

Paper 1: Fundamentals of Economics and Management (FEM)

FUNCTIONS OF MANAGEMENT

Henry Fayol's name comes first in those who classified the management functions. The functions of management as given by Henry Fayol are widely accepted in the management world. Newman and Summer gave the managerial functions as organising, planning, leading and measuring and controlling.



PLANNING FUNCTION OF MANAGEMENT

Planning is deciding in advance what is to be done, how is to be done and why is to be done and who will be responsible for doing it. "A plan is a kind of future picture wherein proximate events are outlined with some distinctness whilst remote events appear progressively less distinct."



In brief, planning is looking ahead and preparing for the future. In the words of Koontz and O'Donnel "Planning bridges the gap from where we are, to where we want to go. It makes it possible for things to occur which would not otherwise happen".



Elements of Planning

Any complete planning must provide for following elements:

- 1. Objectives:** These are goals which are established to guide the efforts of the organisation. Such goals are the ends towards which activity is aimed. Well defined objectives or goals have a number of advantage, including the following:
 - (a) Effective objectives encourage all members to work towards the same organisation objectives.
 - (b) Effective goals give objective yardsticks for measuring, comparing and evaluating performance.
 - (c) Effective objectives can also be good motivators because they make it easier for a member to relate the accomplishment of personal goals to work for the organisation.
- 2. Policies :** General statements that guide decision making are called policies. They are the guidelines for actions which help the subordinates to carry on their work in harmony with the overall goals of the Business.
- 3. Procedures :** Procedure is the starting of initiating actions in order to implement the policies.
- 4. Rules :** Rules are specific instructions of what may or may not be done. Generally breach of rules carries a penalty. "No smoking in the factory", is an example of a rule.
- 5. Strategy :** The term strategy was first used in military to describe the grand plan for winning a war. In recent times, the term has been applied in business firm and other than organisation.
- 6. Programmes :** It is a definite plan of works made in proper sequence and in conformity with the objectives, policies and procedures laid down. The programmes are supported by budget allocation.
- 7. Budgets :** It is a plan formulated for a definite period and in numerical terms. Budgets anticipate operating results over some future period of time and provide a basis for measuring performances.

Advantages of Planning

1. It implies rational thinking in advance. By thinking ahead, a manager can minimise the chances of making hasty decisions and haphazard activity.
2. With proper planning, co-ordination of activities can be effectively achieved.
3. It facilitates control as control function is very much dependent upon planning.
4. By planning, all business activities follow a definite pattern and direction, without any confusion or misunderstanding at any level.
5. Planning helps in proper utilisation of business resources and eliminates unproductive activities.
6. It helps to minimise the risks of uncertainty of future.



Limitation of Planning

1. It is based on forecasts and thus may not be fully reliable.
2. Changing business conditions may shatter the plans originally formulated and may require revision.
3. It is a costly process.
4. There may be a psychological barrier to planning because some managers are psychologically opposed to planning as they consider the present more important than the future.

ORGANISING FUNCTION OF MANAGEMENT

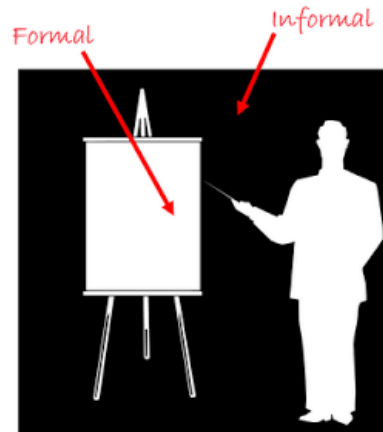
Organisation as a process: It is as used in the sense of a process is a function of management like other functions of planning, controlling etc. In the words of Louis A Allen "Organisation process of identifying and end grouping of the works to be performed, defining and delegating responsibility and authority and establishing relationship for the purpose of enabling people to work most effective together in accomplishing objectives."



Organisation as a structure: It refers to structure or relationship among position and jobs, which is built for the realisation of business objectives. This is also referred to as concept of organisation. Organisation structure is created to accomplish the objectives concerned planning. Such structure defines the relationship among various positions and job is known as formal organisation.

Formal and Informal Objectives: Formal organisation refers to the structure of jobs and positions with clearly defined functions relationship as designed by those who framed the organisation. The formal organisation is thus.

- (a) The position of formal relationships and duties.
- (b) Formal rules, work procedures and similar devices adopted by management to guide employee's behaviour in certain ways within framework of formal relationships.



