or Sellers and Buyers.
  - (ii) Homogeneous Product.
6. Explain features of Oligopoly.
7. With the help of a diagram explain the effect of 'decrease' in demand of a commodity on its equilibrium price and quantity.
8. There is simultaneous decrease in demand and supply of a commodity, when it result in
  - (i) no change in equilibrium price
  - (ii) a fall in equilibrium price.
9. Suppose under a competitive market equilibrium price is too high for an average consumer in case of essential items. Give suggestion to bring down the equilibrium price upto affordable level for a common man.
10. Suppose government reduces the rate of excise duty and raise subsidies. What is the likely impact of these on the market of a product. Explain with diagram.

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## Exam. Oriented Questions with Answer

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### VERY SHORT ANSWER QUESTION (1 MARK)

- Q. 1.** Define equilibrium price.
- Ans.** Equilibrium price refers to that price which equates market demand for a commodity with its market supply.
- Q. 2.** Define perfect competition.
- Ans.** Perfect competition refers to a market situation in which (i) there are very large number of buyers and sellers (ii) products are homogeneous and (iii) there is free entry and exit.
- Q. 3.** What is Cartel?
- Ans.** A Cartel is a group of firms which jointly set output and price of its product in such a way so as to keep benefit of monopoly.
- Q. 4.** Define Price Ceiling.
- Ans.** Price Ceiling refers to the maximum price of a commodity lower than equilibrium price at which the seller can legally sell their product.
- Q. 5.** What is meant by excess demand for a product.
- Ans.** Excess demand refers to the situation in which market demand is more than market supply of a commodity at a given price.

### 3-4 MARKS QUESTIONS

- Q. 1.** Explain the implication of large number of buyers in a perfect competitive market.
- Ans.** The implication is that no single buyer is in a position to influence market price on its own because an individual buyer's purchase for negligible proportion of the total purchase of the good in the market.
- Q. 2.** Explain why are firms mutually interdependent in an oligopoly market.

**Ans.** Firms are mutually interdependent because an individual firms take decision about price and output after considering the possible reactions by the rival firms.

**Q. 3.** Explain the implication of 'freedom of entry and exit of the firms' under perfect competition.

**Ans.** The firms enter the industry when they find that the existing firm earning super normal profits. Their entry raises output of the industry brings down the market price and thus reduce profits. The entry continue till profits are reduced to normal. On the other hand the firms start leaving industry when they are facing losses. This reduces output of the industry raises market price and reduces losses. The exit continues till the losses are wiped out. Hence in the long run, firms earn only normal profit.

**Q. 4.** Explain the implication of 'perfect knowledge about market' under perfect competition.

**Ans.** Perfect knowledge means that both buyers and sellers are fully informed about the market price. Therefore no firm is in a position to charge different price and no buyer will pay a higher price. As a result uniform price prevails in the market.

**Q. 5.** Why is the demand curve more elastic under monopolistic competition than under monopoly.

**Ans.** The elasticity of demand is high when the product has close substitutes and elasticity of demand tends to be low when the products have no close substitutes. As we know in monopolistic competition large number of close substitutes are present and in monopoly there is no close substitutes. Hence the demand curve under monopolistic competition is more elastic than that under monopoly.

**Q. 6.** Why is a firm under perfect competition a price taker while under monopoly a price maker Explain in brief.

**Ans.** A firm under perfect competition a price taker by the following reasons :

1. **Number of Firms :** The number of firms under perfect competition is so large that no individual firm by changing sale, can cause any meaningful change in the total market

supply. Hence, market price remains unaffected.

2. **Homogeneous Product** : All firms in a perfectly competitive industry produce homogeneous product. Hence, price remains same.
3. **Perfect Knowledge** : All the buyers and sellers have perfect knowledge about market price so no firm charge a different price than market price. Hence a uniform price prevails in the market.

A firm under monopoly a price maker by the following reasons :

1. A monopolist is a single seller of the product in the market. Hence it has full control over supply.
2. There are no close substitutes of the monopoly product hence the demand is less elastic or 'inelastic.'
3. There are legal, technical and natural barriers to the entry of new firms so that there is no fear of increase in market supply.

**Q. 7.** Differentiate between price discrimination and product differentiation.

**Ans.** **Price Discrimination** : Price discrimination is a situation when a monopolist charges different price from different buyers of the same product. This is generally done to maximise profits.

**Product Differentiation** : Product differentiation is a situation when different producers under monopolistic competition, try to differentiate their product in terms of its shape, size, packaging, trade mark or brand name. This is done to attract buyers from the rival firms in the market.

**Q. 8.** Distinguish between perfect competition and monopoly.

<b>Ans.</b>	<i>Perfect Competition</i>	<i>Monopoly</i>
-------------	----------------------------	-----------------

- |    |                                     |    |  |
|----|-------------------------------------|----|--|
| 1. | Large number of buyers and sellers. | 1. | One seller & large no. of buyers.                |
| 2. | Products are homogeneous.           | 2. | There is no close substitutes of goods/services. |

- |                                    |   |
|------------------------------------|---|
| 3. Free Entry and exit.            | 3. Barriers to entry                        |
| 4. There is no control over price. | 4. There is full control over market price. |

**Q. 9.** Differentiate between Monopoly and Monopolistic Competition.

**Ans.** *Monopoly*

*Monopolistic competition*

- |   |  |
|---|--|
| 1. Single seller and large number of buyers | 1. Large number of buyers and sellers. |
| 2. No close substitutes                     | 2. There is product differentiation.   |
| 3. Barriers to entry.                       | 3. Free entry and exit.                |
| 4. Selling cost is zero.                    | 4. Heavy selling costs are incurred.   |

**Q. 10.** What is oligopoly? State its main properties/features.

**Ans.** **Oligopoly :** It is a form of the market in which there are a few big sellers of a commodity and a large number of buyers. There is a high degree of interdependence among the sellers regarding their price and output policy.

Following are some principal features of oligopoly :

1. A few firms
2. High degree of interdependence
3. Non-price competition
4. Entry barriers
5. Formation of cartels
6. High selling cost

## 6 MARKS QUESTIONS

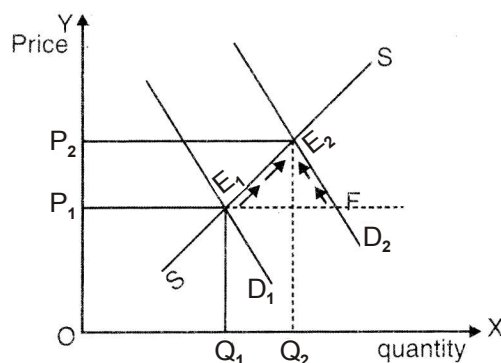
**Q. 1.** Distinguish between collusive and non-collusive oligopoly. Explain how the oligopoly firms are interdependent in taking price and output decisions.

**Ans.** Collusive oligopoly is one in which the firms cooperate with each other in deciding price and output where as, noncollusive oligopoly is one in which the firms compete with each other.

The firms are interdependent because each firm takes into consideration the likely reactions of its rival firms when deciding its output and price policy.

It makes a firm dependent on other firms. The firm may have to reconsider the change in the light of the likely reactions.

- Q. 2.** Market for a good is in equilibrium. There is an 'increase' in demand for this good. Explain the chain of effects of this change. Use diagram.



- Ans.** Increase in demand shifts the demand curve from  $D_1$  to  $D_2$  to the right leading to excess demand  $E_1 F$  at the given price  $OP_1$ .

Since the consumers will not be able to buy all they want to buy at this price, there will be competition among buyers leading rise in price.

As price rises, demand starts falling (along  $D_2$ ) and supply starts rising (along  $S$ ) as shows by arrows in the diagram.

The quantity rises to  $OQ_2$  and price to  $OP_2$ .

- Q. 3.** Market for a good is in equilibrium. There is simultaneous 'decrease' both in demand and supply of the good. Explain its effect on market price.

- Ans.** There are three possibilities :

1. If the relative (percentage) decrease in demand is greater than the decrease in supply, price will fall. The price will fall because of excess supply in the market.
2. If the relative (percentage) decrease in demand is less than the decrease in supply price will rise. The price will rise because of excess demand in the market.

3. If the relative (percentage) decrease in demand is equal to the decrease in supply price will remain unchanged.

The price will remain unchanged because there is neither excess demand nor excess supply in the market.

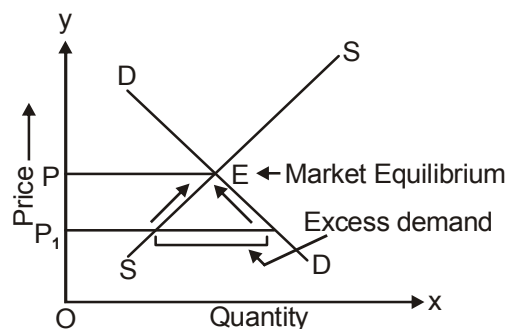
- Q. 4.** Explain why the equilibrium price of commodity is determined at that level of output at which its demand equals its supply.

**Ans.** Suppose demand is greater than supply. Since the buyers will not be able to buy all what they want, there will be competition among the buyers. It will have an upward influence on the price. As a result demand will start falling and supply rising. It will go on till demand is equal to supply again. If demand is less than supply. Since the sellers will not be able to sell all what they want, there will be competition among the sellers. It will have a downward influence on the price. As a result demand will start rising and supply falling. It will go on till demand is equal to supply again.

Hence, the equilibrium price of a commodity is determined at that level of output at which its demand equals its supply.

- Q. 5.** With the help of diagram, show the situation of excess demand. Explain in steps how excess demand reaches to equilibrium.

**Ans.**



Excess demand is a situation when price of a good is less than the equilibrium price. It leads to competition among buyers which push the price upwards which leads to contraction in market demand and expansion in market supply. Due to it price rise, excess demand wiped out.

**Q. 6.** Define price floor. Explain the implications of price floor.

**Ans.** "Price Floor" is the minimum price fixed by the government below which seller cannot sell their product.

Since this price is normally above equilibrium price, there is excess supply in the market. As the seller may not be able to sell all the he wants to sell, he may illegally attempt to sell the product at a price below the floor price. Most well known example of imposition of price floors are agricultural price support programme or MSP (Minimum Support Price) and minimum wage legislation.

**Q. 7.** Define price ceiling. Explain the implications of price ceiling.

**Ans.** 'Price ceiling' is the maximum price fixed by the government that sellers can legally charge for a product or a service.

Since this price is below equilibrium price, there is excess demand in the market. As the buyer may not be able to buy all that he wants to buy, he may illegally attempt to buy the product at a price above the ceiling price and it lead to black marketing'.

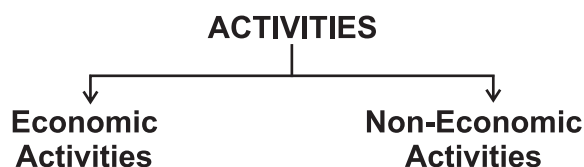
Most well known examples of imposition of price ceiling are dengue test and pricing of stent that is used in the heart surgery.

## PART-B : STATISTICS FOR ECONOMICS

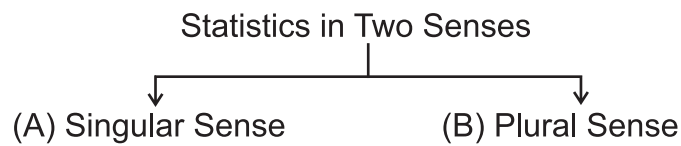
### Unit - 1 INTRODUCTION

Economics is the study of how people and society choose to employ scarce resources that could have alternative uses in order to produce various commodities and services that satisfy their wants and to distribute them for consumption among various person and groups in society.

- **Consumer** :- A consumer is one who consumes goods and services for the satisfaction of his wants.
- **Producer** :- A person is one who produces goods and services for the generation of income.
- **Service Producer** :- A service provider is a person who provides some kind of service to other for a payment.
- **Service Holder** :- A service holder is a person who works for some other person and get paid for it in the form of wages or salary.
- **Activities** :- There are two types of Activities



- **Economic Activities** – Those activities which increase the flow of income in the economy are called economic activities. Example- Production, consumption and capital formation.
- **Non Economic Activities** :- Those activities which do not increase the flow of income in the economy are called non-economic activities. Example- Blood donation for a noble cause.
- **Scarcity** :- It refers to a situation in which supply of any goods, services or resources is limited in relation to its demand.
- **Statistics** :- Statistics may be defined in two main senses.



- **Statistics in singular sense :-** In singular sense statistics may be define as the collection, organisation, presentation, analysis and interpretation of numerical data.
- **Statistics in plural sense :-** In plural sense statistics means aggregate of Numerical facts, which can be placed in relation to one another and which may be affected by multiplicity of causes.
  
- **Functions of Statistics :-**
  1. To simplify complex facts
  2. To present facts in definite form
  3. To facilitate policy formulation
  4. To help in forecasting
  5. To make comparison of facts
  6. To enlarge individual knowledge and experience
- **Importance of Statistics in Economics :-**
  1. Every branch of economics takes support from statistics in order to prove various economics theories in it.
  2. Helps in understanding and solving various economic problem.
  3. Helps in studies of market structure.
  4. Helps in establishing mathematical relation.
  5. Useful to study of different economic concepts.
- **Scope of Statistics :-**

Today the importance of statistics is increasing day by day. Not a single area is visible where statistics is not in use.

In all fields statistics is required whether it is business, politics, banking, economic research etc. For the efficient governance and policy formation data are required to govt. also.

- **Limitations of Statistics :-**
  1. Statistics deals only with quantitative data
  2. Statistics deals with aggregate of facts and not with individual facts.
  3. Statistical results are true on an average.
  4. Only experts can make the best possible use of statistics.
  5. Data should be uniformed and homogeneous.
  6. Statistics can be misused.

## **QUESTION BANK**

### **ONE (1) MARKS QUESTIONS :-**

1. Define economics.
2. Give example of economic activity.
3. Define economy.
4. What is scarcity?
5. What is consumption?
6. What is economic activity.
7. Define non-economic activity.
8. Define Production.

### **THREE & FOUR (3 & 4) MARKS QUESTIONS :-**

1. Describe the importance of statistics in economics.
2. Define statistics as a singular and plural sense.
3. Explain the scope of statistics.
4. State any three limitations of statistics.
5. State any three function of statistics.
6. Consumption, Production and distribution are economic activities, explain.

### **ANSWER OF ONE (1) MARK QUESTIONS**

1. Economics is that science which deals with the use of scarce resources that have alternative uses to fulfill unlimited wants.

2. Producer is one who produces goods and services for the generation of income.
3. It refers to a system which provides means to work.
4. It refers to shortage of resources in relation to their demand.
5. It is process in which people uses goods and services in order to satisfy their wants.
6. Those activities which increase the flow of income in the economy. Example : Production, consumption, capital formation etc.
7. Those activities which do not increase the flow of income in the economy. Example : Blood donation for a noble cause.
8. It is a process in which producer produce goods and services for the generation of income.

## Exam Oriented Questions with Answer

### **Q.1. What is the importance of statistics in economics ?**

**Ans.** A number of economic problems can easily be understood by the use of statistics. It helps in formulation of economic policies e.g., basic economic activities like production, consumption etc. The importance of statistics in various parts of economics as follows:

- a) Statistics in consumption : Statistics helps in understanding how different groups of people spend their income on various goods and services. The data of consumption are useful and helpful in planning their budget and improve their standard of living. It helps producer to analyse consumption pattern, understanding of standard of living of particular region.
- b) Statistics in production : The comparative study of the production process is done with the help of statistics. The statistics of production are very useful and helpful for adjustment of demand and supply and determining quantity of production of the commodity.
- (c) Statistics in distribution : Statistical methods are used in solving the problem of distribution of national income among various factors of production i.e, land, labour, capital and entrepreneur.

### **Q.2. Explain functions of statistics.**

**Ans.** Statistics performs very important functions, these are :

- 1. Helps in Understanding Economic problem : Statistics is an indispensable tool for an economics that helps to understand an economic problem. Using its various methods, effort is made to find the causes behind it with the help of the quantitative facts of the Economic problem.
- 2. Presentation of facts in definite form : Statistics enables an economist to present economic facts in a precise and definite form that helps in proper comprehension of what is stated. When economic facts are expressed in statistical terms, they become exact. Exact facts are more convincing than vague statement.

3. Statistics helps in condensing mass data into a few numerical figures, which can be easily summarised : For example, it would be impossible for us to remember the income of all the people of a group if the number of people is very large. Yet one can remember easily a summary figure like the average income. In this way statistics summarises and presents meaningful overall information about a mass of data.
4. Establishes relation between factors : Statistics is used in finding relationships between different economic factors. An economist may be interested in finding out, what happens to the demand for a commodity when its price increases or decreases ? By applying statistical method, one can answer whether any relationships exist or not.
5. Helps in formulation of plans and policies : Statistical methods, help in formulating appropriate economic policies and plans to solve various economic problems.

**Q.3. Explain limitations of statistics.**

**Ans.** Statistics has some limitations, these are

1. Statistics does not study individuals : Study of an individual is not a part of subject matter of statistics. Statistics studies the aggregate of facts only.
2. Statistics deals with quantitative facts only : Statistics are numerically expressed. Statistics does not study qualitative aspects. It can be used for measured quantitative data only.
3. Statistical results are only on an average : Unlike the laws of natural sciences, statistical observations are not error free. These are not always valid under all conditions.
4. Only experts can make the best possible use of Statistics : Statistics can be used by experts only. It requires special knowledge to use statistical tools otherwise results may be wrong.
5. Uniformity and Homogeneity of Data : It is essential that data must have the quality of uniformity and homogeneity to make data comparable.

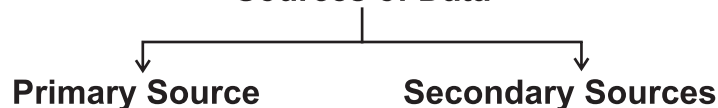
## Unit - 2

### COLLECTION, ORGANISATION AND PRESENTATION OF DATA

### COLLECTION OF DATA

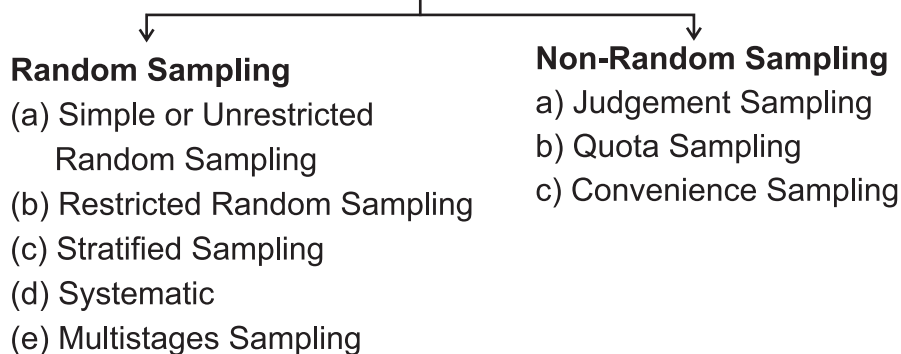
- The data are comparative numerical facts and information. The data are tools which help in reaching a sound conclusion by providing information therefore for statistical investigation, collection of data is the first and foremost.

