



**PERIYAR INSTITUTE OF DISTANCE EDUCATION
(PRIDE)**

**PERIYAR UNIVERSITY
SALEM - 636 011.**

**BACHELOR OF BUSINESS ADMINISTRATION (B.B.A)
SECOND YEAR
PAPER – V : PRODUCTION AND MATERIALS MANAGEMENT**

Prepared by :

A. DUNSTAN RAJKUMAR

Head Dept. of B.B.A.

M.G.R. College

Hosur - 635 109.

BACHELOR OF BUSINESS ADMINISTRATION (B.B.A)
SECOND YEAR
PAPER – V : PRODUCTION AND MATERIALS MANAGEMENT

INTRODUCTION

Dear Students,

PRIDE appreciates you for having joined into BBA (Bachelor of Business Administration) degree course.

The study material of Production and Material Management is configured into five units.

I would be pleased if you learn and enrich your knowledge and skills to serve the society.

With best wishes and regards.

UNIT - I

PRODUCTION AND MATERIAL MANAGEMENT

PRODUCTION MANAGEMENT:

Meaning:

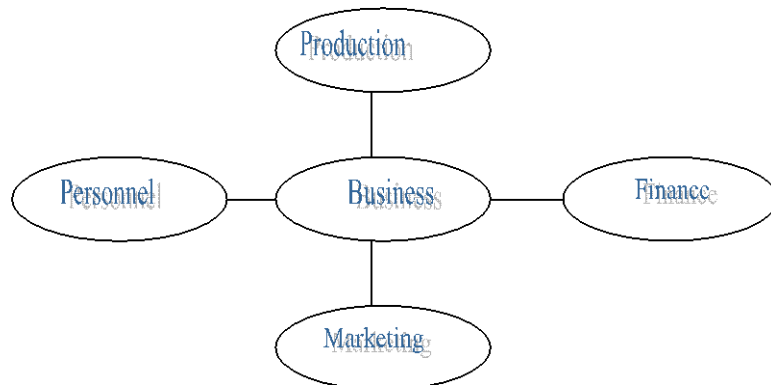
Production management is concerned with the conversion of input into output. Production management plans and regulates the operations so as to transform the inputs into output.

Definition:

According to ELWOOD BUFFA "Production management deals with decisions related to production process so that resulting goods or services are produced according to specifications in amount and by the schedules demanded and at a minimum cost.

Importance of production functions:

- It is one of the functions of business.
- Basic function around which other activities revolve.



- Involves plant location to packing of goods.
- Selection of plant layout and plant site.
- Involves production planning and control (PPC).
- Developing new products through Research and Development (R & D).

Scope/Areas of Production Management:

Scope of Production management is wider because of the increased level of production and the stiff competition. Scope can be studied in two broad areas,

- Designing or formulating production system.
- Analysing and controlling of Production Operation.

Activities relating to production system designing:

This activity concerns the production of tools and jigs, the design, development and installation of equipment and the selection and optimization of the size of the firm.

The selection of plant location, plant layout, and material handling system is the functions of production engineering. Besides, the human factor problems and research and development are also considered.

Activities relating to analysis and control of production:

The main activities related to the analysis and control of production system is production planning and control.

The areas of production management,

- | | |
|--------------------------------------|------------------------|
| i) Plant location | vi) Purchasing |
| ii) Plant layout | vii) Store management |
| iii) Production Planning and Control | viii) Work environment |
| iv) Plant maintenance. | ix) Quality Control |
| v) Work study | |

PLANT LOCATION:

- ❖ Plant is a place where men, materials, money, machinery etc., are brought together for manufacturing products.
- ❖ Location means selection of right place.
- ❖ Plant location means the process of selecting the right place for manufacturing the goods.
- ❖ Object is to select the place where economics of all kinds of production are available and to reduce the cost.

Factors influencing Industry or plant location:

(A) Selection of religion	(B) Selection of community	(C) Selection of site	(D) Optimum selection of site
i) Availability of raw materials ii) Nearness to market iii) Availability of power iv) Transport facilities v) Suitability of climate vi) Government policy vii) Competition among states	i) Availability of labour ii) Civic amenities for workers ii) Existance of complementary and competing industries. iv) Finance and research facilities v) Availability of water and fire fighting facilities vi) Local taxes and restrictions vii) Momentum of an early start viii) Personal factors	i) Soil, Size and topography ii) Disposal of Waste	Optimum site is selected on the basis of a comparative economic survey of the alternative sites in question.