Informal organisation, on the other hand, means the relationship between different individual not on the basis of formal superior-subordinate relationship but on the basis of persons likes, dislikes, attitudes and prejudice etc. It is in a way of natural grouping of people in the work situation. Infact, informal organisation is created because formal one is not complete in itself to attain organisational goals and objectives.

Principles of Organisation

1. **Unity of objectives:** The existence of formulated and understood objectives of enterprises.
2. **Efficiency:** The goals and objectives should be attained at the minimum cost.
3. **Specialisation:** An individual should be loaded with duties related to his abilities and specialised knowledge.
4. **Unity of command:** Each subordinate should have only one superior.
5. **Unity of direction:** Each group activities having same objectives must have one head and one plan.
6. **Span of control:** A manager should supervise only a limited number of subordinates.
7. **Chain of command:** The line of authority must be clearly defined.
8. **Co-ordination:** There should be build in procedures for co-ordination between the roles of various sections of enterprise.
9. **Authority and Responsibility:** Authority must be commensurate with responsibility.
10. **Exception principle:** The routine matters should be dealt with by executive at lower levels and only exceptionally complex problem referred to the higher levels of management.
11. **Balance:** The sequence of work should be arranged scientifically and various units of organisation should be kept in balance.

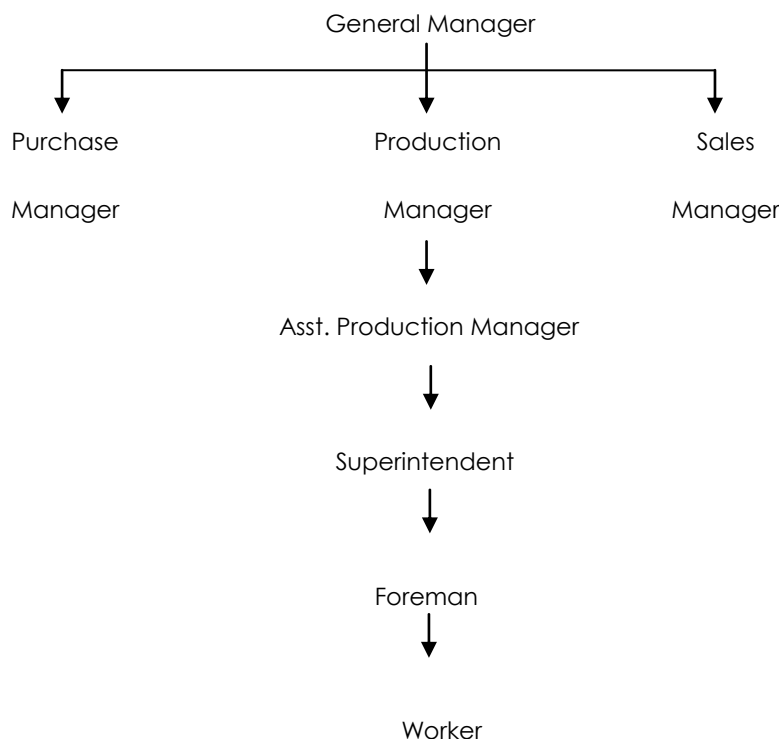


12. **Flexibility:** It should be in a position to adapt itself economically and easily to business and technical changes.
13. **Continuity:** In order to facilitate the enterprise as continuous and dynamic unit.

TYPES OF ORGANISATION

From the view point of nature of authority, organizations are of three types:

- I. **Line Organisation:** This is the simplest and oldest type of organisation. In this type, the lines of authority are vertical and persons on the same level of authority are independent of one another and are responsible only to the persons directly above them. Authority flows from the man at the top to the lowest man vertically.



Advantages of Line Organisation

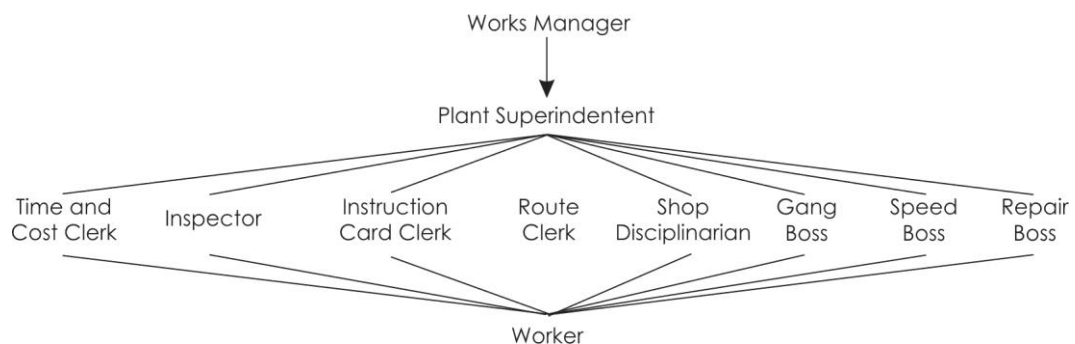
1. There is a clear division of authority and responsibility.
2. It encourages speedy action.
3. It brings about unity of control.
4. It is easy to establish.