#### Sources of Data



- **Primary Data** – The data originally collected in the process of investigation are known as primary data. It is first hand data.
- Methods of collecting primary data :–
  - i) Personal Interviews
  - ii) Mailing (Questionnaire Surveys)
  - iii) Telephone Interviews
- **Secondary Data :-** The data which have been collected for some other purposes by some other agencies are called secondary data.
- **Sources of Secondary Data :-**
  - 1) Published sources
  - 2) Unpublished sources
  - 3) Other sources – Web site
- Important points to be kept in mind while drafting the questionnaire.
  - 1) Introduction and purpose of investigation.
  - 2) Reasonable number of questions.
  - 3) Questions should be arranged logically.
  - 4) Questions should be small and clear.
  - 5) Questions should be relevant to the investigation.
  - 6) Personal questions should be avoided.
  - 7) Avoid calculative questions.

### Methods of Sampling



- **Census Survey** :- In this method every element of population is included in investigation.
- **Sample Survey** :- In this method a group of units representing all the units of population is investigated.
- **Sampling Errors** :- Sampling error is the difference between the result of studying a sample and the result of the census of the whole population.
- **Non-Sampling Errors** :- It can occur in any type of survey whether it be a census or sample survey.

### Types of Error

#### Sampling Errors

1. Biased Errors
2. Unbiased Errors

#### Non-Sampling Error

1. Error in data acquisition
2. Non-Response Error
3. Measurement Error

#### Census of India and National Sample Survey Office (NSSO)

- The census of India provides the most complete and continuous demographic record of population.
- The NSSO was established by the Govt. of India to conduct nation wide survey on socio -economic issues like employment literacy, maternity, child care, utilisation of public distribution system etc.
- The data collected by NSSO survey are released through reports and its quarterly journal 'Sarvekshana'.

## **QUESTION BANK**

### **ONE (1) MARK QUESTIONS :-**

- 1) What are the two main sources of data?
- 2) What is data?
- 3) Give the meaning of primary data.
- 4) What is secondary data?
- 5) Write the meaning of population in statistics.
- 6) Define sample.
- 7) What is direct personal investigation?
- 8) What is random sampling?
- 9) Name any two sources of secondary data.
- 10) What is NSSO?
- 11) What is sampling error?
- 12) What are non sampling errors?
- 13) Main demerit of mailing question naire is that the respondents.
  - (i) do not answer the questions.
  - (ii) do not read them carefully.
  - (iii) do not send it back.
  - (iv) All the above.
- 14) What type of questions should not be included in a questionnaire?
  - (i) Simple
  - (ii) Multiple choice
  - (iii) Personal
  - (iv) Specific
- 15) 'Census of India' collect data related to :
  - (i) Industry
  - (ii) National Income
  - (iii) Agriculture
  - (iv) Demography

### **THREE & FOUR (3 & 4) MARKS QUESTIONS :-**

- 1) Differentiate between the primary data and the secondary data ?
- 2) Differentiate between census and sample ?
- 3) Distinguish between sampling and non sampling error ?

- 4) Discuss the stratified sampling with an example ?
- 5) Write two merits and two demerits of Census method ?
- 6) Mention four demerits of sample method ?
- 7) What do you mean by random sampling ?
- 8) What is pilot survey ? Explain its importance ?
- 9) What are the essentials of a sample ?
- 10) Census of India is the main source of secondary data. Explain.
- 11) What precautions are necessary while using secondary data?
- 12) Differentiate between direct personal investigation and indirect oral investigation.
- 13) "Sampling is a necessity under certain conditions". Explain.
- 14) What information does the reports and publications of NSSO contain?
- 15) What is the difference between questionnaire and schedule?

**SIX (6) MARKS QUESTIONS :-**

- 1) Explain the random methods of collecting samples.
- 2) Briefly, explain the functions of NSSO.
- 3) Explain the merits and demerits of Census method.
- 4) Explain the merits and demerits of personal interview method.
- 5) What is a questionnaire? Write the qualities of a good questionnaire.
- 6) Explain, why a sample survey is usually preferred over a census survey.
- 7) What are the merits and demerits of telephonic interview?

**ANSWERS OF ONE MARK QUESTIONS**

- 1) (i) Internal sources (ii) External sources
- 2) The data are tools which help in reaching a sound conclusion by providing information.
- 3) The primary data are original data which are collected for the first time by an investigator.

- 4) The data which have been collected for some other purposes by some other agencies are called secondary data.
- 5) In statistics population or universe simply refers to an aggregate of items to be studied for an investigation.
- 6) A group of items taken from the population for investigation and representative of all the items.
- 7) It is method of investigation in which data are collected personally by the investigator by asking questions.
- 8) A method in which each item of the universe has equal chance of being selected in the sample.
- 9) (i) Published sources (ii) Unpublished sources
- 10) NSSO is the largest organisation which conducts regular socio economic survey.
- 11) The sampling error is the difference between the result of studying a sample and the result of the census of the whole population.
- 12) The errors that occur in acquiring, recording or tabulating statistical data.
- 13) (iv)
- 14) (iii)
- 15) (iv)

## Exam Oriented Questions with Answers

**Q.1. Explain difference between the primary data and the secondary data.**

**Ans.** 1) The data collected by the investigator for his own purpose for the first time are called primary data.  
2) These are original as these are collected from the source of origin.  
3) These are costlier in terms of time, money and efforts involved.  
4) Example : Investigator makes a list of marks obtained by students in economics of class XI by interrogating them.

• **Secondary Data**

- 1) Data which are already in existence and which have been collected for some other purposes are called secondary data.
- 2) These are not original as these are already in existence. These can be obtained from published or from any other sources.
- 3) These are less costlier in terms of time, money and efforts involved.
- 4) Example : Investigator collects the marks obtained by class teacher in economics of class XI from his school records like award list, result register etc.

**Q.2. What is personal interviews? Write the merits and demerits of personal interviews.**

**Ans.** Personal Interviews : This method is used when the researcher has access to all the members. The researcher conducts face to face interviews with the respondents. The interviewer has the opportunity of explaining the study and answering any query of respondents.

**Merits :**

- 1) Get the highest response rate by this method.
- 2) The Misinterpretation and the misunderstanding can be avoided.
- 3) Watching the reactions of respondents can provide supplementary information.

- 4) Allows clarification of ambiguous questions.

**Demerits :**

- 1) It is expensive.
- 2) It requires trained interviewer.
- 3) It takes longer time to complete the survey.
- 4) Presence of the researcher may inhibit respondents from saying what they really think.

**Q.3. Differentiate between the census method and the sample method.**

**Ans.** Census Method :

- 1) The Census covers every individual/unit belonging to the population.
- 2) Since all items are studied under census method, highest degree of accuracy is possible.
- 3) As all items are studied under census method, this method is very expensive and involves a lot of money and efforts.
- 4) The Census method is very time consuming as all items are studied.
- 5) The Census method is suitable when items in the universe have diverse characteristics.
- 6) This method is suitable when the area under investigation is relatively small.

**Sample Method :**

- 1) The Sample is a smaller group selected from the population from which the relevant information would be sought.
- 2) Since only representative samples are studied under sample method. It is less accurate. However errors can be easily detected and removed.
- 3) As only few samples are studied under sample method, this method is comparatively less expensive.
- 4) The Sample method is less time consuming as only samples are studied.
- 5) The Sample method is suitable when items in the universe are homogeneous.
- 6) This method is suitable when the area under investigation is large.

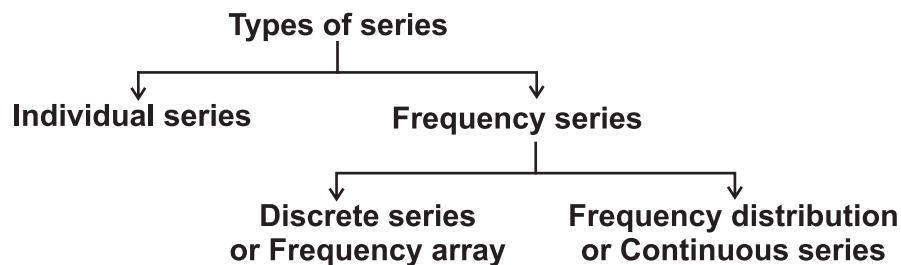
## ORGANISATION OF DATA

- Organisation of data refers to the systematic editing, arrangement and classification of facts and figures (raw data) in such a form that comparison of masses of similar data may be facilitated and further analysis may be possible.
- Classification is the process of arranging data into sequences and groups according to their common characteristics of separating them into different but related parts.
- **Characteristics of classification :-**
  - 1) Homogeneity
  - 2) Clarity
  - 3) Flexibility
  - 4) Diversification
  - 5) Elasticity
  - 6) Suitability
- **Basis of classification :**
  - 1) **Chronological classifications :-** The data are classified either in ascending or in descending order with reference to time such as years, quarters, months, weeks etc.
  - 2) **Spatial classification :-** The data are classified with reference of geographical location such as countries, states, cities, districts etc.
  - 3) **Qualitative classification :-** The data are classified with reference to descriptive characteristics like sex, caste, religion, literacy etc.
  - 4) **Quantitative classification :-** The data are classified on the basis of some measurable characteristics such as height, age, weight, income, marks of students etc.

**Variable :-** Variable is a characteristic which is capable of being measured and capable of change in its value from time to time. There are two types of variables.

- a) **Discrete variables** :- Those variables that increase in jumps or in complete numbers and are not fractional. For example number of students, number of workers.
- b) **Continuous Variables** :- Those variables which can take all the possible values (integral as well as fractional in a given specific range. For example height, weight etc.
- **Frequency distribution** :- The distribution of observations over the several values is called frequency distribution.
- **Class interval** :- The magnitude spreads between the lower and upper class limits is called interval. for example 10-20, 10 is the lower limit and 20 is the upper limit.
- **Class frequency** :- The number of values in each of the quantitative classes are called the class frequency.
- **Mid-point** :- The mid-value which lies half way between the lower and upper class limits is known as mid-point, or it is the central point of a class interval.

$$\frac{10+20}{2} = 15$$



- **Range**:- Range is the difference between the largest and smallest observation.
- **Univariate Frequency Distribution**:- The frequency distribution of a single variable is called a univariate distribution.

**Example:** Marks of a student.

- **Bivariate Frequency Distribution**:- A bivariate frequency distribution is the frequency distribution of two variables.

**Example:** The tables shows the sales and advertisement expenditure of the firm.

- **Exclusive Method:-** Under this method upper limits are excluded. The upper limit of class interval is the lower limit of the next class interval. For example, if the marks obtained by students are grouped as 5–10, 10–15, 15–20, 20–25 etc. If the marks of a student is 15 then it will be included in 15–20, not in 10–15.
- **Inclusive Method:-** Under this method upper limits are included in respective classes. For example if the marks obtained by students are grouped as 5–9, 10–14, 15–19, 20–24 etc. If the marks of a student is 5 to 9 then that will be included in this class.
- **Loss of Information :** The classification of data as a frequency distribution has an inherent short coming, while it summarises the raw data making it concise and comprehensible. It does not show the details that are found in raw data. So there is a loss of information in classifying raw data.
- **Individual series :-** The Individual series are those series in which items are listed singly. For example :-

Roll No.	Marks
1	18
2	95
3	82
4	59
5	92

- **Discrete series (Frequency array) :-** That series in which data are prescribed in array that exact measurements of items are clearly shown. For example :-

Size of household	No. of household
1	15
2	10
3	20
4	30
5	15
6	10

- **Continuous series Frequency Distribution :-** It is that series in which items cannot be exactly measured. The items assume a range of values and are placed within the range of limits. For example :-

Marks	Frequency
0-10	5
10-20	7
20-30	10
30-40	8

## **QUESTION BANK**

### **ONE (1) MARK QUESTIONS :-**

- 1) State the meaning of classification.
- 2) State the meaning of qualitative classification.
- 3) What is variable ?
- 4) Give the meaning of mid-value.
- 5) Define discrete series or frequency array.
- 6) Define class-interval.
- 7) Give the meaning of exclusive series.
- 8) What is meant by frequency ?
- 9) What do you mean by continuous variable ?

### **THREE & FOUR (3 & 4) MARKS QUESTIONS :-**

- 1) State the objectives of classification.
- 2) Write the characteristics of a good classification.
- 3) Difference between discrete and continuous variables.
- 4) Write two advantages of classification.
- 5) Marks of 10 students are given below, Arrange them into ascending order and descending order.  
48, 50, 35, 40, 60, 55, 25, 75, 45, 65
- 6) By using exclusive method and inclusive method make a frequency distribution from following data :-  
33, 10, 17, 15, 20, 12, 18, 16, 20, 22, 29, 29, 23, 24, 16, 11, 16,  
19, 24, 30, 29, 18, 42, 26, 32, 14, 40, 20, 23, 27, 30, 12, 15, 18,  
24, 36, 18, 48, 21, 28

### **SIX (6) MARKS QUESTIONS :-**

- 1) Explain the types of classification of data.

- 2) Define statistical series. How many types of these are ?
- 3) Do you agree that classified data is better than raw data ? why ?

### **ANSWER OF ONE (1) MARK QUESTIONS**

- 1) Classification is the grouping of related facts into different classes.
- 2) The classification according to qualities or attributes of the data are called qualitative classification.
- 3) Variable is a characteristic which is capable of being measured and capable of changing in its value from time to time.
- 4) It lies halfway between the lower class limit and the upper class limit of a class.
- 5) A discrete series or frequency array is that series in which data are presented in a way that exact measurement of items are clearly shown.
- 6) The magnitude spreads between the lower and upper class limit is called class interval.
- 7) When the class intervals are so fixed that the upper limit of one class interval is the lower limit of the next class interval it is called an exclusive series.
- 8) Frequency is number of times an item repeats itself in the series.
- 9) Those variables which can take all the possible values (integral as well as fractional) in a given specified range.

## Exam Oriented Questions with Answers

### Q.1. Discuss the different methods of classification of data.

**Ans.** The raw data is classified in various ways depending on the purpose.

- 1) **Chronological Classification :-** In such a classification data are classified either in ascending or in descending order with reference to time such as years, quarters, months, weeks etc.
- 2) **Spatial Classification :-** The data are classified with reference to geographical locations such as countries, states, cities, districts etc.
- 3) **Qualitative classifications** Characteristics like nationality, literacy, religion, gender, marital status etc. are called qualities or attributes. They can not be measured. Yet these attributes can be classified on the basis of either the presence or the absence of a qualitative classification.
- 4) **Quantitative classification :-** Characteristics like height, weight, age, income, makers of students etc, are quantitative in nature. When the collected data of such characteristics are grouped into classes. It becomes a quantitative classification.

### Q.2. Explain characteristics of classification.

**Ans.** The main characteristics of classification are :

- 1) **Homogeneity :** The data classified in one group or class should be homogeneous all items in a group must be similar to each other.
- 2) **Clarity :** Classification should be done in such a way that meaningful conclusion is possible. Each item of the data should belong to one particular class only. There should be no confusion about the group or class of a given item.
- 3) **Flexibility :** Classification should be flexible and should be able to adapt to new condition of the given enquiry. Some of the classes may have to be abandoned and new classes need to be added.

- 4) **Diversification** : Classification should be done in such a way that every items of study can be classified into class. If all items are not included in the classes arrangement of data will not be correct.
- 5) **Suitable to objectives of study** : The basis selected for classification should be in accordance with the objectives of the statistical study. If basis selected for classification do not match the requirement, the entire exercise of investigation will be meaningless.

**Q.3. Construct a discrete frequency series the help of following data by arranging in ascending order.**

Marks									
6	6	5	7	9	8	7	4	8	4
6	5	7	5	9	7	8	5	6	5
<b>Ans.</b>	<b>Marks</b>	<b>Tally-bars</b>	<b>Frequency</b>						
	4	II	2						
	5	IIII	5						
	6	IIII	4						
	7	IIII	4						
	8	III	3						
	9	II	2						
			Total — 20						

**Q.4. Prepare a frequency distribution by inclusive method taking class interval of 7 from the following data :**

28 17 15 22 29 21 23 27 18 12 7 2 9 4 6 1 8 3 10 5

20 16 12 8 4 33 27 21 15 9 3 36 27 18 9 2 4 6 32 31

29 18 14 13 15 11 9 7 1 5 37 32 28 26 24 20 19 25 19 20

<b>Ans</b>	<b>Class Interval</b>	<b>Tally-bars</b>	<b>Frequency</b>
	1-7	IIII IIII III	15
	8-14	IIII IIII II	12
	15-21	IIII IIII III	15
	22-28	IIII IIII	09
	29-35	IIII II	07
	36-42	II	02
			Total — 60

**Q.5. What is 'loss of information' in classified data?**

**Ans.** The frequency distribution summarises the raw data by making it concise and comprehensible. However, it does not show the details that are found in raw data and leads to loss of information. When the raw data is grouped into classes, an individual observation has no significance in further statistical calculations. For example, the class 20-30 contains 5 observations : 22, 25, 23, 28, 27. So, when these data are grouped as a class 20-30, then individual values have no significance and only frequency i.e., 5 is recorded and not their actual values. All values in this class are assumed to be equal to the middle value of the class interval. Statistical calculations are based on the values of class mark instead of the actual values. As a result, it leads to considerable loss of information.

# PRESENTATION OF DATA

The data are generally voluminous; they need to be put in a compact and presentable form. There are generally three forms of presentation of data:

1. Tabular Presentation of Data
2. Diagrammatic Presentation of Data
  - (a) Geometric form
  - (b) Frequency diagram
  - (c) Arithmetic line graphs
3. Graphical Presentation of Data
 

1. Histogram
  2. Polygon
  3. Frequency curve
  4. Ogive

## Tabular Presentation of Data :-

In a tabular presentation, data are presented in rows (horizontally) and columns (vertically). The most important advantage of tabulation is that it organises data for further statistical treatment and decision making.

To construct a table it is important to learn first what the parts of a good statistical table are. When put together in a systematically ordered manner these parts form a table. The simplest way of conceptualising a table may be data presented in rows and columns along with some explanatory notes.