Factors relating to buying:

i) Nearness to raw materials:

The cost of obtaining raw materials is an influencing factor on location. The importance of nearness to raw materials varies greatly with the nature of the business. Two sub-division of this factor are to be considered in this regard. One is the assurance of a constant and immediate supply, without dependence on transport or weather conditions. The other is the fact that the cost of transporting bulky raw materials from a long distance may add so much to the cost of production as to make the business and profitable.

ii) Accessibility to raw materials:

The Presents in abundance of any material is not sufficient in itself for finalizing the location. The location must also be easily accessible. The climate

should be moderate and adequate transport facilities should be available. The workers who are engaged in getting the raw material should have sufficient supplies of food and water.

Factors related to manufacturing:

i) Availability of labour:

Labour supply refers to the number of skilled and unskilled persons who are available for the kind of work to be done. Labour supply is perhaps the most important of all the factors, especially the supply of skilled labour.

ii) Nearness to the source of power:

The sources of energy for turning the wheels of industry have a decisive influence in plant location and the development of industrial centers.

iii) Availability of services:

Services include,

a) gas, b) electricity, c) water, d) drainage, e) disposal of waste, f) Communications. Certain industries use considerable quantity of water, eg., Industries of food preparation, laundry, chemical and metal plating, etc. Others use a great deal of electricity, for example, steel and smelting processes. Under estimating the needs of any of the services can prove to be extremely costly. Financial services often require rapid communications through out the world. Hence, major banks are often located in well developed cities with excellent communication networks.

iv) Ready accessibility to repair shop:

This factor is important mainly in the case of small-scale industries with plenty of orders on hand and a breakdown of its machinery will incur loss in business and bring down its image. Hence, repairs have to be carried out immediately and work completed at the stipulated time. In a large firm, repairs may be carried out in the factory itself.

v) Availability of amenities:

A location which provides good external amenities-housing, shops, community services, communication systems-is often more attractive than one which is more remote. One important amenity in this connection is the good personnel transport-buses and trains, etc., and some companies consider factor this so vital that they provide their own transport facilities.

vi) Transport and communication:

Of the economic factors governing plant location, transport costs are very important. It is possible to obtain raw materials and market finished goods only with the help of an effective transport network. In the choice of a site, great

attention must be given to the availability and frequency of rail, water, road, and air transport services. The term transport implies also the existence of storage, handling and service facilities and industries are attached to those localities where these are readily available at reasonable cost.

vii) Safety requirements:

Some production units may present, or may be believed to present potential dangers to the surroundings neighborhood; for example, nuclear power station, chemical and explosives factories are often considered dangerous. Locations of such plants in remote areas are desirable.

viii) Adequate fire fighting facilities:

Fire may originate from within or outside the plant. Internal fire can be controlled with fire fighting appliances but it is difficult to control agencies causing fire from outside. A site with adequate fire fighting facilities is, therefore, desirable.

ix) Availability of educated personnel and research facilities:

New industries as well as the development and expansion of those already established hinge on research and investigation to develop products and improve methods. More over, the profitable operation of industry is dependent on a constant supply of educated and trained personnel. To provide both, existence of educational institutions and research agencies is essential.

x) Ability to build and expand plant capacity:

A plant has to be built in such a way that the manufacturing processes are carried on with minimum expenditure of time and material. Also, there must be ample scope for addition or re-arrangement. Availability of low cost land is most desirable for putting up a factory.

xi) Political stability:

A government influences the development of industry by providing political stability and also subsidies. Lack of political stability stands in the way of establishment of new factories or drive away those already established.

xii) Suitable soil, climate and topography:

Soil and climate have direct bearing upon the type of activity that can be undertaken in any area in its early development. Climate has a great influence on the industrial activity. A cool invigorating climate develops the best type of industrial workers. Inhabitances of very hot climate are less efficient as industrial workers. Topography also exercises an important influence on location.

xiii) Association with other industries:

Some manufacturers select locations which are near complementary or subsidiary industries. From the plant location standpoint, this tends to encourage the centralization of industry. On the other hand, competition between establishments may in many cases act as encouragement for decentralization. **Industries tend to thrive best in groups for the following reasons:**

- a) A number of similar organizations in a locality can usually help secure materials at competitive prices.
- b) A group of organizations can collectively generate so much demand that will help a variety of repair shops such as foundries, tool-making, machine-shop, etc., being setup near by.
- c) A group of similar or related manufacturers established in one location serves to perfect their local market. The reputation of each firm supplements to other until the name of the town becomes almost a trademark for a particular product, etc., and enjoys considerable goodwill from the mere fact of location in the noted place.
- d) A large specialized manufacturing centre, is able to afford various commercial service industries such as, bankers insurers, packers, forwarders, professional graders and appraisers, advertising agencies, public ware houses, etc.

Factors related to selling:

i) Nearness and accessibility to market:

The advantages of being near to a market are numerous. A manufacturer can ensure quick and uninterrupted supply of his/her products at all times.

ii) Characteristic of people:

All Manufactures exist to supply markets with goods which people buy. The market which a community affords for the consumption goods can be sold only when the living habits of the people are such that they can be persuaded by including these products in their pattern of living.

iii) Special grants, regional taxes and import/export barriers:

Certain government and local authorities often offer special grants, low-interest loans for setting up industries in particular locations.