Disadvantages of Line Organisation

1. It suffers from lack of specialised skill of experts.
2. Too much is expected of a person in authority as it overburdens key personnel.
3. It usually does not provide for communication from the lower ranks upwards.
4. There is a lot of scope for nepotism and favouritism.

II. Functional Organisation: In this, work is divided into many functions and a specialist placed in charge of each function. Each such specialist has complete control of the function in his charge, irrespective of where these functions are to be found in the organization.



The foremen to operate in planning room are:

1. **Time and cost clerk:** For preparing standard time and compiling the costs.
2. **Instruction card clerk:** Who issues instructions regarding the exact method of doing work.
3. **Route clerk:** Who lays down the exact route through which work should travel to completion.
4. **Shop disciplinarian:** Who is concerned with discipline and absenteeism of workers.

Advantages of Functional Organisation

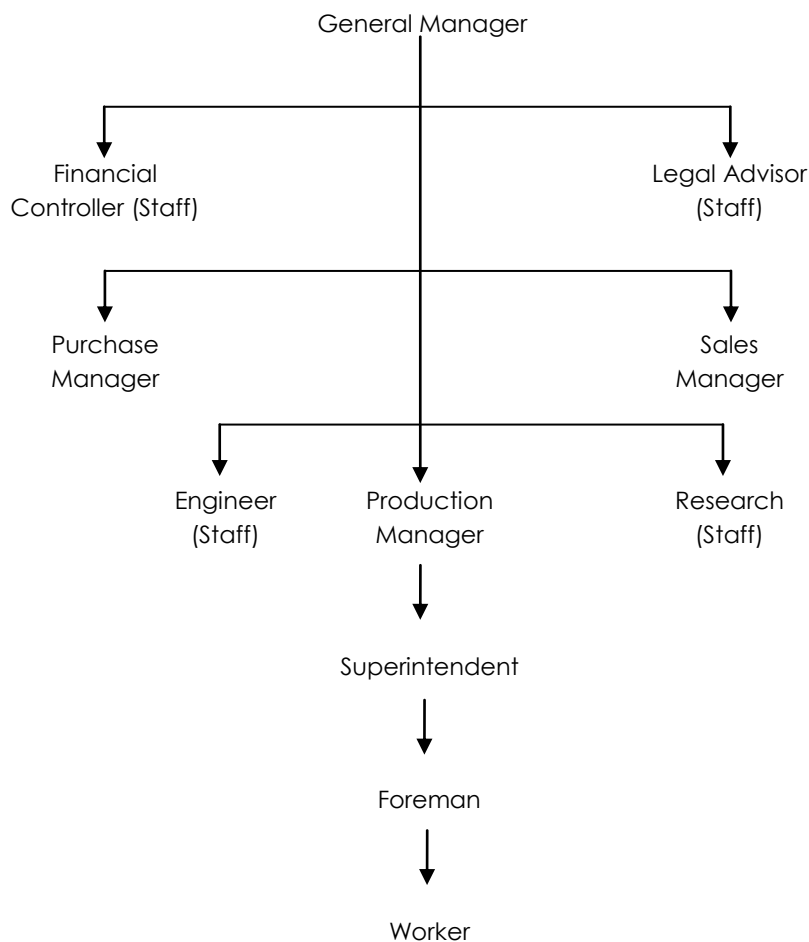
1. It promotes division of works and enables to concern to take advantage of specialisation.
1. It separates the mental and manual functions.
2. It helps mass production by standardisation and specialisation.
3. The disadvantage of one man control under the organisation is largely alleviated here.



Disadvantages of Functional Organisation

1. It is too complicated in operation as it entails the division of functions into a number of sub-functions.
2. There is practical difficulty of establishing a functional organisation.
3. The task of co-ordination especially at lower levels becomes difficult.
4. The clear cut lines of responsibility and authority are lost.

III. Staff and Line Organisation: This type of organisation is a combination of best points of line and function types of organisation. In this system, the authority flows in a vertical line from top to downwards, as in case of line organisation.