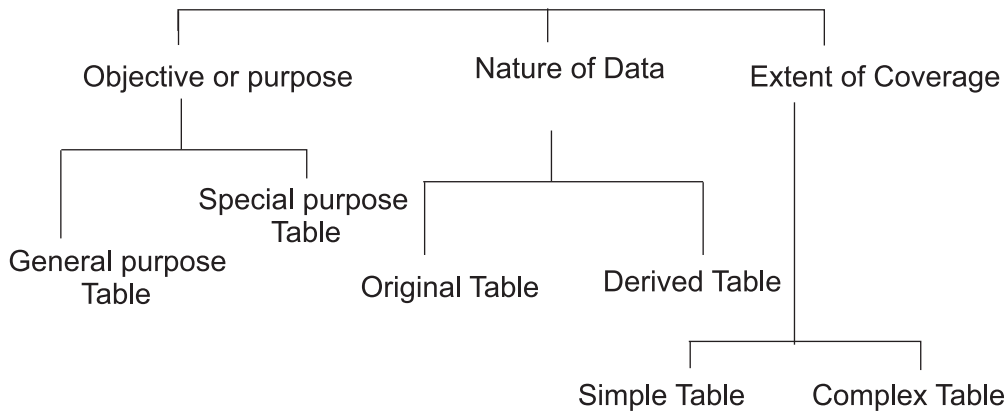
Tabulation can be done using one-way, two-way or three-way classification depending upon the number of characteristics involved. A good table should essentially has the following:

- i. Table Number
- ii. Title
- iii. Captions or Column Headings
- iv. Stubs or Row Headings
- v. Body of the Table
- vi. Unit of Measurement
- vii. Source Note
- viii. Footnote

Table No. ---		
Title --- (Head Note)		
Caption		
Stub	Sub-Head	Sub-Head
BODY		Total (Rows)
Total (column)		
Source note ---		
Foot note ---		

### Basis of classification of table

1.



### 2. Merits of Tabular Presentation

1. Simple and Brief Presentation
2. Easy Analysis
3. Facilitates Comparison
4. Economical
5. Highlights Characteristics of Data

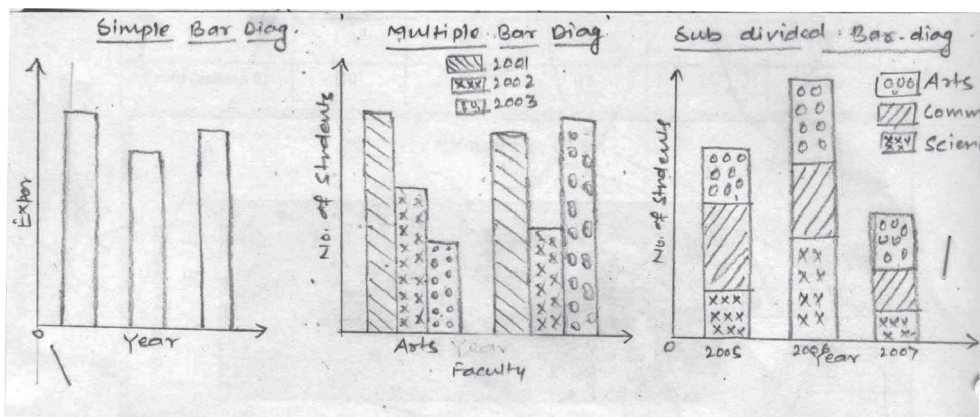
### Diagrammatic Presentation of Data :-

This method provides the quickest understanding of the actual situation to be explained by data in comparison to tabular or textual presentations. Diagrammatic presentation of data translates quite effectively the highly abstract ideas contained in numbers into more concrete and easily comprehensible form.

Diagrams may be more or less accurate but are much more effective than tables in presenting the data. There are various kinds of diagrams in common use. There are two main types of the Diagrammatic representation.

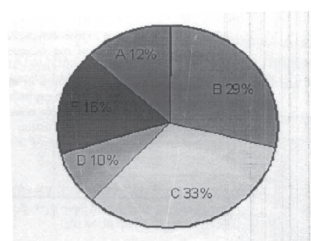
1. Bar Diagram
2. Pie Diagram

1. **Bar diagram:** Bar diagram comprises a group of rectangular bars for each category of data. Height or length of the bar reads the magnitude of data. Bars of a bar diagram can be visually compared by their relative height and accordingly data are comprehended quickly.



2. **Pie Diagrams:** A pie diagram is a component diagram. A circle whose area is proportionally divided among the components it represents. It is called a pie chart. Also called Angular Diagram circle diagram, circle graph, pizza chart, or sector graph. The circle is divided into as many parts as there are components by drawing straight lines from the center to the circumference.

1. Pie charts usually are not drawn with absolute values of a category. The values of each category are first expressed as percentage of the total value of all the categories.
2. A circle in a pie chart, irrespective of its value of radius, is thought of having 100 equal parts of  $3.6^\circ$  ( $360^\circ/100$ ) each. To find out the angle, the component shall subtend at the center of the circle, each percentage figure of every component is multiplied by  $3.6^\circ$ .
3. It may be interesting to note that data represented by a component can be represented equally well by a pie chart, the only requirement being that absolute values of the components have to be converted into percentages before they can be used for a pie diagram.



Pie Diagram

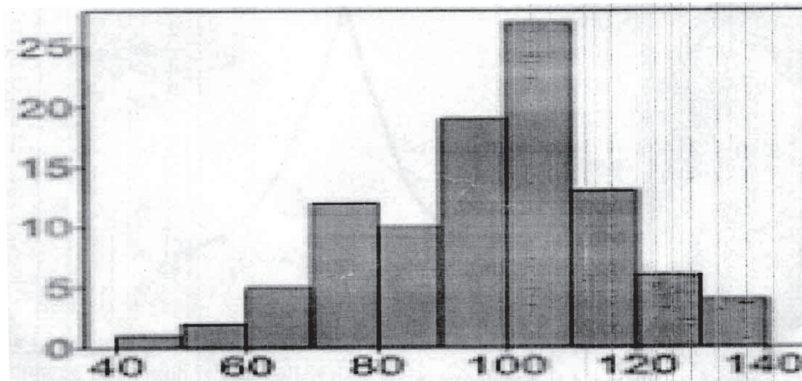
$$\text{Angular Part in Circle} = \frac{\text{Value of Component}}{\text{Total Value}} \times 360^\circ$$

$$\text{i.e. } A^\circ = \frac{C}{T} \times 360^\circ$$

**Graphical Presentations of Data** : The Graphical presentations are two types i.e. Frequency diagram and Arithmetic Graph.

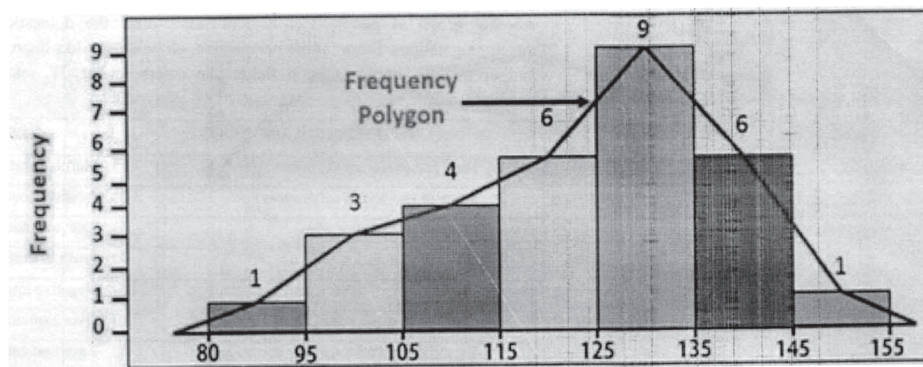
**Frequency Diagram** : The data in the form of grouped frequency distributions are generally represented by frequency diagrams like histogram, polygon Frequency curve and ogive.

1. **Histogram** : A histogram is a two dimensional diagram. It is a set of rectangles with bases as the intervals between class interval (along X-axis) and with areas proportional to the class frequency.
  - For graphical representation of such data, height for area of a rectangle is the quotient of height (here frequency) and base (here width of the class interval).
  - A histogram is never drawn for a discrete variable/data
  - If the classes are not continuous they are first converted into continuous classes.
  - A histogram looks similar to a bar diagram. But there are more differences than similarities between the two than it may appear at the first impression.
  - Moreover, in histogram no space is left in between two rectangles, but in a bar diagram some space must be left between consecutive rectangles.
  - Although the bars have the same width, the width of a bar is unimportant for the purpose of comparison. The width in a histogram is as important as its height.
  - We can have a bar diagram both for discrete and continuous variables, but histogram is drawn only for a continuous variable. Histogram also gives value of mode of the frequency distribution graphically.



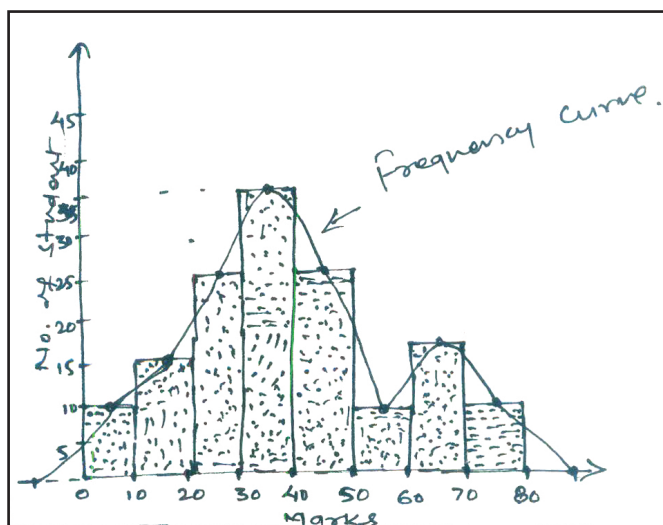
Histogram

2. Polygon : A frequency polygon is a plane bounded by straight lines, usually four or more lines. Frequency polygon is an alternative to histogram and is also derived from histogram itself. A frequency polygon can be fitted to a histogram for studying the shape of the curve. The simplest method of drawing a frequency polygon is to join the midpoints of the topside of the consecutive rectangles of the histogram.

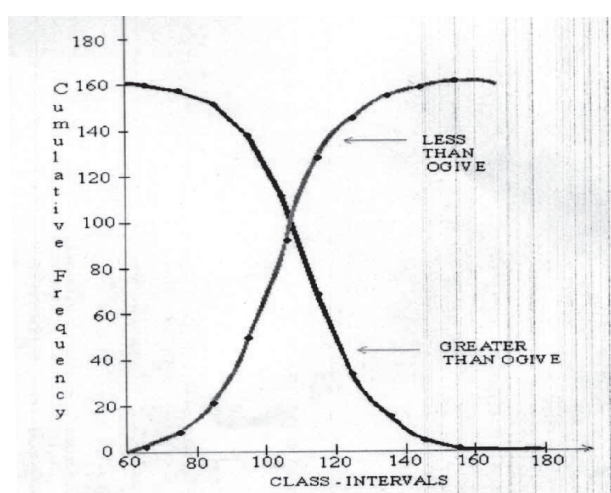


3. Frequency Curve : It is the free hand curve passing through the mid-points of the tops of rectangle of a histogram. It is also known as smoothed frequency curve.

As a generated rule, the curve should start and end at the base line.



4. Ogive: Ogive is also called cumulative frequency curve. As there are two types of cumulative frequencies, for example less than type and more than type, accordingly there are two ogives for any grouped frequency distribution data. Here in place of simple frequencies as in the case of frequency polygon, cumulative frequencies are plotted along Y-axis against class limits of the frequency distribution. For less than ogive the cumulative frequencies are plotted against the respective upper limits of the class intervals whereas for more than ogives the cumulative frequencies are plotted against the respective lower limits of the class interval. An interesting feature of the two ogives together is that their intersection point gives the median.



- Arithmetic Line Graph

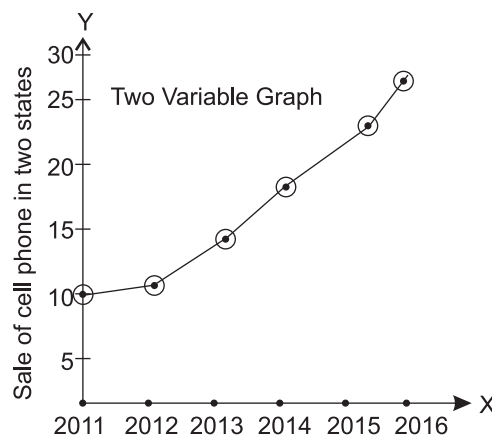
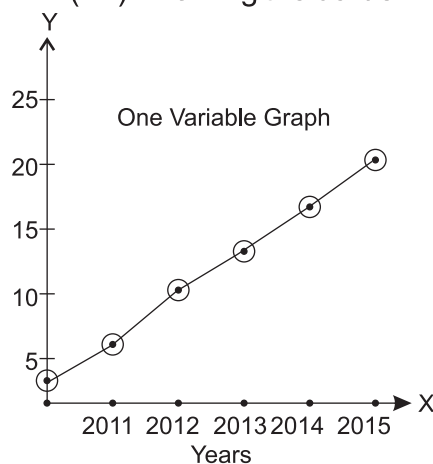
An arithmetic line graph is also called time series graph and is a method of diagrammatic presentation of data. In it, time (hour, day/date, week, month, year, etc.) is plotted along x-axis and the value of the variable (time series data) along y-axis. A line graph by joining these plotted points, thus, obtained is called arithmetic line graph (time series graph). It helps in understanding the trend, periodicity, etc. in a long term time series data.

**Two types of Graphs :-**

- (i) One variable graphs
- (ii) Two or more variable graphs

**General Rules for Constructing Diagram and Graphs :-**

- (i) Proper size
- (ii) Proper heading
- (iii) Proper scale
- (iv) Use of signs and colours only
- (v) Less use of words.
- (vi) Simple
- (vii) From left to right or bottom to top
- (viii) Drawing the border



**Limitations of Diagrammatic Presentation or Graphic Presentation:-**

1. Limited use
2. Misuse
3. Only preliminary conclusions.

## **QUESTION BANK**

### **ONE (1) MARK QUESTIONS :-**

1. What is meant by tabulation?
2. Define caption as a part of table.
3. What is meant by manifold table ?
4. Define the bar diagrams.
5. Give the meaning of the sub-divided bar diagrams.
6. Define pie-diagram.
7. What is meant by histogram ?
8. Give the meaning of frequency curve.
9. Write the name of the curve which is formed by joining mid point of the top of all rectangles in histogram.
10. Define the ogive curve.
11. Give the meaning of false base line.

### **THREE & FOUR (3 & 4) MARKS QUESTIONS :-**

1. State three features of a good table.
2. State the merits of tabular presentation.
3. Define pie-diagram. Write the steps of making pie-diagram.
4. State any three differences between tabulation and diagrammatic presentation.
5. Present the following data by multiple bar diagram. Number of students in respective classes/sections (year wise) give below:

<b>Year</b>	<b>XI A</b>	<b>XI B</b>	<b>XI C</b>
2011-12	500	300	200
2012-13	600	250	300
2013-14	700	350	400

6. Present the following data of final consumption expenditure of family with the help of a pie-diagram.

<b>Items</b>	<b>% of Income Spent</b>
Cloths	15
Food	60
Education	10
Electricity	5
Others	10

7. Make a pie diagram from following data :

Marks	No. of students
0-9	4
10-19	17
20-29	25
30-39	32
40-49	13
50-59	6

8. Present the following data in a pie-diagram.

Items	% expenditure
Labour	27.2%
Bricks	12.9%
Steel	15.4%
Cement	15.9%
Timber	12.5%
Supervision	16.1%

**SIX (6) MARKS QUESTIONS :-**

1. Explain the main parts of a table.
2. Explain the precautions while constructing of an ideal table.
3. Draw ogive curve less than and more than with the help of following data .

Marks	No. of students
0-10	7
10-20	12
20-30	15
30-40	30
40-50	22
50-60	14

4. Make a frequency polygon or frequency curve.

Marks	No. of students
30-35	10
35-40	12
40-45	20
40-45	26
45-50	20
50-55	38
55-60	28
60-65	18
65-70	12

### **ANSWER OF ONE (1) MARK QUESTIONS**

1. The method of arranging data orderly in form of rows and columns is known as tabulation.
2. The Caption is the title given to the columns of a table. It indicates information contained in the columns.
3. The Manifold table shows more than three characteristics of the data.
4. The Bar diagrams are those diagrams in which data are presented in the form of bars and rectangles.
5. The Sub divided bar diagrams are those diagrams in which more than one data are presented simultaneously, total values and parts there in set of data.
6. The Pie diagram is a circle divided into various segment showing the percent value of a series.
7. The Histogram is a graphical presentation of a frequency distribution of a continuous series.
8. The Frequency curve is obtained by joining the points of a frequency polygon through freehand smoothed curves not by straight lines.
9. Frequency polygon.
10. It is the curve which is constructed by plotting cumulative frequency data on the graph paper in a form of a smooth curve.
11. If there is a large gap between zero and minimum value of a variable than to minimise this gap we use false base line.

## Unit - 3

# STATISTICAL TOOLS AND INTERPRETATION

## MEASURES OF CENTRAL TENDENCY

- A central tendency is a single figure that represents the whole mass of data.
1. **Mean :-** The mean is the average of a set of numbers of data.
    - Arithmetic mean is the number which is obtained by adding the values of all the items of a series and dividing the total by the number of items.
    - When all items of a series are given equal importance then it is called simple mean and when different items of a series are given different weight according to their relative importance is known as weighted arithmetic mean .
  - **The Merits of mean**
    1. It is simple to compute and understand
    2. It is rigidly defined
    3. Based on all values
    4. Easy to comparison
  - **The demerit of mean**
    1. It is affected by unduly extreme values
    2. Mean value may not exist in the series
    3. Misleading conclusion
    4. It can not be estimated with graph
  2. **Median –** The Median is the middle value of the series when data are arranged in ascending order or in descending order.
  - Quartile – If a series is divided into four equal parts, the end value of each part is called a quartile.
  - **Merits of Median**
    1. It is not affected by extreme value
    2. It can be determined by graphical method
    3. It can be measured even when data is incomplete
  - **Demerits of Median**
    1. It is not based on all items.

2. In arranging the data in ascending or in descending order it takes much time.
  3. Not suitable for algebraic treatment.
  4. Affected by fluctuations of items.
- 3. Mode** - Mode is the value which occurs most frequently in the series.
- **The Merits of Mode**
    1. It is easy to calculate.
    2. It is not affected by the extreme values.
    3. It can be located on graph.
    4. It is the most representative value in the given series.
  - **The Demerits of Mode**
    1. It is not based on all the values.
    2. It is not suitable for statistical treatment.
    3. Procedure of grouping is complicated.
    4. It is an uncertain measure.
  - **Main purposes and functions of Central Tendencies**
    1. Comparisons
    2. Formulations of policies
    3. To represent a brief picture of data.
    4. One value for all the group.
  - **Relation among Mean, Median and Mode**

$$\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$$

- **Formulae of calculating mean**

Types of series	Direct Method	Shortcut Method	Step Deriation Method
Individual	$\bar{x} = \frac{\sum x}{N}$	$\bar{x} = A + \frac{\sum d}{N}$	$\bar{x} = A + \frac{\sum d'}{N} \times C$
Discrete	$\bar{x} = \frac{\sum fx}{N}$	$\bar{x} = A + \frac{\sum fd}{N}$	$\bar{x} = A + \frac{\sum fd'}{N} \times C$
Continuous	$\bar{x} = \frac{\sum fm}{N}$	$\bar{x} = A + \frac{\sum fd}{N}$	$\bar{x} = A + \frac{\sum fd'}{N} \times C$

- Combined Mean

$$\bar{X}_c = \frac{N_1 \bar{X}_1 + N_2 \bar{X}_2}{N_1 + N_2}$$

- Weighted Mean

$$\bar{X}_w = \frac{\sum WX}{\sum W}$$

- **Formulae of calculating median and Quartile Deviation**

Measures	Individual Series Size of item	Discrete Series Size of item	Continuous size of items	Series Formula
Median (Q <sub>2</sub> )	$\left(\frac{N+1}{2}\right)^{\text{th}}$ term	$\left(\frac{N+1}{2}\right)^{\text{th}}$ term	$\frac{N}{2}$	$L_1 + \frac{\frac{N}{2} - CF}{f} \times i$
First (Q <sub>1</sub> ) Quartile	$\left(\frac{N+1}{4}\right)^{\text{th}}$ term	$\left(\frac{N+1}{4}\right)^{\text{th}}$ term	$\frac{N}{4}$	$L_1 + \frac{\frac{N}{4} - CF}{f} \times i$
Third (Q <sub>3</sub> ) <sub>3</sub> Quartile	$\left(\frac{N+1}{4}\right)^{\text{th}}$ term	$3\left(\frac{N+1}{4}\right)^{\text{th}}$ term	$3\left(\frac{N}{4}\right)$	$L_1 + \frac{\frac{3N}{4} - CF}{f} \times i$

- **Formula of Calculating Mode**

(i)  $Z = L_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$

Where  $L_1$  = Lower limit of modal class

$f_1$  = Frequency of modal class

$f_0$  = Frequency of pre modal class

$f_2$  = Frequency of after modal class

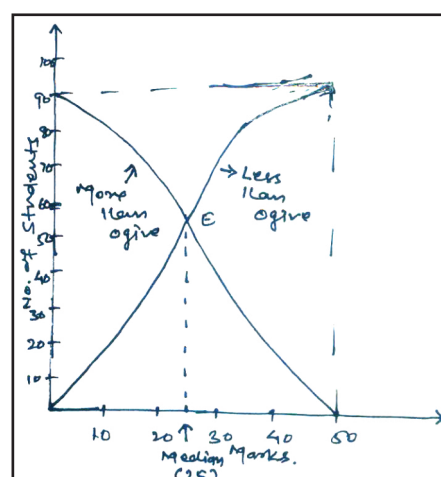
$L = L_2 - L_1$  Class interval of the modal class.

(ii)  $Z = 3M - 2\bar{X}$ ; where  $M$  = Median,  $\bar{X}$  = Mean

- **Graphical Method to Calculate the Median**

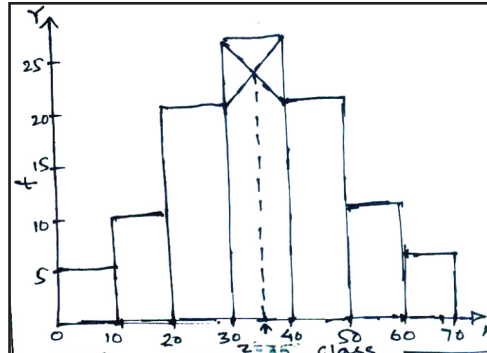
Median is calculated with the help of less than or more than ogive curve. Both intersects at point E. A perpendicular is drawn on X-axis from E, which touches at 25.

So, Median is 25.



- **Graphical Method of Calculating Mode**

Graphically mode is calculated by drawing histogram. The rectangle with the greatest height will be the modal class. By joining the top right point of the rectangle of the modal class with the top right point of the rectangle of the class preceding the modal class. Similarly with left point of the rectangle of modal class with the top left point of the rectangle of the class succeeding the modal class. Both line intersect each other. From intersection point draw a perpendicular on x-axis which cuts x-axis at 35. So mode is 35.



## QUESTION BANK

### ONE (1) MARK QUESTIONS :-

- 1) What is meant by mean?
- 2) Write two types of mean.
- 3) Write one merit of median.
- 4) Find mode 10, 5, 4, 6, 4, 5, 4, 12, 4, 15, 4
- 5) Write the formula of combined mean.
- 6) Define quartile.
- 7) Define median.
- 8) What is the relationship b/w mean, median and mode?
- 9) What is the sum of derivations taken from mean in a series?
- 10) State one objective of an average.
- 11) Name the most popular statistical average.
- 12) Find median of 4, 9, 10, 12, 14
- 13) State one disadvantage of mode.
- 14) How many columns are there in a grouping method ?
- 15) If mean is 40 and median is 48. Find mode.

### THREE AND FOUR (3 & 4) MARKS QUESTIONS :-

- 1) Write two merits and demerits of median.
- 2) State three advantages of mode.
- 3) The average marks in statistics obtained by 30 students is 52. The average marks of top 6 students is 31. Calculate average marks of the remaining students.  

Ans. 57.25
- 4) The average marks of 100 students were found to be 40. Later on it was discovered that a score of 53 was misread as 83. Find the correct mean.  

Ans. 39.7
- 5) Calculate Mean  

Class	1-10	11-20	21-30	31-40	41-50
Freq.	4	10	20	13	3

Ans.  $\bar{X}$ =25.7
- 6) Find out  $Q_1$  and  $Q_3$ .  
6, 8, 10, 12, 18, 19, 23, 23, 24, 28, 37, 48, 49, 53, 56  

Ans.  $Q_1$  = 12  
 $Q_3$  = 48
- 7) Show that the sum of deviations of the observation from their arithmetic mean is zero with the help of suitable example.

### SIX (6) MARKS QUESTIONS :-

- 1) If  $\bar{X} = 52$ , find missing frequency.  

Class	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Freq.	5	3	4	?	2	6	13

Ans. 7
- 2) Calculate mean from following information by short-cut method.  

Marks	0-10	10-20	20-30	30-40	40-50
No. of Students	4	6	10	20	10

Ans.  $\bar{X}$ =30.2
- 3) Calculate mean by step derivation method.  

Class	5-15	15-25	25-35	35-45	45-55	55-65
Freq.	8	12	6	14	7	3

Ans.  $\bar{X}$ =31.8
- 4) Find out median.  

Age(Yrs)	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
No. of Person	50	70	100	180	150	120	70	60

Ans. 40 Year

- 5) Calculate the Mean.

Class	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Freq.	7	9	11	28	30	22	7	5

Ans. 21

- 6) Find out  $Q_1$  and  $Q_3$ .

X	30-35	35-40	40-45	45-50	50-55	55-60	60-65
Freq.	14	16	18	23	18	8	3

Ans.  $Q_1 = 38.43$ ,  $Q_3 = 51.11$

- 7) Calculate Mean, Median and Mode.

Marks	10-19	20-29	30-39	40-49	50-59
No. of Students	3	5	9	3	2

Ans.  $\bar{X} = 37.6$ ,  $M = 36.7$ ,  $Z = 36$

- 8) Graphically calculate Median.

Class	0-10	10-20	20-30	30-40	40-50	50-60
Freq.	6	11	20	12	6	5

Ans.  $M = 26.5$

### **ANSWER OF ONE (1) MARK QUESTIONS**

- 1) Mean is defined as the sum of all items divided by their numbers.
- 2) Two types of mean are  
(i) Simple mean (ii) Weighted mean
- 3) It can be determined by graphical method.
- 4) Mode = 4
- 5)  $\bar{X}_c = \frac{N_1\bar{X}_1 + N_2\bar{X}_2}{N_1 + N_2}$
- 6) Quartile is a value which divide a series into four equal parts.
- 7) Median is a value which divide a series into two equal parts.
- 8) Mode = 3 median – 2 mean
- 9) Zero
- 10) It summarises huge data.
- 11) Mean
- 12) 10

13) It is not based on all the values.

14) six

$$\begin{aligned} 15) \quad Z &= 3M - 2\bar{X} = 3 \times 48 - 2 \times 40 \\ &= 144 - 80 = 64 \end{aligned}$$

### Exam Oriented Questions with Answers

1. Which average would be suitable in the following cases ?

- (a) Average production in factory per shift.
- (b) Average wages in an industrial concern.
- (c) In case of open ended frequency distribution
- (d) Average size of readymade garments.
- (e) Average intelligence of students in a class.

Ans. (a) Arithmetic Mean (b) Arithmetic mean  
(c) Median. (d) Mode (e) Median

2. Write merits and demerits of mean or median.

Ans. Mean	Median
Merits	Merits
a) No. need of arrangement of data	a) Definite value
b) Easy to calculate	b) Expressed/determined graphically.
c) Based on all values of series	c) Easy to calculate
Demerits	Demerits
a) Can't be located graphically	a) Arrangement of data is required
b) Calculation not possible if single item missing	b) Not suitable for algebraic treatment
c) Not used in case of qualitative measurement	c) Affected by fluctuations of items.

3. What are the requisites of an ideal averages ?

- Ans. i) Easy to understand.  
ii) Easy to compute.  
iii) Rigidly defined.  
iv) Based on all items of series.  
v) Capable of algebraic treatment  
vi) Least effect of fluctuation.

4. Write main objectives and functions of averages.

Ans. The main objectives and functions of averages are following.

1. It establish relationship between different groups.
2. It summarises huge data.
3. It makes comparison easier.
4. It helps in decision-making.

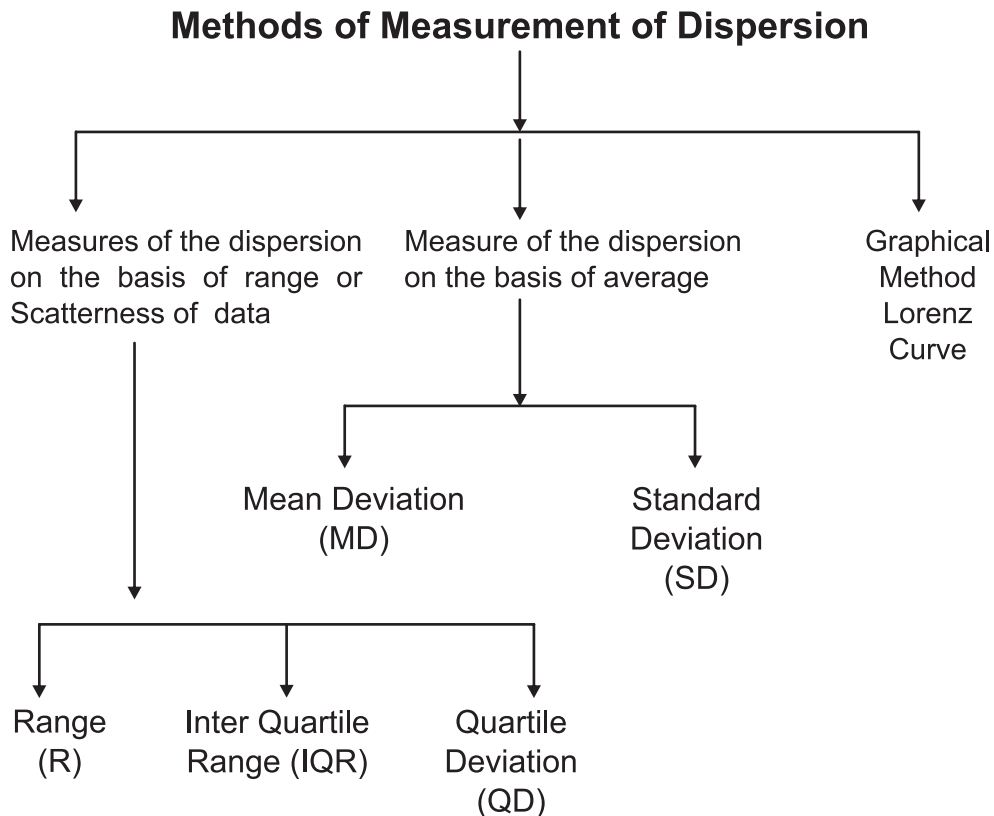
5. Write properties of arithmetic mean.

Ans. These are the following properties of arithmetic mean.

1. The sum of deviation of the observations from their arithmetic mean is always zero.
2. The sum of the square of the deviations of the items from their arithmetic mean is minimum.
3. If each observation of a series is increased or decreased by a constant, say K, then the arithmetic mean of the new series will also get increased or decreased by K.
4. If all the items in a series are multiplied or divided by a constant, then the mean of these observations also get multiplied or divided by it.

## (ii) MEASURES OF DISPERSION

Scatterness of data from central value is known as dispersion. It indicates that how value of Variable or Items are different from its average value.



- Absolute and Relative measures of Dispersion :

**Absolute measures of Dispersion** : When the scatter or spread of data is measured in the same units of original data. It is used only within a series and measured in the same unit as that of series. It is not suitable for comparison between two series.

**Relative measures of Disperions** : When the scatter or spread of data is measured as ratios or percentage, they are also known as coefficients of dispersion. These are independent of the units of measurement and used to compare two or more series where unit of measure are different.

**Absolute Measures**

1. Range (R) = L – S
2. Quartile deviation  

$$= \frac{Q_3 - Q_1}{2}$$
3. Mean Deviation M.D  

$$= \frac{\sum |dx|}{N}$$
4. Standard deviation  

$$\text{S.D or } \sigma = \sqrt{\frac{\sum dx^2}{N}}$$

**Relative Measures**

1. Coefficient of range =  $\frac{L - S}{L + S}$
2. Coefficient of Q.D.  

$$= \frac{Q_3 - Q_1}{Q_3 + Q_1}$$
3. Coefficient of M.D  

$$= \frac{MD_x}{\bar{X}}$$
4. Coefficient of S.D. =  $\frac{\text{S.D.}}{\bar{X}}$
5. Coefficient of Variation  

$$CV = \frac{SD}{\bar{X}} \times 100$$

- 1) Range : It is the difference between largest and smallest value of the series.

Range (R) = Largest value (L) – Smallest value (S)

$$\text{Coefficient of Range} = \frac{L - S}{L + S}$$

Note : More value of range means more dispersion and vice-versa.

2. Inter-Quartile Range (IQR)

$$IQR = Q_3 - Q_1$$

Where Q3 = Upper Quartile or Third Quartile

Q1 = Lower Quartile or First Quartile

Note: It is based on 50% of average value of distribution. It does not influence with extreme value.

3. Quartile Deviation (QD)

It is also called semi Inter Quartile Range.

$$QD = \frac{Q_3 - Q_1}{2}$$

$$\text{Coefficient of QD} = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

- **Measures of Dispersion on the Basis of Average**

It includes the following two methods.

1. Mean Deviation (MD)

It is calculated as an average on the basis of deviation obtained from any central value such mean, median and mode. Here we calculate it from deviation taken from mean on median. It takes only the absolute value which is indicated by two | | bars. It is also known as second degree average. It is based on all the values. If dispersion is measured by the mean then the dispersion will be minimum. It ignore signs.

- A. Mean Deviation from Mean ( $MD_x^-$ )

Individual series	Discrete and continuous series
$MD_x^- = \frac{\sum  X - \bar{X} }{N} = \frac{\sum  dx }{N}$ $\bar{X} = \frac{\sum X}{N}$ <p>N = No. of items</p> $\text{Coeff. of MD} = \frac{MD_x^-}{\bar{X}}$	$MD_x^- = \frac{\sum f  X - \bar{X} }{\sum f} = \frac{\sum f  dx }{\sum f}$ <p><math>\sum f</math> = Summation of frequencies  <math>f</math> = Frequencies</p> $\bar{X} = \frac{\sum fx}{\sum f}$ $\text{Coeff. of MD} = \frac{MD_x^-}{\bar{X}}$

- B. Mean Deviation from Median MDm

- First of all, we should arrange the items and classes into ascending or descending order.
- Calculate cumulative frequency in discrete series and continuous series
- Find out MDm in different series by using the following formula :

Individual Series	Discrete and continuous series	
$MD_m = \frac{\sum  X - M }{N}$ $= \frac{\sum  dx }{N}$	$MD_m = \frac{\sum f  X - M }{\sum f} = \frac{\sum f  dm }{\sum f}$	
$M = \text{size of } \left(\frac{N+1}{2}\right)^{\text{th}} \text{ items}$ <p>N = no. of items.</p>	$M = \text{size of } \left(\frac{N+1}{2}\right)^{\text{th}} \text{ items}$ <p>in discrete series N = <math>\sum f</math></p>	$M = L_1 + \frac{\frac{N}{2} - C_f}{f} \times i$ <p>in continuous series where <math>L_1</math> = Lower limit of median class</p>
Coeff. of MD = $\frac{MD_m}{M}$	Coeff. of MD = $\frac{MD_m}{M}$	

## 2. Standard Deviation (SD)

It is the square root of the arithmetic average of the square of the deviations measure from mean. It is also known as root mean square deviation. It is indicated by Greek Letter Sigma ( $\sigma$ ). It is the best measure of dispersion. It removes the mathematical errors of mean deviation. It is based on all the values of the series and is rigidly defined.

- **Methods of Measurement of SD**

There are following four methods of measurement of standard deviation.

- Actual mean method.
- Assumed mean method.
- Direct method.
- Step-Deviation method

### INDIVIDUAL SERIES

Actual Mean Method	Assumed Mean Method	Step-Deviation method	Direct method
$\bar{X} = \frac{\sum X}{N}$	$\bar{X} = A + \frac{\sum d}{N}$	$\bar{X} = \frac{A + \sum d' \times i}{N}$	$\bar{X} = \frac{\sum X}{N}$
$SD = \sqrt{\frac{\sum (X - \bar{X})^2}{N}}$ or $SD = \sqrt{\frac{\sum X^2}{N}}$	$SD = \sqrt{\frac{\sum d^2}{N} - \left(\frac{\sum d}{N}\right)^2}$  $d = X - A$	$SD = \sqrt{\frac{\sum d'^2}{N} - \left(\frac{\sum d'}{N}\right)^2} \times c$  $d' = \frac{X - A}{c}$	$SD = \sqrt{\frac{\sum X^2}{N} - \left(\frac{\sum X}{N}\right)^2}$ or $SD = \sqrt{\frac{\sum X^2}{N} - (\bar{X})^2}$
$X = X - \bar{X}$	$d = \text{deviation from assumed mean}$		
$X = \text{deviation from actual mean}$	$A = \text{assumed mean}$		

### DISCREET AND CONTINUOUS SERIES

Actual Mean Method	Assumed Mean Method	Step-Deviation method	Direct method
$\bar{X} = \frac{\sum fx}{\sum f}$	$\bar{X} = A + \frac{\sum fd}{\sum f}$	$\bar{X} = \frac{\sum fd' \times i}{\sum f}$	$\bar{X} = \frac{\sum fx}{\sum f}$
$SD = \sqrt{\frac{\sum f(X - \bar{X})^2}{\sum f}}$ or $SD = \sqrt{\frac{\sum fx^2}{\sum f}}$	$SD = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$  $d = X - A$	$SD = \sqrt{\frac{\sum fd'^2}{\sum f} - \left(\frac{\sum fd'}{\sum f}\right)^2} \times c$  $d' = \frac{X - A}{c}$	$SD = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$ or $SD = \sqrt{\frac{\sum fx^2}{\sum f} - (\bar{X})^2}$

NOTE : X = Value of item in discrete series and it is the median value of C.I. i.e. Class Interval

$$\text{Coff. of SD} = \frac{SD}{\bar{X}} \text{ (in all series)}$$

**Coefficient of Variation (CV) :** It is the most important relative measures of dispersion. When we multiply coefficient of standard deviation by 100 then we get coefficient of variation.

$$CV = \frac{SD}{\bar{X}} \times 100 = \frac{\sigma}{\bar{X}} \times 100$$

more the value of CV means more variation, and less consistency, less uniformity, less homogeneity and vice versa.