Advantages of Line and Staff Organisation:

1. Line and staff organisation provides the benefits of expert advice and guidance to the line managers in particular and the business as whole in general.
2. The stability and discipline of the line organisation are retained and expertise is added.

Disadvantages of Line and Staff Organisation:

1. A confusion may be created when line and staff relationship is not properly understood.
2. Executive has only advisory function and they lack authority to implement their advice.
3. As staff people have no responsibility, they may not take proper care before advising the line managers.

Paper 2: Fundamentals of Accounting (FOA)

Bank Reconciliation Statement

(A) Example on Two Bank Accounts:

Perfect Pvt. Ltd. has two accounts with Best Bank Ltd. The accounts were known as 'Account-I' and 'Account-II'. As at Dec. 31, 2013, the balance as per Cash books reflected the following:

Account-I ₹ 1,25,000 Debit balance.

Account-II ₹ 1,11,250 Debit balance.

The accountant failed to tally the balance with the Pass Book and the following information was available:

- (a) The Bank has credited Interest on Account-I ₹1,250, but not recorded by the accountant.
- (b) ₹12,500 drawn on Dec.10, 2013, from Account-I was recorded in the books of Account-II.
- (c) A deposit of ₹ 17,500 in Account-I was wrongly entered in Account-II in the books.
- (d) Cheques issued for ₹20,000 and ₹15,000 from Account-I and Account-II, respectively, were not presented until Jan. 5, 2014.



Solution:

Bank Reconciliation Statement for the year ended 31.12.2013

Account - I		
Particulars	Amount (₹)	Amount (₹)
Bank Balance as per Books of Account		1,25,000
Add: Interest earned but not recorded in Cash Book	1,250	
Deposit not entered in Cash Book	17,500	18,750
		1,43,750
Less: Withdrawals not entered in Cash Book	12,500	
Cheques issued but not present for payment	20,000	32,500
Bank Balance as per Pass Book		<u>1,11,250</u>

Account - II		
Particulars	Amount (₹)	Amount (₹)
Bank Balance as per Books of Account		1,11,250
Add: Withdrawals wrongly recorded	12,500	
Cheques issued but not presented	15,000	27,500
		1,38,750
Less: Deposits wrongly entered	17,500	17,500
Bank Balance as per Pass Book		<u>1,21,250</u>

(B) Example on Amendment Cash Book

D's Cash Book shows an overdrawn position of ₹3,630 on 31.3.2013, though the Bank Statement shows only ₹3,378 overdrawn. Detailed examination of two records revealed the following:

- (i) A cheque for ₹ 1,560 in favour of Rath Associates has been omitted by the Bank from its statement, thus, cheque having been debited to another customer's account.

Treatment

[It will be considered in the Bank Reconciliation Statement as it is not a mistake in either in the Cash Book or in the Pass Book]

- (ii) The debit side of Cash Book has been under cast by ₹ 300.



Treatment

This is required to be adjusted in Cash Book first and it should be written in the debit side of the Cash Book.

- (iii) A cheque for ₹ 182 drawn in payment of electricity amount had been entered in the Cash Book on ₹ 128 & was shown correctly in the Bank statement.

Treatment

Amount wrongly shown in the Cash Book (₹182 – ₹128) i.e. ₹54 should be shown in the credit side of Cash Book, as the amount was understated.

- (iv) A cheque for ₹ 210 from S. Gupta having been paid into Bank, was dishonoured & shown as such on Bank statement, although no entry relating to dishonoured had been made in Cash Book.

Treatment

It should be credited in the Cash Book first, as the cheque was dishonoured

- (v) The Bank had debited a cheque for ₹ 126 to D's A/c, in error. It should have been debited to Sukhal's A/c.

Treatment

It will be considered in the Bank Reconciliation Statement as it is not a mistake in either in the Cash Book or in the Pass Book

- (vi) A dividend of ₹ 90 on D's holding of equity shares has been duly shown by Bank, no entry has been made in Cash Book.

Treatment

The amount of dividend received will appear in the debit side of the Cash Books as it was not entered in the Cash Book

- (vii) A lodgment of ₹ 1,080 on 31.3.2013 had not been credited by Bank.

Treatment

It will be considered in the Bank Reconciliation Statement as it is not a mistake in either in the Cash Book or in the Pass Book

- (viii) Interest on ₹ 228 had been directly debited by Bank not recorded in Cash Book.

Treatment

Interest was directly debited by the Bank. It is required to be shown in the credit side of the Cash Book



Solution:

Dr. Cash Book (Bank Column only) Cr.

Date	Particulars	Amount (₹)	Date	Particulars	Amount (₹)
2013 March 31	To Dividend A/c. " Error (under casting in debited side) " Balance c/d.	90 300 3,732	2013 March 31	By Balance b/d. " Electric Charges A/c. Cheque drawn for [₹ 182 wrongly recorded as ₹ 128 (₹ 182 – ₹ 128)] " S. Gupta's A/c. Cheque dishonoured " Bank interest A/c	3,630 54 210 228
		4,122			4,122
				By Balance b/d	3,732

Reconciliation Statement	Amount (₹)	Amount (₹)
Overdraft as per Cash Book		3,732
Add: (i) A cheque for ₹ 126 wrongly debited by Bank.	126	
(ii) A lodgement not credited by Bank	<u>1,080</u>	<u>1,206</u>
		4,938
Less: (i) A cheque was issued in favour of Rath Associates not debited by Bank		<u>1,560</u>
Overdraft as per Pass Book.		<u>3,378</u>



Paper 3: Fundamentals of Laws and Ethics (FLE)

PERFORMANCE OF THE CONTRACT OF SALE

Performance of the contract of sales means due discharge of the contractual obligations by both the parties to the contract i.e. Buyer and Seller. The obligation of the seller is to deliver the goods in accordance with the terms of the contract as to time and place and obligation of the buyer is to accept the goods and pay the price agreed upon. As per section 31 performance of a contract of sale means as regards the seller, delivery of the goods to the buyer, and as regards the buyer, acceptance of the delivery of the goods and payment for them, in accordance with the terms of sale. Delivery of goods and payment for thereof are concurrent conditions, however the parties may agree otherwise also. In order to discharge the contractual obligations the seller must be ready and willing to deliver the goods. However, unless otherwise provided in the contract, seller cannot demand payment in advance of delivery. Refusal to deliver the goods unless agreed price is paid in advance is breach of contract. But the buyer is required to apply for delivery.



Performance of a contract involves two things timely delivery on the part of the seller and payment of the price as per the terms of contract by the buyer. Unless otherwise agreed, delivery of the goods and payment of the price are concurrent conditions, that is to say, the seller shall be ready and willing to give possession of the goods to the buyer in exchange for the price, and the buyer shall be ready and willing to pay the price in exchange for possession of the goods.



Deliverv of Goods

Actual Delivery

Where the seller hands over the goods to the buyer or his duly authorized agent, the delivery is treated as actual delivery. It may also be done by doing anything which has the effect of putting the goods in possession of the buyer.

Example: S agreed to sell 200 kg potato to T @ ₹15 per kg. S delivered the goods at the godown of T. This is a case of actual delivery.

Symbolic Delivery

When goods are bulky, it is usual for seller to make symbolic delivery.

Example, a symbolic delivery takes place when the seller hands over the key of godown where goods are kept to the buyer. This type of delivery has the same effect as that of an actual delivery even though there is no change in possession of the goods and the goods remain in the custody of seller until they are removed by the buyer.

Constructive Delivery

This is also called delivery by attornment. Where a third person who is in possession of the goods of the seller at the time of sale acknowledges to the buyer that he holds the goods on his behalf delivery by attornment or constructive delivery take place.

Example: S sold 10 qt of sugar to T lying in the Godown of U. S instruct U to transfer 10 qt of sugar to T. U acknowledge the instruction of S and transfers the goods in his books to T. This is delivery by attornment and has the same effect as that of actual delivery.

This rule of delivery by attornment is subject to the transfer of documents of title, because where, for example a bill of lading is transferred, the transferee is deemed to have got possession of the goods even when they are in the hands of a carrier who has not



Rules as to delivery of Goods:

Mode of Delivery	Explanation: The mode of delivery of goods is provided in section 33 which says that, delivery of goods sold may be made by doing anything which the parties agree shall be treated as delivery or which has the effect of putting the goods in the possession of the buyer or of any person authorised to hold them on his behalf. Delivery as contemplated in the Act may be actual, symbolic or constructive.
Delivery of goods and payment of price	<p>Explanation: Delivery of goods and payment of price are concurrent conditions unless otherwise agreed upon. In other words seller must be ready and willing to make delivery and buyer must also be willing to take delivery and willing and ready to pay the price (Sec 32).</p> <p>Example: A agrees and delivers his car to B and B in turn pays price for it.</p>
Effect of part delivery	<p>Explanation: As per section 34, a delivery of part of goods, in progress of the delivery of the whole has the same effect, for the purpose of passing the property in such goods, as a delivery of the whole, but a delivery of part of the goods, with an intention of severing it from the whole, does not operate as a delivery of the remainder.</p> <p>Example: A directed the wharfinger to deliver his goods lying at the wharf to B to whom these goods had been sold. B weighted the goods and took away a part of them. Held, the delivery of a part of the goods had taken place which has the effect as delivery of the whole. [Hammond v Anderson (1803) RR763]</p>
Buyer to apply for delivery	<p>Explanation: Apart from any express contract, the seller of goods is not bound to deliver them until the buyer applies for delivery. (Section 35) It may also happen that the goods are subsequently acquired by the seller, he is to intimate the buyer and the buyer then should apply for delivery. Buyer has no cause of action against the seller if he does not apply for delivery, unless otherwise agreed upon.</p> <p>Example: S agreed to sell his old car to T and T agreed to take delivery thereof on the auspicious day of Deepawali, S kept the car ready for delivery to T but T did not approach him for delivery. T has no reason to take any action against S if delivery of car did not take place on that day.</p>
Place of delivery	Explanation: As per section 36(1), Goods must be delivered at the place and time



	<p>specified in the contract. Whether it is for the buyer to take possession of the goods or for the seller to send them to the buyer is a question depending in each case on the contract, express or implied, between the parties. Apart from any such contract, goods sold are to be delivered at the place at which they are the time of the sale, and goods agreed to be sold are to be delivered at the place at which they are at the time of the agreement to sell, if not then in existence, at the place at which they are manufactured or produced.</p>
Time of delivery	<p>Explanation: Where under the contract of sale the seller is bound to send the goods to the buyer, but no time for sending them is fixed, the seller is bound to send them within a reasonable time. If demand or tender of delivery is not at reasonable time tender of delivery may be treated as ineffectual. What is a reasonable hour is a question of fact which has to be decided taking into consideration various factors. [Sec 36(2)]</p>
Goods in possession of a third person	<p>Explanation: Where the goods at the time of sale are in the possession of a third person, there is no delivery by seller to buyer unless and until such third person acknowledge to the buyer that he holds the goods on his behalf. [Sec 36(3)]</p>
	<p>Example: X sold 50 ton of rice to Y, the goods are lying in the godown of Z. X ask Y to take delivery from the godown of Z. Delivery shall not be treated as completed unless Z acknowledge to Y that he hold the goods on his behalf.</p>
Cost of delivery	<p>Explanation: Unless otherwise agreed, the expense of and incidental to putting the goods into a deliverable state are borne by the seller. [Sec 36(5)] All the expenses incurred for putting the goods into a deliverable state are to be borne by the seller. Similarly all the expenses relating to taking possession the goods must be borne the buyer.</p>
	<p>Example: S agrees to sell 50 ton of Basmati Rice to B at FOR Delhi. All the expenses for delivering the goods up to Delhi will be borne by S. Subsequent expenses from Delhi Railway station to office of B will be borne by B himself.</p>
Delivery of wrong quantity [Sec. 37]	<p>Explanation: (a) It is not necessary that the delivered quantity always confirm to the ordered quantity. If less than contracted quantity is supplied, the buyer may reject them, but if the buyer accepts the goods so delivered he shall pay for them at the contract rate. [Sec 37(1)]</p>



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	<p>Example: A sells to B 2000 gross of 200 yards reels of swing cotton. After taking delivery B finds that the length of the cotton per reel is less than 200 yds, the average being shortage of about 6%. B may reject the goods. If he waives the right of rejection, he is liable to pay the price of the goods at the contract price. [Beck etc v Synzmanoski(1924) AC43]</p> <p>Explanation: (b) Similarly if a quantity of goods larger than contracted to sell is delivered, the buyer may accept the goods included in the contract and reject the rest, or he may reject the whole. If the buyer accepts the whole of the goods so delivered, he shall pay for them at the contract rate. [Sec 37(2)]</p> <p>Explanation: (c) If the goods agreed to be supplied are delivered with goods mixed with goods of a different description not included in the contract, the buyer may accept the goods which are in accordance with the contract and reject the rest, or may reject the whole.[Sec 37(3)]</p> <p>Example: A buyer inspected certain timber and branded by hammer marks those which he accepted. When the timber arrived, it contained a large quantity of unbranded timber. Held, the buyer could reject the whole consignment. [London Plywood Ltd v Nasik Oak Ltd (1939)2KB343] The above provisions are subject to any usage of trade, special agreement or course of dealing between the parties.</p>
<p>Installment delivery [Sec. 38]</p>	<p>Explanation: Buyer is not bound to accept installment unless agreed by the parties. If the contract provide for installment delivery which are to be separately paid for, and the seller makes no delivery or defective delivery in respect of one or more installments, or the buyer neglects or refuses to take delivery of or pay for one or more installments, it is a question in each case depending on the terms of the contract and the circumstances of the case, whether the breach of contract is a repudiation of the whole contract, or whether it is a severable breach giving rise to a claim for compensation, but not a right to treat the whole contract as repudiated.</p> <p>Example: X brought from Y 25 tonnes of pepper Oct-Nov shipment. Y shipped 20 tonnes in November and 5 tonnes in December. Since the goods have not delivered as per the contractual provisions, X is not bound to accept installment delivery unless they had already agreed for it. X could reject the whole lot.[Renter v sala (1879)48LJ492]</p>