- **Graphical Method : Lorenz Curve**

This method was developed by Dr. Max. O. Lorenz it estimates dispersion. It is a graphical method. It is useful for the study of distribution of income, wealth, profits, wages, sale, purchase turnover etc.

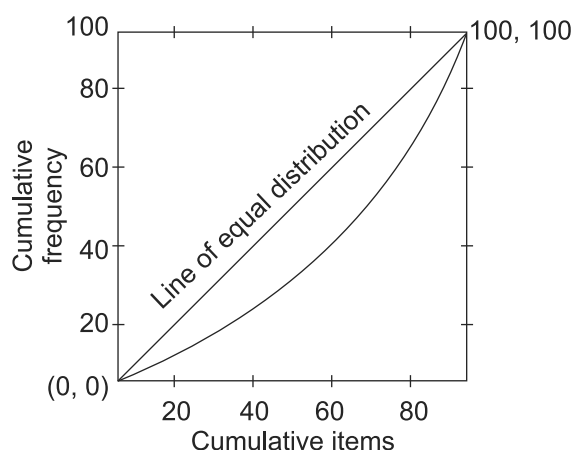
In this method, value the frequencies are cumulative and their percentage are calculated. These values are plotted on the graph paper and to join all the points with a curve. Thus the obtained curve is called Lorenz Curve.

The nearer the curve is to the line of equal distribution, lesser will be dispersion and the farther the curve is from the line of equal distribution, the greater will be dispersion.

The most important draw back of this curve is that is does not give a quantitative measure of dispersion.

- **Construction of Lorenz Curve**

- 1) Series is converted into a cumulative frequency series, the cumulative sum of items is assumed to be 100 and different items are converted into percentage of the cumulative sum.



- 2) Cumulative sum of frequency is assumed to be 100 and different frequencies are converted into percentage of sum of frequency.
- 3) Cumulative frequencies are plotted on X-axis and cumulative items are plotted on Y-axis of graph.
- 4) On both axis values are plotted of own 1–100.
- 5) A diagonal line joining (0, 0) with cumulative frequency (100,100) is called line of equal distribution.
- 6) Actual data are plotted by joining different points. This is the Lorenz Curve.

### **QUESTION BANK**

#### **ONE (1) MARK QUESTIONS :-**

- 1) What is inter quartile range?
- 2) Give the formula of calculating coefficient of variation.
- 3) What is Lorenz Curve?
- 4) Calculate Range –  
22, 35, 32, 45, 42, 48, 39
- 5) Which graphical method is used to measure dispersion?
- 6) Give meaning of dispersion.
- 7) How is coefficient of mean deviation computed?
- 8) Which measure of dispersion covers middle 50% of the items?
- 9) Write one major demerit of mean deviation.
- 10) Define relative measure of dispersion?
- 11) Define Range.
- 12) Why standard deviation is better than mean deviation?
- 13) If each item of a series is increased by 5, then effect on standard deviation is :
 

(i) increase by 5	(ii) decrease by 5
(iii) increase by 25	(iv) No change

- 14) If each item of a series is multiplied by 2, then effect on standard deviation is :
- (i) increased by 2                      (ii) Multiplied by 2  
(iii) decreased by 2                      (iv) become half.
- 15) Income of top 10% earner become double, then the quartile deviation also become :
- (i) double                                  (ii) half  
(iii) do not change                      (iv) insufficient information

### THREE & FOUR (3 & 4) QUESTIONS :-

- 1) Mention important measures of dispersion.
- 2) Mention any two merits and two demerits of mean deviation.
- 3) Distinguish between mean deviation and standard deviation.
- 4) What do you understand by dispersion?
- 5) Discuss the relative merits of range, mean deviation, deviation and standard as measures of dispersion.
- 6) Find the range and coefficient of range of the following :  

Marks	10	20	30	40	50	60	70
No. of students	8	12	7	30	10	5	2

(Range = 60 marks; coefficient of range = 0.75)
- 7) Why do we calculate the coefficients of the measure of dispersion? Explain with example.
- 8) Discuss the importance of measures of dispersion.
- 9) Why standard deviation is regarded as the better measure of dispersion?
- 10) Find quartile deviation and its coefficient :  

Wages	50	55	58	60	70	90	95	110
Frequency	5	7	12	10	8	6	2	9
- 11) From the price of gold and silver, state which is more stable in value—  

Gold :	410	440	430	480	450	460	490	500	420	400
Silver :	910	930	960	920	900	970	990	940	980	950
- 12) Why is range not calculated for openended frequency distribution?

- 13) Explain two merits and demerits of Lorenz curve.  
 14) Calculate mean deviation from mean and coefficient of mean deviation.

X:	10-20	20-30	30-50	50-70	70-80
f:	5	8	16	8	3

- 15) Calculate standard deviation (direct method)

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	5	10	25	30	20	10

(Range = 60 marks; coefficient of range = 0.75)

#### SIX (6) MARKS QUESTIONS :-

- 1) The sum of 10 values is 100 and the sum of their squares is 1090. Find the Co-efficient of variation.

Ans. 30%

- 2) Calculate mean deviation and compare the variability of two series A and B.

Series A	10	12	16	20	25	27	30
Series B	10	20	22	25	27	31	40

Ans.  $M.D_A = 6.28$   
 $CMD = 0.30$   
 $MD_B = 6.57$   
 $CMD = 0.26$   
 A more variable

- 3) Calculate SD and its Co-efficient.

Class	0-5	5-10	10-15	15-20	20-25	25-30	30-35
Freq.	4	6	10	16	12	8	4

Ans.  $\bar{X} = 18$ ,  $SD = 7.89$ ,  $CSD = 0.44$

- 4) Calculate IQR, QD and CQD

Class Interval (X)	0-5	5-10	10-15	15-20	20-25	25-30
Freq.	3	9	15	23	30	20

Ans.  $IQR = 9.84$ ,  $QD = 4.92$ ,  $CQD = 0.25$

- 5) Draw the Lorenz Curve from the given data as below :

Income	Below 200	200-500	500-1000	1000-2000	2000-3000
Factory A	6	10	14	12	8
Factory B	7	12	15	10	6

### **ANSWERS OF ONE (1) MARK QUESTIONS**

- 1) The difference in the two values of quartile is called inter quartile range ( $Q_3 - Q_1$ ).
- 2) Coefficient of variation =  $\frac{\sigma}{\bar{X}} \times 100$
- 3) Lorenz Curve is the graphic presentation of studying dispersion.
- 4) Range = Largest Value – Smallest Value  
=  $48 - 22 = 26$
- 5) Lorenz Curve method is used to measure dispersion.
- 6) Dispersion is a measure of the variation of the item from a central value.
- 7) Mean deviation =  $\frac{\sum f (D)}{\bar{X}}$
- 8) Inter quartile range.
- 9) The major demerit of mean deviation is that it ignores  $\pm$  signs.
- 10) Relative measures are expressed in ratios or percentage, also known as coefficient of dispersion.
- 11) Range is the difference between largest and smallest value of series.
- 12) Standard deviation is rigidly defined and fit for algebraic operators.
- 13) (iv)
- 14) (ii)
- 15) (iii)

## Exam Oriented Questions with Answers

**Q1. What do you mean by Lorenz Curve?**

**Ans.** It is a graphic representation of dispersion, which studies about distribution of income, wealth, profit, wages etc.

**Q2. What is variance?**

**Ans.** The square of standard deviation is known as variance

$$\text{Variance} = \sigma^2 = \frac{\sum x^2}{N}$$

**Q3. From the following data find out which factory may be considered more uniform.**

Wages (in Rs.)	No. of Workers	
	Factory A	Factory B
20	30	45
60	25	35
100	30	25
140	45	40
180	25	25
220	13	20
260	24	5
300	8	5

**Hints :** Calculate  $\bar{X}$  and standard deviations of both factory.

Then calculate co-efficient of variation of both factory with help of

$$\text{Formula C.V.} = \frac{\sigma}{\bar{X}} \times 100 = \frac{\text{Standard Deviation}}{\bar{X}} \times 100$$

Factory A  $\rightarrow \bar{X}_A = 137, \sigma_A = \text{S.D.} = 80.8, \text{C.V.} = 59\%$

Factory B  $\rightarrow \bar{X}_B = 114, \sigma_B = \text{S.D.} = 75.6, \text{C.V.} = 66\%$

Hence, factory A is more uniform than B.

### (iii) CORRELATION

Correlation is a statistical device or tool which measures the quantitative relationship between two variables. It measures the direction and intensity of relationship among variables. Thus, correlation measures co-variation, not causation.

- **Types of Correlation**

- 1) **Positive and negative correlation :**

When both the variables (say X and Y) move in the same direction then it is called positive correlation. For eg. increase in temperature and increase in sale of AC.

When both the variable (say X and Y) move in the opposite direction then it is called negative correlation for eg. increase in temperature and decrease in sale of Heater.

- 2) **Linear and Non-linear correlation :**

When both the variables (say X and Y) change in the same proportion, it is called linear correlation. When both the variables (say X and Y) change in the different proportions, it is called non-linear correlation.

- 3) **Simple, Partial and Multiple Correlation :**

When we study the correlation between two variables then it is called simple correlation. In this correlation. There are two variables one is independent and another is dependent.

When we study the correlation between more than two variables is called multiple correlation. If we study correlation between two variables keeping the content of all other variables then it is called partial correlation.

### DEGREE OR MAGNITUDE OF CORRELATION

Degree	Positive	Negative
Perfect	+1	-1
Higher	(+ 0.75) – (+ 1)	(- 0.75) – (- 1)
Medium	(+ 0.25) – (+ 0.75)	(- 0.25) – (- 0.75)
Low	0 – (+ 0.25)	(0) – (- 0.25)
Zero (Absence of correlation)	0	0

- Methods of measurement of correlation :**

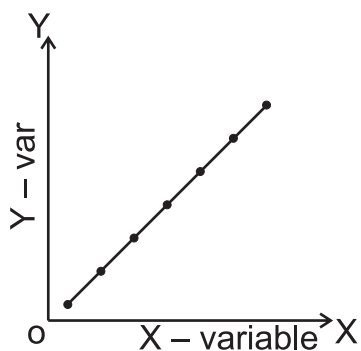
There are following methods.

1. Scattered Diagram Method
2. Karl Person's Coefficient
3. Spearman's Coefficient

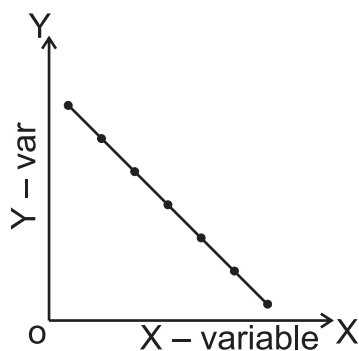
- 1) Scattered Diagram Method

It is a graphical method. In this method we use graph paper. We show X-variable on X-axis and Y-variable on the Y-axis. We plot the corresponding value of both the variable by dot (.) on the graph paper.

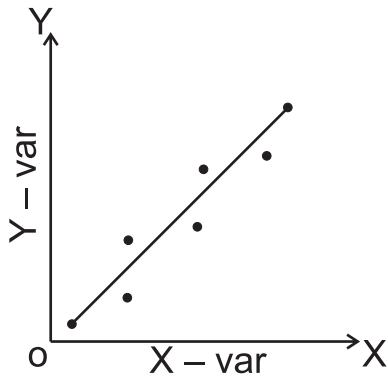
Perfect degree positive correlation



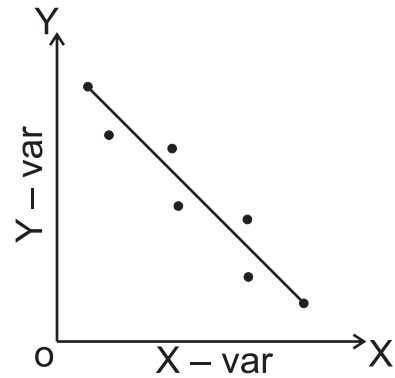
Perfect degree negative correlation



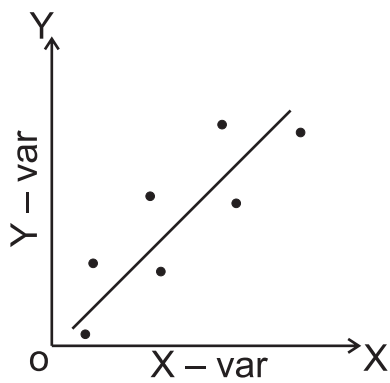
Higher degree positive correlation



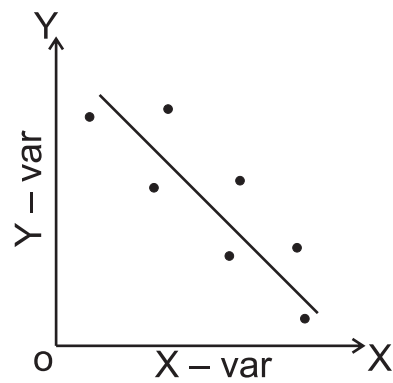
Higher degree negative correlation



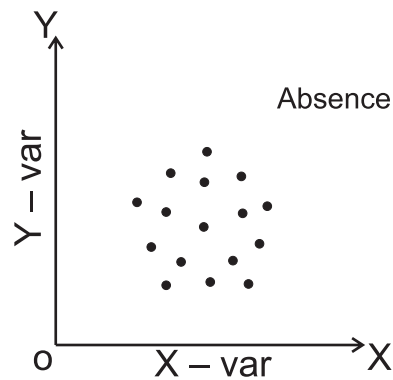
Lower degree positive correlation



Lower degree negative correlation



Absence of correlation



## 2. Karl Pearson's Method

It is also called product moment method of correlation coefficient. It is indicated by  $r$ . It is based on arithmetic mean and standard deviation.

Let there are two variables  $X$  and  $Y$ .

Mean of  $x$ -series is  $\bar{X} = \frac{\sum X}{N}$  and mean of  $y$ -series is  $\bar{Y} = \frac{\sum Y}{N}$ .

Standard deviation of  $x$ -series is  $\sigma_x = \sqrt{\frac{\sum x^2}{N}}$  and standard deviation of  $y$ -series is  $\sigma_y = \sqrt{\frac{\sum y^2}{N}}$ . Here  $x = X - \bar{X}$  and  $y = Y - \bar{Y}$

Covariance of variable  $x$  and  $y$  is

$$\text{Cov. (X, Y)} = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{N} = \frac{\sum xy}{N}$$

then we find Karl Pearson's coefficient of correlation

$$r = \frac{\text{Cov. (X, Y)}}{\sigma_x \cdot \sigma_y}$$

OR

$$r = \frac{\sum xy}{N \cdot \sigma_x \cdot \sigma_y}$$

OR

$$r = \frac{\sum xy}{N \sqrt{\frac{\sum x^2}{N}} \times \sqrt{\frac{\sum y^2}{N}}}$$

OR

$$r = \frac{\sum xy}{\sqrt{\sum x^2} \times \sqrt{\sum y^2}} = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum (X - \bar{X})^2} \sqrt{\sum (Y - \bar{Y})^2}}$$

Therefore, the following methods are used to measure Karl Pearson's coefficient of correlation.

1) Actual Mean Method

$$r = \frac{\sum xy}{\sqrt{\sum x^2} \sqrt{\sum y^2}} \quad \text{where } x = X - \bar{X}; y = Y - \bar{Y}$$

$$\bar{X} = \frac{\sum X}{N}; \quad \bar{Y} = \frac{\sum Y}{N}$$

N = No. of observations

2) Assumed Mean Method

$$r = \frac{N \sum dxdy - (\sum dx)(\sum dy)}{\sqrt{N \cdot \sum dx^2 - (\sum dx)^2} \sqrt{N \cdot \sum dy^2 - (\sum dy)^2}}$$

OR

$$r = \frac{\sum dxdy - \frac{(\sum dx)(\sum dy)}{N}}{\sqrt{\sum dx^2 - \frac{(\sum dx)^2}{N}} \sqrt{\sum dy^2 - \frac{(\sum dy)^2}{N}}}$$

Where  $dx = X - A$ ;  $dy = Y - A$

A = Assumed mean from X and Y series.

3) Step-deviation Method

$$r = \frac{N \cdot \sum dx' dy' - (\sum dx')(\sum dy')}{\sqrt{N \cdot \sum dx'^2 - (\sum dx')^2} \sqrt{N \cdot \sum dy'^2 - (\sum dy')^2}}$$

OR

$$r = \frac{N \cdot \sum dx' dy' - \frac{(\sum dx')(\sum dy')}{N}}{\sqrt{\sum dx'^2 - \frac{(\sum dx')^2}{N}} \sqrt{\sum dy'^2 - \frac{(\sum dy')^2}{N}}}$$

$$\text{Where } dx' = \frac{X - A}{i}; \quad dy' = \frac{Y - A}{i}$$

If we assume that  $dx^1 = U = \frac{X-A}{i}$  and

$$dy^1 = V = \frac{Y-A}{i}$$

then above formula can be written as

$$r = \frac{\sum UV - \frac{(\sum U)(\sum V)}{N}}{\sqrt{\sum U^2 - \frac{(\sum U)^2}{N}} \sqrt{\sum V^2 - \frac{(\sum V)^2}{N}}}$$

then correlation between X and Y ( $r_{xy}$ ) is same as correlation between  $r_{uv}$ .