Delivery to carrier or wharfinger [Sec. 39]	<p>Explanation: If, in pursuance of a contract of sale, the goods are delivered to a carrier for transmission to the buyer or to a wharfinger for safe custody, delivery of goods to them is prima facie deemed to be delivery of goods to the buyer. In such a case the seller must enter into a reasonable contract with the carrier or wharfinger on behalf of the buyer for same transmission or custody of goods. Failure to do so coupled with loss of goods in transit, buyer may reject delivery to carrier/wharfinger as delivery to himself and may hold the seller responsible for such loss. Unless otherwise agreed, if goods are sent by the seller to the buyer by a route involving sea transit, in circumstances in which it is usual to insure, the seller is required to give such notice to the buyer as may enable him to insure them during their sea transit and if the seller fails so to do, the goods are deemed to be at his risk during such sea transit.</p>
Risk where goods are delivered at distant place	<p>Explanation: It is quite possible sometimes for the buyer ask the seller to deliver the goods at the place they were agreed to be delivered. If the seller agrees to deliver the goods at the risk of the buyer at place other than that where they are when sold, the buyer shall, nevertheless, unless otherwise agreed, buyer take any risk of deterioration in the goods necessarily incident to the course of transit.</p> <p>Example: S sold 50 ton of sugar to T, T requested him to deliver the same to him at his risk at China instead of Delhi. S agreed to deliver the same at China at the risk and cost of T. During transit 5 ton of sugar was lost due to transit leakage and another 5 ton got moisturized. The loss in transit and deterioration in quality will be borne by T instead of S.</p>
Buyer's right of examination of the goods	<p>Explanation: Section 41 gives the buyer right to examine the goods which are delivered to him which he has not previously examined. He is not deemed to have accepted them unless and until he has a reasonable opportunity of examining them for the purpose of ascertaining whether they are in conformity with the contract.</p>



Acceptance of Delivery: (Sec 42)

The buyer is deemed to have accepted the goods –

- (a) When he has intimated the seller that he has accepted the goods.
- (b) When the goods have been delivered to him and he does any action in relation to them which is inconsistent with ownership of the seller.

Delivery Acceptance



Liability of buyer for rejecting, neglecting or refusing delivery of goods.

- (a) Buyer not bound to return rejected goods (Sec 43). As per section 43 unless otherwise agreed, if the goods are delivered to the buyer and he refuses to accept them, he is not bound to return them to the seller. But at the same time he is to intimate the seller that he refuses to accept them. Quite possible the seller may also refuse to take back the delivery in such cases the buyer becomes bailee and his position is that of a bailee for which he can charge reasonable amount for keeping the goods.
- (b) As per section 44 failure of the buyer to take delivery of goods within a reasonable time of seller's request, the buyer becomes liable to the seller for any loss occasioned by his neglect or refusal to take delivery and also for a reasonable charge for the care and custody of the goods. This does not affect the rights of the seller where the neglect or refusal of the buyer to take delivery amounts to a repudiation of the contract.



Paper 4: Fundamentals of Business Mathematics and Statistics (FBMS)

QUARTILE DEVIATION

It is based on the lower quartile Q_1 and the upper quartile Q_3 . The difference $Q_3 - Q_1$ is called the inter quartile range. The difference $Q_3 - Q_1$ divided by 2 is called semi-inter-quartile range or the quartile deviation. Thus

$$Q.D = \frac{Q_3 - Q_1}{2}$$

The quartile deviation is a slightly better measure of absolute dispersion than the range. But it ignores the observation on the tails. If we take different samples from a population and calculate their quartile deviations, their values are quite likely to be sufficiently different. This is called sampling fluctuation. It is not a popular measure of dispersion. The quartile deviation calculated from the sample data does not help us to draw any conclusion (inference) about the quartile deviation in the population.

Coefficient of Quartile Deviation:

A relative measure of dispersion based on the quartile deviation is called the coefficient of quartile deviation. It is defined as Coefficient of Quartile Deviation.

$$\text{Coefficient of Quartile Deviation} = \frac{\frac{Q_3 - Q_1}{2}}{\frac{Q_3 + Q_1}{2}} = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

It is pure number free of any units of measurement. It can be used for comparing the dispersion in two or more than two sets of data.

Example:

The wheat production (in Kg) of 20 acres is given as: 1120, 1240, 1320, 1040, 1080, 1200, 1440, 1360, 1680, 1730, 1785, 1342, 1960, 1880, 1755, 1720, 1600, 1470, 1750, and 1885. Find the quartile deviation and coefficient of quartile deviation.

Solution:

After arranging the observations in ascending order, we get



1040, 1080, 1120, 1200, 1240, 1320, 1342, 1360, 1440, 1470, 1600, 1680, 1720, 1730, 1750, 1755, 1785, 1880, 1885, 1960.

$$Q_1 = \text{Value of } \left(\frac{n+1}{4}\right)\text{th item}$$

$$= \text{Value of } \left(\frac{20+1}{4}\right)\text{th item}$$

$$= \text{Value of } (5.25)\text{th item}$$

$$= 5\text{th item} + 0.25(6\text{th item} - 5\text{th item}) = 1240 + 0.25(1320 - 1240)$$

$$Q_1 = 1240 + 20 = 1260$$

$$Q_3 = \text{Value of } \frac{3(n+1)}{4}\text{th item}$$

$$= \text{Value of } \frac{3(20+1)}{4}\text{th item}$$

$$= \text{Value of } (15.75)\text{th item}$$

$$= 15\text{th item} + 0.75 (16\text{th item} - 15\text{th item}) = 1750 + 0.75(1755 - 1750)$$

$$Q_3 = 1750 + 3.75 = 1753.75$$

$$Q.D = \frac{Q_3 - Q_1}{2} = \frac{1753.75 - 1260}{2} = \frac{493.75}{2} = 246.875$$

Example:

Calculate the quartile deviation and coefficient of quartile deviation from the data given below:

Maximum Load (short-tons)	Number of Cables
9.3-9.7	2
9.8-10.2	5
10.3-10.7	12
10.8-11.2	17
11.3-11.7	14



11.8–12.2	6
12.3–12.7	3
12.8–13.2	1

Solution:

The necessary calculations are given below:

Maximum Load (short-tons)	Number of Cables (f)	Class Boundaries	Cumulative Frequencies
9.3–9.7	2	9.25–9.75	2
9.8–10.2	5	9.75–10.25	2+3=7
10.3–10.7	12	10.25–10.75	7+12=19
10.8–11.2	17	10.75–11.25	19+17=36
11.3–11.7	14	11.25–11.75	36+14=50
11.8–12.2	6	11.75–12.25	50+6=56
12.3–12.7	3	12.25–12.75	56+3=59
12.8–13.2	1	12.75–13.25	59+1=60

$$Q1 = \text{Value of } \left(\frac{n}{4}\right)\text{th item} = \text{Value of } \left(\frac{60}{4}\right)\text{th item} = 15\text{th item}$$

Q1 lies in the class 10.25–10.75

$$\therefore Q1 = l + \frac{h}{f} \left(\frac{n}{4} - c \right)$$

Where $l = 10.25$, $h = 0.5$, $f = 12$, $n/4 = 15$ and $c = 7$

$$\therefore Q1 = 10.25 + \frac{0.5}{12} (15 - 7) = 10.25 + 0.33 = 10.58$$



$$Q_3 = \text{Value of } \left(\frac{3n}{4}\right) \text{th item} = \text{Value of } (3 \times 604) \text{th item} = 45 \text{th item}$$

Q_3 lies in the class 11.25–11.75

$$\therefore Q_3 = l + \frac{h}{f} \left(\frac{3n}{4} - c \right)$$

Where $l = 11.25$, $h = 0.5$, $f = 14$, $3n/4 = 45$ and $c = 36$

$$\therefore Q_1 = 11.25 + \frac{0.5}{14} (45 - 36) = 11.25 + 0.32 = 11.57$$

$$Q.D = \frac{Q_3 - Q_1}{2} = \frac{11.57 - 10.58}{2} = \frac{0.99}{2} = 0.495$$

$$\text{Coefficient of Quartile Deviation} = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{11.57 - 10.58}{11.57 + 10.58}$$

$$\text{Coefficient of Quartile Deviation} = \frac{0.99}{22.15} = 0.045$$