- Direct Method

$$r = \frac{N \cdot \sum XY - (\sum X)(\sum Y)}{\sqrt{N \cdot \sum X^2 - (\sum X)^2} \sqrt{N \cdot \sum Y^2 - (\sum Y)^2}}$$

OR

$$r = \frac{\sum XY - \frac{(\sum X)(\sum Y)}{N}}{\sqrt{\sum X^2 - \frac{(\sum X)^2}{N}} \sqrt{\sum Y^2 - \frac{(\sum Y)^2}{N}}}$$

- **Properties of correlation**

- It is independent from unit.
- Negative value of coefficient of correlation indicates negative correlation while positive value of coefficient of correlation indicates positive correlation.
- Coeff. of correlation lies between  $-1$  and  $+1$   
i.e.  $-1 \leq r \leq +1$
- If  $r = 0$ , it means of absence of correlation.
- If higher value of  $r$  shows higher degree linear correlation and a lower value of  $r$  shows lower degree of linear corr.
- If  $r = +1$ , it means perfect degree positive correlation between two variable and if  $r = -1$ , it means perfect degree negative correlation between two variables.

- vii) It is independent of change of origin and change of scale of the variables. It is proved by value of  $r$  which is calculated by step deviation method.

### 3. Spearman's coefficient of correlation.

It is also called rank order coefficient of correlation. It is useful for qualitative observations. When values of variables are not impressed in quantitative measures then it is used to measure correlation. For example honesty, morality, character, beautifulness, originality, leadership, quality, wisdom etc. It is better alternative to determine the ranks instead of quantification of qualitative information.

It is indicated by  $r_k$  or  $R_{oh}(P)$ .

This method is useful in the following three situation :

- 1) When ranks are given :

If ranks are already given then

$$r_k = 1 - \frac{6 \sum D^2}{N^3 - N}$$

Where  $N$  = No. of observations

$D$  = Deviation / Difference between ranks of two variables

- 2) When ranks are not given.

1. First of all rank the values of variables. Ranking can be done either in ascending order or in descending order. 1st rank to largest value 2nd rank to second largest value, 3rd rank to 3rd largest value and so on. and vice-versa.
2. Find deviation or difference between ranks of two series.
3. Use the following formula to find correlation

$$r_k = 1 - \frac{6 \sum D^2}{N^3 - N}$$

3. When values are repeated.

- When two or more than two values are equal then average rank is given.
- Next rank to next value and so on.
- Use the following formula to find correlation.

$$r_k = 1 - \frac{6 \left[ \sum D^2 + \frac{1}{12} (m_1^3 - m_1) + \frac{1}{12} (m_2^3 - m_2) + \dots \right]}{N^3 - N}$$

Where  $m_1, m_2, \dots$  indicate number of repetition of values and  $\frac{1}{12} (m_1^3 - m_1), \frac{1}{12} (m_2^3 - m_2), \dots$  indicate their corresponding correction coefficient.

- **Similarities between Karl Pearson's and Spearman's. Correlation.**
  - (i) The values of both correlation lie between  $\pm 1$ .
  - (ii) When  $r_r = -1$ ; it means perfectly disagree. In this case ranks are such that highest ranking X goes with the lowest ranking Y and so on, we have perfect negative correlation with coefficient of  $-1$ .
  - (iii) When  $r_r = +1$ , it means perfectly agree. If each X and its paired Y have exactly the same rank, we have perfect positive correlation with coefficient if  $+1$ .
- **Dissimilarities**
  - (i) Ranks correlation give less importance to the extreme values and it does not based on the numerical value of all the informations. So, result of this method is not accurate as compared to product moment method. It is because that product moment method gives more importance to extreme values because it is based on all actual values.
  - (ii) It is more useful when number of items are small, data are given as ranks, scores etc. and data are not numerically expressed than product moment method.

### **QUESTION BANK**

#### **Very Short Answer Type Questions (1 Mark Questions) :-**

- 1) What is meant by correlation?
- 2) List some variables where accurate measurement is difficult.
- 3) What is negative correlation?
- 4) Give the meaning of positive correlation.

- 5) What is the range of simple correlation coefficient?
- 6) State the type of correlation when two variables change in the same ratio.
- 7) Give two examples of positive correlation.
- 8) Mention the principal short coming of scatter diagram as a method of estimating correlation.
- 9) Give two examples of negative correlation.
- 10) When is rank correlation method used?
- 11) Mention the names of different methods for measuring correlation.
- 12) What is the main demerit of spearman's rank method?
- 13) Mention the principal short coming of Karl Pearson's coefficient correlation.
- 14) If  $r_{xy} = 0$ , then the variables X and Y are :
  - i) Linearly related
  - ii) Not linearly related
  - iii) Independent
- 15) The unit of correlation coefficient between height in feet and weight in kilograms is :
  - i) kg / feet
  - ii) percentage
  - iii) non-existent
- 16) Which method of measuring correlation measures any type of relationship?
  - a) Karl Pearson's Co-efficient of correlation.
  - b) Spearman's rank correlation.
  - c) Scattered Diagram.
- 17) If precisely measured data are available, the simple co-efficient correlation is :
  - a) more accurate than rank correlation co-efficient
  - b) less accurate than rank correlation co-efficient
  - c) as accurate as the rank correlation co-efficient

**Short Answer Type Questions (3/4 Mark Questions) :-**

1. What is meant by correlation? What are the properties of coefficient of correlations?
2. Interpret the values of  $r$  as 1,  $-1$  and 0.
3. Calculate the correlation coefficient between X & Y and comment on their relationship.

X	-3	-2	-1	1	2	3
Y	9	4	1	1	4	9

(Ans.  $r = 0$ )

4. Calculate the correlation coefficient between X & Y and comment on their relationship :

X	1	2	3	4	5
Y	3	4	6	7	10

(Ans.  $r = +0.98$ )

5. Plot the following data as a scatter diagram and comment over the result :

X	11	10	15	13	10	16	13	8	17	14
Y	6	7	9	9	7	11	9	6	12	11

6. Calculate the Karl Pearson's coefficient of correlation from the following data :

X	20	25	30	35	40	45	50	55	60
Y	16	20	23	25	33	38	46	50	55

(Ans.  $r = +0.99$ )

7. From the following data, compute the product movement correlation between x and y.

	<b>X series</b>	<b>Y series</b>
i) No. of items	15	15
ii) Arithmetic mean	25	18
iii) Square of deviations		
From arithmetic mean	136	138
iv) Summation of products of deviations of X and Y series from respective means = 122		(Ans. $r = 0.89$ )

8. Number of pairs of observations of X and Y series = 10

X series    Arithmetic average = 65

Standard deviation = 23.33

Y series    Arithmetic average = 66

Standard deviation = 14.9

Summation of products of corresponding deviation of X and Y series = + 2704

Calculate product moment correlation of x and y series.

(Ans.  $r = + 0.78$ )

9. Calculate the Spearman's rank correlation from the following data X 10

X	10	12	8	15	20	25	40
Y	15	10	6	25	16	12	8

(Ans.  $r = + 0.14$ )

10. Two judges in a beauty competition rank the twelve entries as follows :

Without Make-up	1	2	3	4	5	6	7	8	9	10	11	12
With Make-up	12	9	6	10	3	5	4	7	8	2	11	1

(Ans.  $r = -0.45$ ) Calculate rank correlation coefficient.

11. Calculate the rank coefficient correlation of the following data :

X	68	75	90	75	50	62	40	35
Y	10	12	14	10	10	13	9	8

(Ans.  $r = + 0.76$ )

12. Does correlation imply causation?
13. Does zero correlation mean independence ?
14. Why does rank correlation coefficient differ from Karl Pearson's coefficient of correlation?
15. When is rank correlation coefficient more precise than simple correlation coefficient?

**Long Answer Type Questions (6 Mark Questions) :-**

- 1) Discuss Karl Pearson's method of calculating coefficient of correlation. Give its merits and limitations.
- 2) In a beauty contest, three judges accorded following ranks to 10 participants :

Judge I	1	6	5	1	0	3	2	4	9	7	8
Judge II	3	5	8	4	7	1	0	2	1	6	9
Judge III	6	4	9	8	1	2	3	1	0	5	7

Find out by Spearman's rank difference method which pair of judges has a common taste in respect of beauty.

(Ans.  $r_{s I \& II} = -0.21$ ;  $r_{s II \& III} = -0.29$ )

3. What are the advantages of spearman's rank correlation coefficient over Karl Pearson's correlation coefficient? Explain the method of calculating Spearman's rank correlation coefficient.
4. Following are the heights and weights of 10 students in a class. Draw a scatter diagram and indicate whether the correlation is positive or negative.

Height (in inches)	72	60	63	66	70	75	58	78	72	62
Weight (in Kg.)	65	54	55	61	60	54	50	63	65	50

5. Calculate the correlation coefficient of ten marks obtained by 12 students Mathematics and Statistics and interpret it.

Marks (in Maths)	50	54	56	59	60	62	61	65	67	71	71	74
Marks (in Statistics)	22	25	34	28	26	30	32	30	28	34	36	40

(Ans.  $r = 0.78$ )

### **ANSWERS OF ONE (1) MARK QUESTIONS**

1. Correlation is a statistical tool which studies the relationship between two variables.
2. Beauty, bravery, wisdom, ability etc.
3. The correlation is said to be negative when the variable move in opposite direction.
4. The correlation is said to be positive when the variable move together in the same direction.
5.  $-1 \leq r \leq 1$
6. Perfect correlation.
7. i) Age of husband and age of wife.  
ii) Increase in height and weight.
8. Scattered diagram does not indicate the exact numerical value of correlation.
9. i) Sale of wollen garments and day temperature.  
ii) Yield of crops and price.
10. When data are of qualitative nature like beauty, honesty etc.
11. i) Scattered diagram  
ii) Karl Pearson's coefficient of correlation.  
iii) Spearman's Rank correlation coefficient.
12. This method can not be employed for finding out correlation in a grouped frequency distribution.
13. The value of the coefficient is affected by extreme items.
14. Independent
15. Non-existent
16. Karl Pearson's coefficient of correlation.

## Frequently Asked Questions

Q1. Who gave the rank difference method of correlation? (1 Marks)

Hint : Prof. Charles Spearman

Q2. Define correlation. Give an example each of positive and negative correlation. (3 Marks)

Hints : Positive correlation :– Increase in Price and increase in supply.

Negative correlation :– Rise in price and fall in demand.

Q3. Compute the Karl Pearson's coefficient from following data : (6 Marks)

X	10	12	11	13	12	14	9	12	14	13
Y	7	9	12	9	13	8	10	2	7	13

Hints :

- i) Compute the mean of both series ( $\bar{x}$   $\bar{y}$ )
- ii) Take the deviation from the mean ( $xy$ )
- iii) Square the deviation of ( $x^2y^2$ )
- iv) Compute the product of ( $xy$ )
- v) Use the following formula :

$$r = \frac{\sum xy}{\sum x^2 \times \sum y^2}$$

Ans. –0.115 (Low degree of negative correlation)

4. Find out rank difference correlated of X and Y. (6 Marks)

X	80	78	75	75	58	67	60	59
Y	12	13	14	14	14	16	15	27

X	R1	Y	R2	D=R1-R2	D <sup>2</sup>
80	1	12	8	-7	49
78	2	13	7	-5	25
75	3.5	14	5	-1.5	2.25
75	3.5	14	5	-1.5	2.25
58	8	14	5	3	9
67	5	16	2	3	9
60	6	15	3	3	9
59	7	17	1	6	36

$$\Sigma D^2 = 141.5$$

$$rk = 1 - \frac{6 \left[ \Sigma D^2 + \frac{1}{12} (m_1^3 - m_1) - \frac{1}{12} (m_2^3 - m_2) \right]}{N^3 - N}$$

$$rk = 1 - \frac{6 \left[ 141.5 + \frac{2^3 - 2}{12} + \frac{3^3 - 3}{12} \right]}{8^3 - 8}$$

$$= 1 - \frac{6 (141.5 + 0.5 + 2)}{504}$$

$$= 1 - \frac{6 \times 144}{504}$$

$$= \frac{504 - 864}{504}$$

$$= \frac{-360}{504}$$

$$= -0.71$$

## (iv) INTRODUCTION TO INDEX NUMBERS

Index numbers :- An index numbers is a statistical measure design to show changes in a variable or group of related variables with respect to time, geographical location or other characteristics.

- **Characteristics of Index Numbers :**

1. Index numbers are not qualitative statements like prices are rising or falling. It is a precise measurement of quantitative changes in the concerned variable.
2. Index numbers show changes in terms of averages. For example when it is said that price level has been increased it does not mean that price of all goods and services have been increased. But it means that on and average prices have been increased.
3. An Index number, indicating change in magnitude, as of price, wage, employment, or production shifts, relative to the magnitude at a standard or base value usually taken as 100.

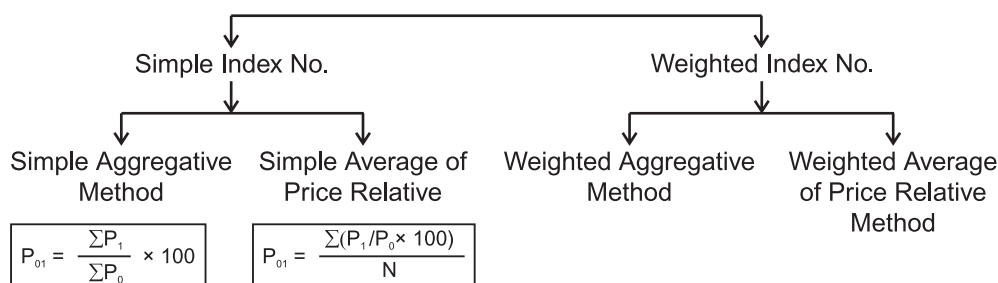
- **Types of Index Numbers**

Index numbers are names after the activity they measure. Their types are as under :

1. **Price Index** : Measure changes in price over a specified period of time. It is basically the ratio of the price of a certain number of commodities at the present year as against base year. Some price index numbers are **Wholesale price Index (WPI)**, **Consumer Price Index (CPI)** or **Cost of Living Index (COLI)**.
2. **Quantity Index** : As the name suggest, these indices pertain to measuring change in volume of commodities like goods produced or goods consumed, etc. An important quantity index number is **Index of Industrial Production (IIP)**

3. **Value Index** : These pertain to compare changes in the monetary value of imports, exports, production or consumption of commodities.

- **Methods of Constructing Index Numbers**



- **Weighted Aggregative Method**

(i) Laspeyre's Method  $P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100$   $P_1$  = Price of current year  
 $P_0$  = Base year price  
 $q_0$  = Base year quantity

(ii) Paasche's Method  $P_{01} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100$   $q_1$  = Current year quantity

(iii) Fisher's Method  $P_{01} = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100$

- **Fisher's Index Number** is called ideal index number because :-

- It considers both base year and current year quantity;
- It is based on Geometric Mean which is considered as best average.
- It satisfies time reversal & factor reversal test.

- **Weighted Average of Price Relative**

$$P_{01} = \frac{\sum RW}{\sum W}$$

where  $R = \frac{P_1}{P_0} \times 100$

$W$  = Weight

### 1. Wholesales Price Index (WPI)

WPI is used to measure the relative changes in the prices of commodities traded in the wholesale markets. presently 2011-12 is used as the base year. It is also used to calculate the rate of inflation in a country.

### 2. Consumer Price Index (CPI) OR Cost of Living Index (COLI)

CPI can be measured through two methods

1. Aggregate expenditure method
2. Family budget method

Aggregate expenditure method :

$$CPI = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

Family budget method :

$$CPI = \frac{\sum RW}{\sum W}$$

If W is not given ( $W = p_0 q_0$ )

$$R = \frac{p_1}{p_0} \times 100$$

### 3. Index of Industrial Production (IIP)

The index of industrial production is a composite indicator that measures the short-term changes in the quantity of production of industrial products during a given period with respect to that in a chosen base period.

$$IIP = \frac{\sum \left( \frac{Q_1}{Q_0} \right) W}{\sum W} \times 100$$

Where  $Q_1$  = Production level in current year

$Q_0$  = Production level in base year

$W$  = Weightage of different industrial output

#### 4. Inflation and Index Number

Inflation is the percentage increases in price level i.e prices of a basket of goods and services over a specific period of time in respect of base year.

$$\text{Inflation Rate} = \frac{I_1 - I_0}{I_0} \times 100$$

Where  $I_1$  = Index of current period

$I_0$  = Index of base period.

### QUESTION BANK

#### ONE (1) MARK QUESTIONS :-

- 1) What do you mean by index numbers ?
- 2) Define base year.
- 3) State the three different index numbers.
- 4) Give the formula to calculate the rate of inflation.

#### THREE & FOUR (3 & 4) MARKS QUESTIONS :-

- 1) Mention three advantages of index number.
- 2) Construct the index no. for 2017 taking 2011 as base year by simple average of price-relatives.

Items	A	B	C	D	E
2011 (prices)	15	22	38	25	50
2017 (prices)	30	25	57	35	63

Ans. $P_{01} = 145.9$
-----------------------

- 3) Explains the limitations of index number.

#### SIX (6) MARK QUESTION :-

- 1) Explain the problems to construct an index number.
- 2) Explain the importance of index number.

- 3) Calculate Paasche's and Laspeyre's index number.

Commodities	Base Year		Current Year	
	Quantity	Price	Quantity	Price
A	10	10	20	15
B	3	25	5	30
C	4	20	10	15
D	15	5	18	7
E	2	30	4	30

Ans. Paasche's = 115.10, Laspeyre = 136.67

- 4) Calculate consumer price Index No. Using Family Budget Method.

Items	Weight	Base year price	Current year price
Food	45	300	350
Rent	20	200	225
Fuel	8	100	110
Clothing	10	150	175
Others	17	250	300

Ans. 115.87

### **ANSWER OF ONE MARK QUESTIONS**

- 1) An index number is a statistical device for measuring changes in the magnitude of a group of relative variables.
- 2) It refer to year of reference with which prices of current year are compared to measure the changes.
- 3) (a) consumer price index (b) wholesale price index (c) Index of industrial production

$$4) \frac{I_1 - I_0}{I_0} \times 100$$

## Frequently Asked Questions Index Numbers

1. What is the symbol of the price of the base year ?  
(Hint:  $P_0$ )
2. State the characteristics of index number.  
Hint :
  - (i) Expressed in numbers
  - (ii) Relative measure
  - (iii) Average of percentage
  - (iv) Basis for comparison
  - (v) Universal utility
3. Write three uses of Wholesale Price Index.  
Hints :
  - (i) Forecasting of demand and supply.
  - (ii) Determination of Real Change in Aggregate.
  - (iii) Indicator of Rate of Inflation.

### **INDEX NUMBER**

#### **Multiple Choice Questions :- (1 Mark Questions)**

1. An index number which accounts for the relative importance of the items is known as.
  - (a) Weighted index
  - (b) Simple aggregative index
  - (c) Simple average of relatives
2. In most of the weighted index numbers weight pertains to
  - (a) Base year
  - (b) Current year
  - (c) Both base and current year
3. The impact of change in price of a commodity with little weight in the index will be.
  - (a) Small
  - (b) Large
  - (d) Uncertain

4. A Consumer Price Index measures change in
- (a) Retail prices
  - (b) Wholesale price
  - (c) Producer prices
5. In general, inflation is calculated by using
- (a) Wholesale price index
  - (b) Consumer price index
  - (c) Producer's price index
6. The item having the highest weight in consumer price index for industrial worker is
- (a) Food
  - (b) Housing
  - (c) Clothing

### **ANSWERS OF ONE MARK MULTIPLE CHOICE QUESTIONS**

- 1. (a)
- 2. (a)
- 3. (a)
- 4. (a)
- 5. (a)
- 6. (a)

### **Exam Oriented Questions with Answers**

Q.1. What are the difficulties or problems in the construction of index numbers?

Ans. The main difficulties or problems in the construction of index numbers are as follows :

1. **Purpose of Index Number** : Different index number serve different purposes. So before constructing an index number, one must define the objective.
2. **Selection of Base Year** : Base year is the year with which prices of the current year are compared. So it should be selected with due care. It should be a normal year without much ups and downs.

3. **Selection of the Price of the Goods and Services :** In the construction of price index, selection of prices is a major difficulty. The problem is that which prices should be taken into consideration. Wholesales prices or retail prices. Besides it, prices at different places are different. So, one should be careful in its selection.
4. **Selection of Goods and services :** Which goods and services should be included for measuring index number, is another major problem. So, one should keep the purpose of index number into consideration. While selecting it.
5. **Selection of Method :** There are various methods to measure index number. So, which method should be used, is another problem.

Q.2. What are the steps to construct consumer price index (CPI).

Ans. The steps to construct consumer price index are as follows :

1. **Selection of the Consumer Class :** First of all, it should be determined, for whom CPI is to calculate i.e., for industrial labour, farmers, govt employee etc.
2. **Information about the Family Budget :** After the selection of consumers class, information about their family budget should be collected i.e., what they consume, how much they consumers, prices of the concerned goods and services etc.
3. **Choice of Base Year :** After this, base year selection should be done. It should be a normal year without much ups and downs.
4. **Information about Prices :** The data regarding retail prices of selected goods and services should be collected from the concerned area, where the selected consumer group lines and makes the purchases.
5. **Weightage :** Selected items should be given weights according to their relative importance.
6. **Selection of Method :** At the end, it should be decided that aggregative expenditure method should be used or family budget method should be used to measure CPI.

Q.3. What is the importance of CPI or cost of living index.

Ans. Importance of CPI

1. It helps government in formulation of various policies regarding taxation, prices, rent control, general economic and fiscal policies etc.
2. It helps in determination of dearness allowance, on the basis of which govt employees salaries are hiked to compensate the rising prices level.
3. It is used to measure the real value of the rupee or its purchasing power and real income.

Q.4. What are the limitations of index numbers?

Ans. These are the following limitations of index numbers :

1. It provides only relative changes.
2. It considers only quantitative changes.
3. Index numbers does not reflect perfect accuracy.
4. Different methods of measuring index number give different results.

## SOME MATHEMATICAL TOOLS USED IN ECONOMICS

Relationship between two variables can express in three ways -

- (1) In the form of table
- (2) In the form of diagram
- (3) In the form of an algebraic equation.

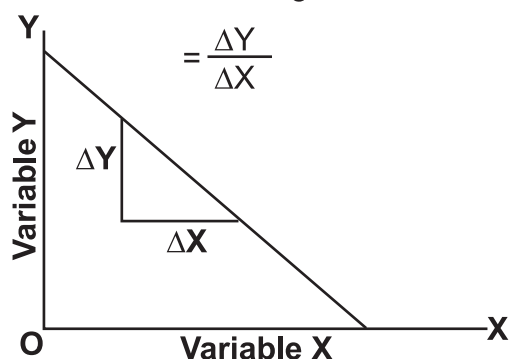
Economics now prefers to describe relationship between different variables in terms of algebraic equations

**Functional Relationship** - It refers to the 'cause and effect' relationship between the variables.

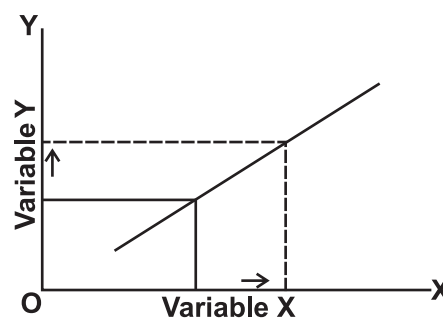
### (I) SLOPE OF A LINE (LINEAR GRAPH)

Straight lines have the same slope. It means change in one variable in response to a unit change in other is same everywhere on the straight line. The slope of a straight line is calculated as :

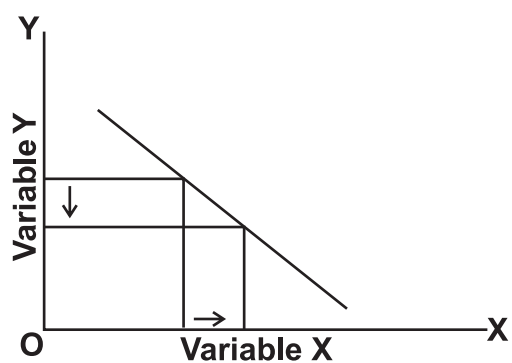
$$\text{Slope} = \frac{\text{Change in variable on the Y - axis}}{\text{Change in variable on the X - axis}}$$



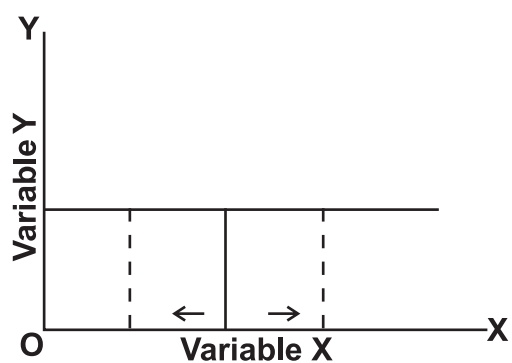
- 1) Positive Slope - If the line is upward sloping then the two variable are directly related.



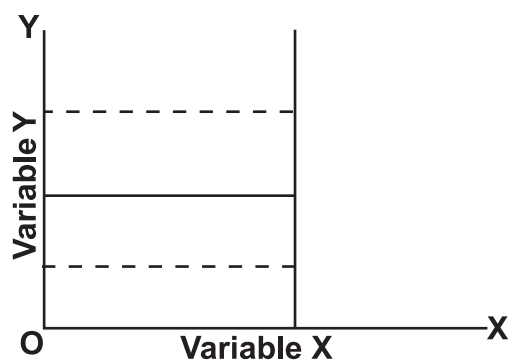
- 2) Negative Slope - When the Line is downward Slopping, then the two variable are inversely related.



- 3) Zero Slope – In case of a horizontal straight line, the slope is Zero as OY is zero.



- 4) Infinite Slope – In case of a vertical straight line, the slope is infinite as OY is too big to be measured.

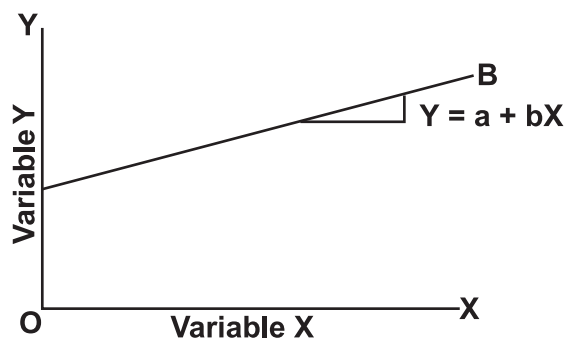


## (II) Equation of Line

If the slope is constant throughout, the curve will be a straight line.

- 1) Equation of an upward sloping straight line curve:

$$Y = a + bX$$



where  $a$  = Value of the Y - axis intercept (OA) of the curve AB.

$$b = \text{Its coefficient} = \frac{\Delta Y}{\Delta X}$$

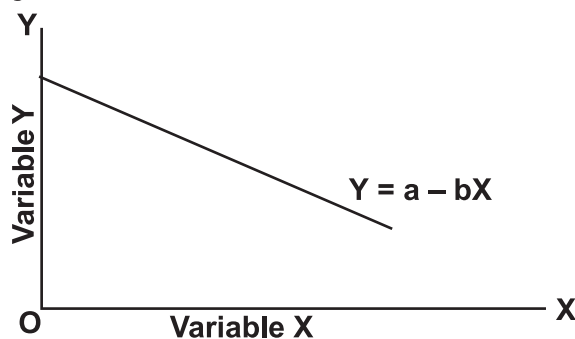
$X$  = Independent Variable

$+$  = Sign indicates direct relation between  $x$  and  $y$

- 2) Equation of a downward sloping Straight Line curve –

$$Y = a - bx$$

$(-)$  = Sign indicates inverse relation between  $x$  and  $y$



## III SLOPE OF A CURVE

A non-linear curve is the one, whose slope changes. Unlike the slope of a straight line, the slope of a curve is continuously changing.

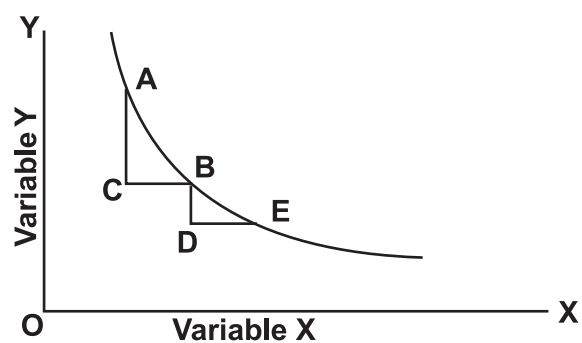
- 1) Downward sloping convex curve –

In case of movement from A to B

$$\text{Slope} = \frac{\Delta Y}{\Delta X} = \frac{AC}{CB}$$

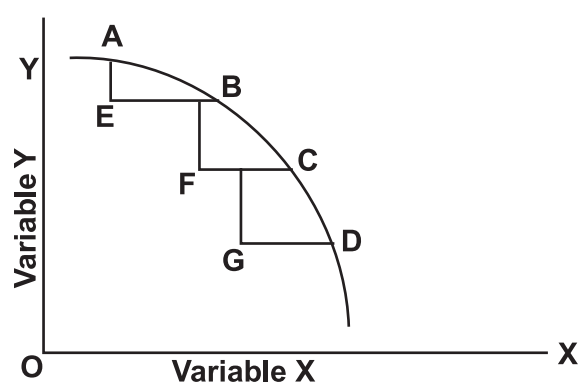
In case of movement from B to E

$$\text{Slope} = \frac{\Delta Y}{\Delta X} = \frac{BD}{DE}$$



- 2) Downward sloping concave curve –

The slope of concave curve tends to rise.



## Model Test Paper – I

### Section – A

1. Define normative economics.
2. A consumer consumes two good consumer is said to be in equilibrium when.
  - (a) Marginal utility of two goods is equal.
  - (b) Total utility of two goods is equal.
  - (c) Per rupee marginal utility of two good is equal.
  - (d) Number of two goods is equal.
3. Demand curve shifts right ward in case of
  - (a) Decrease in the price of the commodity.
  - (b) Decrease in the price of the substitute goods.
  - (c) Decrease in the price of the complimentary goods.
  - (d) Increase in the income inequality.
4. The most preferred bundle by a consumer having monotonic preferences is
  - (a) 6 units of x good and 5 units of y good.
  - (b) 5 units of x good and 5 units of y good.
  - (c) 5 units of x good 6 units of y good.
  - (d) 6 units of x good and 6 units of y good.
5. Government launched MGNAREGA scheme for employment in rural areas. What will be its effect on production possibility curve (PPC)
6. Price elasticity of supply a commodity is 1.5. 10 percent increase in price, raises its supply by 30 units. Calculate its supply at the original price.

or

Explain how does “increase in the price of inputs” affects supply of a commodity?

7. Differentiate between budget set and budget line.
8. What does the law of variable proportions show? Why it does not apply in long run?
9. Distinguish between perfect competition and monopolistic competition (any four)

or

Explain the implication of non-price competition in an oligopoly market.

10. A consumer consumes two goods X and Y and he is in equilibrium condition. What will be behavior of the rational, consumer if price of good Y decrease. Explain with indifference curve analysis method.

or

Differentiate between 'expansion in demand' and increase in demand. Give example from your daily life.

11. (a) Explain the relationship between marginal cost (MC) and average cost (AC)  
(b) When price of good remain same at all level of output then what is the shape of total revenue (TR) curve?
12. How are equilibrium price and equilibrium quantity of a commodity gets affected when price of substitute good changes?

### Section – B

13. Which measure of central tendency is not fit for algebraic treatment?
14. What is frequency array?
15. Consumer price index (CPI) is not used in  
(a) Wages decision  
(b) price policy  
(c) taxation policy  
(d) production policy
16. Write the formula to calculate the inter quartile range.
17. What is loss of information in classified data?
18. Consumer price of agriculture labours (CPIAL) is 215 in current year. Price of metro train fare has increased by 50% this month. Explain its effect on CPIAL with reasons.

or

In a data set of 100 families 5 families have extremely low income. Which measure of dispersion will you to use in this data set Give reasons.

19. Calculate mean from the following data

Items:	more than 0	more than 10	more than 20	more than 30	more than 40
frequency:	28	24	14	4	0

20. Percentage marks obtained by 100 students of a class are given below calculate the first and third quartiles.

Marks	30–35	35–40	40–45	45 – 50	50 – 55	55– 60	60 – 65
No. of students	14	16	18	23	18	8	3

21. Calculate weighted aggregative price index with Paasche's method from the following data.

items	base year price	current year price	Base year quantity	current year quantity
A	20	24	10	12
B	15	21	15	16
C	30	33	8	10
D	5	7	20	22
E	12	18	30	40

or

Nidhi Gupta is earning Rs 80,000 salary in year 2018, when CPI is 850. Her father was earning Rs 11,000 in base year 2002. Who was better off in maintaining standard of living?

22. Use Histogram to represent the following data and locate the mode.

Marks	more than 0	More than 10	More than 20	More than 30	More than 40	More than 50
No- of students	40	38	30	20	6	0

23. Calculate mean deviation and coefficient of mean deviation from the following data with median

Age (years)	20-30	30-40	40-50	50-60	60-70
No. of persons	8	12	20	16	4

24. Calculate Karl Pearson's coefficient of correlation from the following data:

X	30	40	60	70	100
Y	90	110	140	150	160

or

Calculate spearman's rank coefficient of correlation from the following data.

X	60	50	45	55	65
Y	85	60	55	65	75

### Answers Part - A

1. It deals with what ought to be or how the economic problems should be solved.
2. (c)
3. (c)
4. (d)
5. Reducing unemployment has no effect on the production potential of the economy. It is because production potential is determined assuming full employment. It simply helps in reacting potential.

6. 
$$E_s = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$$

$$1.5 = \frac{\% \text{ change in quantity supplied}}{10\%}$$

$$15\% \text{ of original supply} = 30$$

$$Q = 200$$

or

Price of inputs forms a major part of the cost of production for producing a commodity. Rise in price of inputs increase the cost of production and reduces the profit margin. As a result supply falls.

7. Budget set is the set of all possible combinations of the two goods which a consumer can afford given his income and prices in the market.

Whereas budget line is a graphical representation of all possible combinations of two goods which can be purchased with given income and prices of the goods, when consumer spends his entire income.

8. Law of variable proportions : Law of variable proportions states that as we increase quantity of only one input keeping other inputs constant total product initially increases at an increasing rate, then at decreasing rate and finally falls.

It does not operate in the long run because in the long run output can be changed by changing all factors of production.

9. Perfect competition is that market situation in which large number of buyers and large number of sellers buy & sell homogeneous product at a given price, that is determined by the industry.

Features of perfect competition :

1. Homogeneous product

2. Perfect knowledge
3. No control over price
4. Demand curve is perfectly elastic

whereas monopolistic competition is that market situation in which there are large number of sellers which sell differentiated products.

Features of monopolistic competition :

1. Differentiated product
2. Lack of perfect knowledge
3. Partial control over price
4. Demand curve downward sloping and elastic

or

In oligopoly market situation price tends to stay fixed irrespective of changes in demand and supply conditions firms use other methods like advertising better service, after sale service etc to compete with one another.

#### 10. Condition's for consumer's equilibrium

$$(1) \text{ MRS} = \frac{P_x}{P_y}$$

(2) MRS continuously falls

When price of y good falls then condition will  $\text{MRS} < \frac{P_x}{P_y}$  it means that to obtain one more unit of x the consumer is willing to sacrifice less units of y as compared to what is required in the market. It induces the consumer to buy less of x and more y.

As a result, MRS rises till it becomes equal to the ratio of prices and the equilibrium is established.

or

**Expansion in demand :** When the quantity demanded rises due to a decrease in the price, keeping other factors constant. For example rise in demand of mobile set when its price decreases.

**Increase in demand :** A rise in the demand of a commodity caused due to any factor other than the commodity caused due to any factor other than the comprise of the commodity. Example increase in demand of car, when its price is same, because of rise in income of consumer.

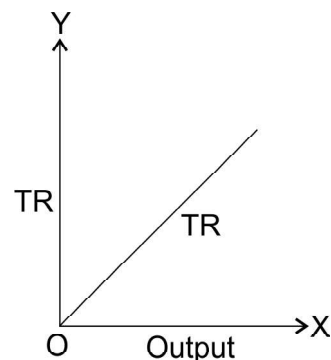
11. (a) Relation between MC and AC

when  $AC > MC$ , AC falls

$AC = MC$ , AC constant

$AC < MC$ , AC rises

(b)	Output	price = AR	TR
	1	10	10
	2	10	20
	3	10	30
	4	10	40
	5	10	50



TR will increase constantly or we can say at constant rate.

12. When price of substitute good increases, demand for given good increases due to that excess demand is created at given price.

Excess demand cause competition among buyers and consequently price rises due to that there will be expansion in supply and demand and supply are equal. So equilibrium price will rise and quantity demanded also increased.

13. Mode and median

14. Frequency array is that series in which data are presented in exact measurements of items with frequency.

15. (d) Production policy

16.  $Q_3 - Q_1$

17. When data are grouped into different class intervals, all calculations are based on mid-value of class interval. There is a loss of information regarding different values of observation in a class interval.

18. There will be no effect on CPIAL when price of metro train fare increases as it is not an item of consumers basket of agriculture labour.

or

I will use Quartile dispersion in this case as it is least effected by the extreme values. Extreme values of lower side (25%) and higherside (25%) are not included in quartile deviation.

19. Class Interval	f	M	fm
0-10	4	5	20
10-20	10	15	150
20-30	10	25	250
30-40	4	35	140
	$\Sigma f = 28$	$\Sigma f_m = 560$	

$$\begin{aligned}\text{Mean } \bar{X} &= \frac{\Sigma f_m}{\Sigma f} \\ &= \frac{560}{28} = 20\end{aligned}$$

$$\bar{X} = 20$$

20.	Marks	No. of students	Cf.
	30-35	14	14
	35-40	16	30
	40-45	18	48
	45-50	23	71
	50-55	18	89
	55-60	8	97
	60-65	3	100

$$Q_1 = \text{Size of } \frac{N}{4} \text{th item} = \frac{100}{4} = 25\text{th item}$$

$$Q_1 = L + \frac{\frac{N}{4} - C.f.}{f} \times i \quad (\text{Lies in 35-40})$$

$$= 35 + \frac{25 - 14}{16} \times 5$$

$$= 35 + \frac{55}{16} = 35 + 3.43 = 38.43$$

$$Q_3 = \text{Size of } 3\left(\frac{N}{4}\right)^{\text{th}} \text{ Item} = 75\text{th item}$$

$$Q_3 = L + \frac{\left(\frac{N}{4}\right) - C.f.}{f} \times i$$

$$Q_3 = 50 + \frac{75 - 71}{18} \times 5 = 50 + \frac{20}{18} = 51.11$$

$$Q_1 = 38.43 \text{ and } Q_3 = 51.11$$

21.	Item	$p_0$	$p_1$	$q_0$	$q_1$	$p_1 q_1$	$p_0 q_1$
	A	20	24	10	12	288	240
	B	15	21	15	16	336	240
	C	30	33	8	10	330	300
	D	5	7	20	22	154	110
	E	12	18	30	40	720	480
						1828	1370

$$\text{Paasche's Price Index } p_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{1828}{1370} \times 100 = 133.43$$

or

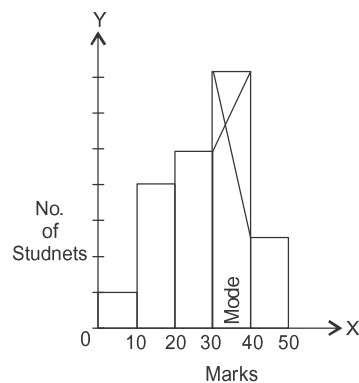
$$\text{Real value of Nidhi Gupta's} = \frac{80000}{1370} \times 100 = 9411.76$$

Her father's earning in Base Year = 11,000

Her father was earning more in real value so

He was better off in maintaining standard of living.

22.	Marks	No. of students
	0-10	2
	10-20	8
	20-30	10
	30-40	14
	40-50	6



23.	Age	No. of persons	C.F.	X-M	dM	f dM
	20-30	8	8	25	20	160
	30-40	12	20	35	10	120
	40-50	20	40	45	0	0
	50-60	16	56	55	10	160
	60-70	4	60	65	20	80
						520

$$M = \text{Size of } \frac{N}{2} \text{ item} = \frac{60}{2} = 30^{\text{th}} \text{ item}$$

Median is in 40-50 class interval

$$M = L_1 + \frac{\frac{N}{2} - C.f}{f} \times i = 40 + \frac{30 - 20}{20} \times 10 = 40 + \frac{100}{20} = 45$$

Mean deviation from median

$$MDm = \frac{\sum f |dM|}{\sum f} = \frac{520}{60} = 8.67$$

$$\text{Coefficient of mean deviation} = \frac{MDm}{M} = \frac{8.67}{45} = 0.19$$

24.	$X$	$x = X - \bar{X}$	$x^2$	$Y$	$y = Y - \bar{Y}$	$y^2$	$xy$
	30	-30	900	90	-40	1600	1200
	40	-20	400	110	-20	400	400
	60	0	0	140	10	100	0
	70	10	100	150	20	400	200
	100	40	1600	160	30	900	1200
	$\Sigma X = 300$	$\Sigma x = 0$	3000	$\Sigma Y = 650$		3400	3000

$$\bar{X} = \frac{\Sigma X}{N} = \frac{300}{5} = 60$$

$$\bar{Y} = \frac{\Sigma Y}{N} = \frac{650}{5} = 130$$

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \times \Sigma y^2}} = \frac{3000}{\sqrt{3000 \times 3400}} = \frac{3000}{\sqrt{10200000}} = \frac{3000}{3193.7}$$

$$r = 0.93$$

Coefficient of correlation highly positive correlation

Or

$X$	$R_1$	$Y$	$R_2$	$R_1 - R_2$	$D$	$D^2$
60	4	85	5	-1		1
50	2	60	2	0		0
45	1	55	1	0		0
55	3	65	3	0		0
65	5	75	4	1		1

$$\Sigma D^2 = 2$$

$$r_k = 1 - \frac{6 \Sigma D^2}{N^3 - N} = 1 - \frac{6 \times 2}{5^3 - 5} = 1 - \frac{12}{120} = 1 - 0.01$$

## Model Test Paper-II

### Section – A

1. What are the characteristics of resources which causes economic problem? (1)
2. At every level of output marginal revenue (MR) is equal to the price. Average revenue (AR) : (1)
  - (a) Increase with the increase in output.
  - (b) Increase in first stage and then start decreasing.
  - (c) Remain more than Marginal Revenue (MR)
  - (d) Remain same at every level of output.
3. When Marginal Cost (MC) is minimum then : (1)
  - (a) Marginal Cost (MC) is equal to average cost (AC)
  - (b) Total Cost (TC) is maximum
  - (c) Average Cost (AC) is also minimum
  - (d) Total cost is constant.
4. Supply curve shifts rightward in case of — (1)
  - (a) Increase in the price of the commodity
  - (b) Increase in the price of related goods.
  - (c) Decrease in the price of inputs.
  - (d) Decrease in the number of firms.
5. Explain the central problem of an economy 'For whom to produce'. (3)
6. A consumer buys 40 units of a good at a price of ₹ 10 per unit. How many units the consumer will buy at a price of ₹ 11 per unit, if price elasticity of demand for the good is  $(-1.5)$ . Calculate (3)

Or

How does 'Availability of substitutes' affects the price elasticity of demand of a commodity? Explain with example.

7. What is the meaning of monotonic preferences? Explain why higher indifference curve shows higher level of satisfaction. (4)
8. What is 'Short Run'? In which phase of law of variable proportions a rational producer will operate in the short run? (4)
9. Explain the implications of 'Freedom of Entry and Exit of firms' under perfect competition. (4)

Or

Distinguish between perfect oligopoly and imperfect oligopoly.

10. "There is a negative relationship between price of a commodity and quantity demanded." Explain the statement with the help of utility analysis method. (6)
11. What is producer's equilibrium? Explain conditions of producer's equilibrium with the help a numerical example. (6)

Or

What is the meaning of supply function? Explain any four determinants of market supply.

12. How are equilibrium price and equilibrium quantity of a commodity gets effected, when number of firms producing the goods change? (6)
13. Write any other name of Random Sampling. (1)
14. Which of the following central tendency is most effect by extreme values?  
(a) Mean                      (b) Median                      (c) Quartile                      (d) Mode
15. Who introduced 'Standard Deviation' as measure of dispersion? (1)
16. 'SENSEX' Index indicates—  
(a) Change in the price of top 100 shares of Bombay Stock Exchange  
(b) Change in the price of top 100 shares of National Stock Exchange.  
(c) Change in the price of top 30 shares of Bombay Stock Exchange.  
(d) Change in the number of shares sold at Bombay Stock Exchange.
17. What is the importance of statistics in economics? Explain any three. (3)
18. Differentiate between exclusive series and inclusive series with example. (3)

Or

While collecting secondary data from internet what precaution do you take?  
Write any three.

19. Calculate median in the following distribution. (4)

Marks (More than)	0	10	20	30	40	50	60
No. of Students	50	46	40	20	10	3	0

20. Calculate mode from the following data — (4)

Wages	10-15	15-20	20-25	25-30	30-35	35-40
No. of workers	7	10	27	15	12	8

21. Calculate weighted average of price relative index from the following data : (4)

Items	Base Year Price	Current Year Price	Weight
A	40	64	52
B	100	140	8
C	10	18	18
D	50	60	12
E	20	50	10

Or

Months	January	February	March	April	May	June
W.P.I	200	210	231	245	255	278

On the basis of data given above answer the following :

(i) In which month inflation rate was highest?

(ii) In which month inflation rate was lowest?

22. Use ogive to represent the following data and locate the median. (6)

Class interval	0-10	10-20	20-30	30-40	40-50
Frequency	6	9	15	12	8

23. Draw lorenz curve from the following data and compare the distribution of wages in from A and from B. (6)

Wages (Rs)	Firm-A No. of Workers	Firm-B No. of Workers.
100-200	20	150
200-300	15	100
300-400	20	90
400-500	25	110
500-600	20	50

24. Calculate Karl Pearson's coefficient of correlation from the following data. (6)

X :	28	29	30	31	33	35	36
Y :	23	24	25	26	28	29	30

Or

Calculate spearman's Rank coefficient of correlation from the following data :

X :	36	25	75	82	92	62	65	35
Y :	51	60	68	60	86	58	35	49

## Model Question paper-III

### Class-XI

#### Subject Economics

1. Which of the following is the example of economic activity. (1)  
(a) Production (b) Consumption (c) Exchange (d) All of these
2. Define opportunity cost? (1)
3. What do you mean by contraction in Demand? (1)
4. What does break-even point indicate? (1)  
(a)  $TR > TC$  (b)  $TR < TC$  (c)  $TR = TC$  (d)  $TC = 0$
5. Explain the central problem 'For whom to Produce. (3)
6. Distinguish between fixed costs and variable costs. Give two examples of each. (3)
7. A consumer buys 100 units of Good-Y at ₹ 5 per unit. The price elasticity for the Good is 2. At what price will he be willing to buy 140 units of Good-Y. (4)
8. What do you understand by consumer's equilibrium? Explain consumer's equilibrium in case of a single commodity. (4)
9. Explain any four factors that affects the elasticity of demand. (4)
10. Explain the characteristic features of oligopoly. Also distinguish between collusive and non-collusive oligopoly. (6)
11. Explain with the help of diagrams, the effect of the following changes on demand for a good (6)  
(1) Rise in the income of its buyers.  
(2) Fall in the income of its buyers.
12. Given below is a cost and revenue schedule of a producer. At what level of output is the producer in equilibrium Give answer the suitable reason. (6)

Quantity Sold Units	Price (₹ Per Unit)	Total Cost (₹)
1	15	14
2	16	24
3	17	30
4	18	51
5	19	75

13. Which of the following is a source of secondary data? (1)  
 (a) Government publication (b) Private publication  
 (c) Report published by State Bank of India  
 (d) All of these
14. What is meant by tabulation? (1)
15. Define variable? (1)
16. Bar diagram is a (1)  
 (a) One dimensional diagram  
 (b) Two dimensional diagram  
 (c) Diagram with no dimension  
 (d) None of these above
17. Explain any three merits of sampling method. (3)
18. Distinguish between primary data and secondary data? (3)
19. Calculate Arithmetic mean by using step-deviation method. (4)
- |                |      |       |       |       |       |
|----------------|------|-------|-------|-------|-------|
| Marks          | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 |
| No. of Student | 20   | 24    | 40    | 36    | 20    |
20. What do you mean by a circular diagram? Present the data on expenditure of a labour family in the form of circular diagram? (4)
- |                            |      |          |         |                |       |
|----------------------------|------|----------|---------|----------------|-------|
| Items of Expenditure       | Food | Clothing | Housing | Fuel and Light | Other |
| Percentage of Income spent | 65   | 15       | 12      | 5              | 3     |
21. What is an Index number? Point out its limitation. (4)
22. Calculate mode from following table : (6)
- |           |      |       |       |       |       |
|-----------|------|-------|-------|-------|-------|
| Size      | 6-10 | 11-15 | 16-20 | 21-25 | 26-30 |
| Frequency | 20   | 30    | 50    | 40    | 10    |
23. Explain the concept of correlation. What is the basic difference between  
 (i) Linear and non-linear correlation and  
 (ii) Positive and negative correlation.
24. Calculate standard deviation of the marks of following 10 students : (6)
- |       |    |    |    |    |    |    |    |    |    |    |
|-------|----|----|----|----|----|----|----|----|----|----|
| S.No. | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
| Marks | 43 | 48 | 65 | 57 | 31 | 60 | 37 | 48 | 78 | 59 |

## Model Question paper-IV

### Class-XI

### Subject Economics

1. Initially  $\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$ . With a fall in the price of y, the consumption of the commodity –y : (1)  
(a) Diminishes (b) Increases  
(c) Remains constant (d) Becomes zero
2. Define marginal cost. (1)
3. When Production level is zero, then fixed cost is : (1)  
(a) Zero (b) Negative (c) Positive (d) Equal to variable cost
4. Define oligopoly. (1)
5. Distinguish between positive and normative economics. (3)
6. Complete the following table — (3)

Output (Units)	TVC (`)	AVC (`)	MC (`)
1	20	—	—
—	—	16	12
3	54	—	—
—	—	20	26
7. Why does demand curve slope downwards? Explain. (4)
8. Explain the equation of budget line with the help of a hypothetical numerical example. (4)
9. What are the characteristics of the perfectly competitive market? (4)

Or

Explain its conditions through MR – MC approach.
10. Explain the law of variable proportions in terms of the behaviour of total physical product with the help of a diagram. (6)

11. What is meant by producer's equilibrium? (6)
12. Explain any three factors affecting price elasticity of demand. (6)
13. Define population. (1)
14. Under random sampling, each item of the universe has \_\_\_\_\_ chance of being selected. (1)  
(a) Equal (b) Unequal (c) Zero (d) None of these
15. Define class-Interval. (1)
16. Arithmetic line-graphs are also known as : (1)  
(a) Linear graphs (b) Non-linear graphs  
(c) Time series graphs (d) None of these
17. Calculate Median (3)
- |                 |      |       |       |       |       |
|-----------------|------|-------|-------|-------|-------|
| Wage rate       | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 |
| No. of labourer | 22   | 38    | 46    | 35    | 20    |
18. State the three merits of mode. (3)
19. Calculate mean deviation (by mean) (4)
- |        |      |       |       |       |       |
|--------|------|-------|-------|-------|-------|
| Profit | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 |
| Shops  | 5    | 10    | 15    | 20    | 25    |
20. What is statistical classification? What is the importance of such a classification? (4)
21. What is meant by bar diagram? Explain its types. (4)
22. Define census method and sampling method and also explain the difference between census and sampling. (6)
23. Calculate coefficient of co-relative by rank difference method.
- |   |    |    |    |    |    |    |    |    |
|---|----|----|----|----|----|----|----|----|
| X | 46 | 56 | 39 | 45 | 54 | 58 | 36 | 40 |
| Y | 30 | 60 | 40 | 50 | 70 | 70 | 30 | 50 |
24. Calculate standard deviation (6)
- |                |      |       |       |       |       |
|----------------|------|-------|-------|-------|-------|
| Daily Wages    | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 |
| No. of labours | 2    | 7     | 10    | 5     | 3     |

### Common Errors in Economics

1. Interchange of MRT and MRS while explaining PPC. Marginal Rate of Transformation is the concept related to the production. Producer can transform one good into other by shifting factors of production. Marginal Rate of Substitution is related to the consumer as he can only substitute the goods available in the market.
2. Slope of various curves is decided by the relationship between two variables represented in the diagrams. Students don't explain their relationship and shape of curves.
3. Not clear about why PPC is concave to the origin and IC is convex to the origin. They write only about negative relationship between two goods.
4. Central economic problem "For whom to produce" is not explained with respect to the distribution of income among the factors i.e. (1) Personal distribution and (2) Functional distribution
5. Do not relate change in PPC with assumptions of PPC. (i) Number of factors (ii) Technology and (iii) Efficiency of the resources.
6. Most of the students use term satisfaction for marginal utility where as it is

utility derived from one addition unit. In the same way they explain  $\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$ , situation as that consumer is getting more utility from X commodity than Y. Whereas it is per rupee marginal utility of X commodity.

7. Most of the students use diagram to explain consumer equilibrium condition

$$MRS_{xy} = \frac{P_x}{P_y}.$$

Which is generally not asked in exams. Always explain equilibrium conditions in three steps. (i) Meaning (ii) Conditions and (iii) Explanation i.e., (i)  $MRS_{xy} >$

$$\frac{P_x}{P_y} \text{ and (2) } MRS < \frac{P_x}{P_y}$$

8. Students mix-up conditions of consumer equilibrium of two methods (i) utility analysis and (ii) Indifference curve analysis.

To make them clear about differences, we should use comparative method of teaching with points of comparison.

Utility Analysis One Commodity	Utility Analysis Two commodities	Indifference Curve
1. $MU_x = P_x$	1. $\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = MUM$	1. $MRS_{xy} = \frac{P_x}{P_y}$
2. MU is diminishing	2. MU is diminishing	2. MRS is diminishing

**Point of comparison :**

- Utility approach conditions includes 'MU' in condition where indifference curve do not include MU>
- In one commodity only one variable 'X' is used and in two commodities two variables 'X' and 'Y' are used.
- In utility approach, consumers change quantity to change marginal utility of a commodity to reach equilibrium points.

Whereas in indifference curve a consumer substitute one commodity with another to change  $MRS_{xy}$  and ratio of price remain same.

- While filling the blanks in a cost schedule students do errors because they try to fill each column at a time. Following tip can reduce their errors.
  - Always start with 0 quantity of production.
  - Fill the schedule row wise.
  - Calculate total cost first for each row and then all others of the same row.
  - TFC is always remain same, even at zero level of output.
- There are seven curves of cost related aggregates. Divide them in two broad categories to understand their relationship.
  - TC, TFC, TVC
  - AC, AVC, AFC and MC

Explain the relationship between (1) TC, TVC and TFC with diagram and (2) AC, AVC, AFC and MC with diagram to make it more clear and reduce errors.
- Students are not particular in using terms change in demand and change in quantity demanded. It results in deduction of marks.
- While explaining the effect of change in the price of related goods or change in the income of consumer students forget to differentiate them further in two goods i.e., (i) complementary goods and substitute goods and (ii) Normal goods and inferior goods.

13. Relationship between marginal revenue and average revenue is to be explained in general conditions only whereas students explain them in special cases where  $AR = MR$  or  $MR < AR$ .
14. While explaining producer equilibrium students use TR & TC terms to explain profit maximum and lose marks. Producer equilibrium is to be explained with MC & MR method.  
·Students should write that producer is getting profit in production of one additional unit.
15. Slope of demand curve and slope of supply curve is to be explained with the help of consumer equilibrium and producer equilibrium.
16. Features of market and implication of that feature are two different concepts. Students usually write features even when asked about implications.
17. In case of numerical especially in elasticity of demand and elasticity of supply students do not write formula, while there is mark of writing formula in marking scheme. So, students lose marks.
18. In statistics, students perform badly in theory, so students must pay attention to the theory part of statistics.
19. In problems related to graph i.e., Histogram bar diagram, ogive & Lorenz curve most of the students do not write all the components i.e., heading on X-axis, on Y-axis, origin, scale etc. properly.