Specific site location:

- ❖ Country-Rural-Village
- ❖ City-Town-Urban
- ❖ Semi-Urban/Sub-Urban

Country Location:

Advantages:

- ❖ Land is cheap
- ❖ Unskilled labour is available and they can be trained to suit the requirement of the concern.
- ❖ Employee and employer relation are good.
- ❖ No Union problem will arise
- ❖ Undesirable competitors are not likely to be present.
- ❖ Municipal and other regulation and taxes etc., are set down burdensome.
- ❖ Government activities are more

Disadvantages:

- ❖ Skilled labours are not available.
- ❖ Rail, Road and Air links may not be there at all.
- ❖ Power is not available.
- ❖ Infrastructure facilities are inadequate.
- ❖ High grade executives may not like to live in rural areas.

City-Urban:

Condition Suggesting the Urban location:

- ❖ Large skilled Labour force required.
- ❖ Process near by dependent upon availability of city utilities.
- ❖ Multi-storey building desirable.
- ❖ Close center with suppliers demanded.
- ❖ Good infrastructural facilities required.
- ❖ Technical and research requirement.

Advantages:

- ❖ A city is very well connected by rail and air.
- ❖ It provides a good market.
- ❖ Right labour force is available.
- ❖ Power is easily available.
- ❖ It has good infrastructural facilities like hospital, bank, transportation, post office etc.
- ❖ Good provision of established building available.

- ❖ For Workers training classes and many other educational facilities are found.
- ❖ Services of experts and specialist are available.
- ❖ Many other small ancillary industries are available.
- ❖ Security is there in city.

Disadvantages:

- ❖ Land is limited in area.
- ❖ Cost of land and building construction is high.
- ❖ Expansion is seldom available.
- ❖ Local taxes etc., are high.
- ❖ Union Problems are more.

Sub-Urban areas/Semi urban:

The advantages of both urban and rural results in sub-urban area. The non-availability of work force can be offset by locating a plant.

Advantages:

- ❖ Land is available at a cheaper rate as compared to urban areas.
- ❖ Adequate land is available for future expansion unit.
- ❖ Infrastructure facility like road, water supply, drainage, banking, warehousing, insurance etc., are developed either by government, municipal authority or industrial associations.
- ❖ As the city area is nearer both skilled and unskilled, labour are available.
- ❖ It is possible to make use of the advantages of industrial training institutes, management development program, Research institutes, etc., which are available in near by city area.
- ❖ The near by city area provides a substantial market for the products of the unit.
- ❖ Educational institutions, medical facilities are available in the sub-urban area itself as well as in the near by city area.

Disadvantages:

The limitation of sub-urban area as a site for industry is that in the development process it may be converted into a part of the urban area with all its merits and demerits. In general, the big city offers particular benefits to the small enterprise, rural areas offer benefits to a large manufacturing firms and sub-urban areas often suit to medium sized industries.

Weber's theory of industrial location:

Alfred Weber, a German economist attempted for the first time to analyze the problem of industrial location. Weber classified factors of location into;

- i) Primary or direct or regional factors and
- ii) Secondary or indirect factors.

i) Primary or direct or regional factors:

To point out the important regional factors, Weber enumerated the elements of the cost as follows;

- a) The cost of land.
- b) The cost of building, Machines and other fixed asserts.
- c) The cost of securing materials, power and fuel.
- d) The cost of labour.
- e) The cost of transportation.
- f) The interest rates and
- g) The rate of depreciation on fixed capital.

This theory is based on the two regional factors, a) Transportation and
b) Labour cost

Transportation cost:

Transportation costs are incurred twice-First, when raw materials are imported and secondly, when a company sends out manufactured goods to the market for sale. They are also affected by two factors i.e., the distance to be covered and the weight to be transported. For this purpose Weber classified raw material into two broad categories.

- a) Localized raw materials and
- b) Ubiquitous i.e., materials available everywhere.

Ubiquitous does not affect the location of the plant.

Localized raw materials have further been classified as Pure raw material and gross raw materials.

Pure raw materials does not lose weight during the process of manufacturing, whereas, **Gross raw material** lose weight during the manufacturing process.

If gross raw materials are used in an industry, it will choose the location near the source of raw materials and if it is uses pure raw materials, it will be naturally be set up near the market. It has been explained by Weber through the following formula:

$$\text{Material index} = \frac{\text{Weight of the localized materials}}{\text{Weight of the finished product}}$$

Labour cost:

The second primary factor is the cost of labour. He assumed certain fixed labour centres. If an industry is labour intensive, It will be attached to labour centers, otherwise transportation costs will decide the ultimate location.

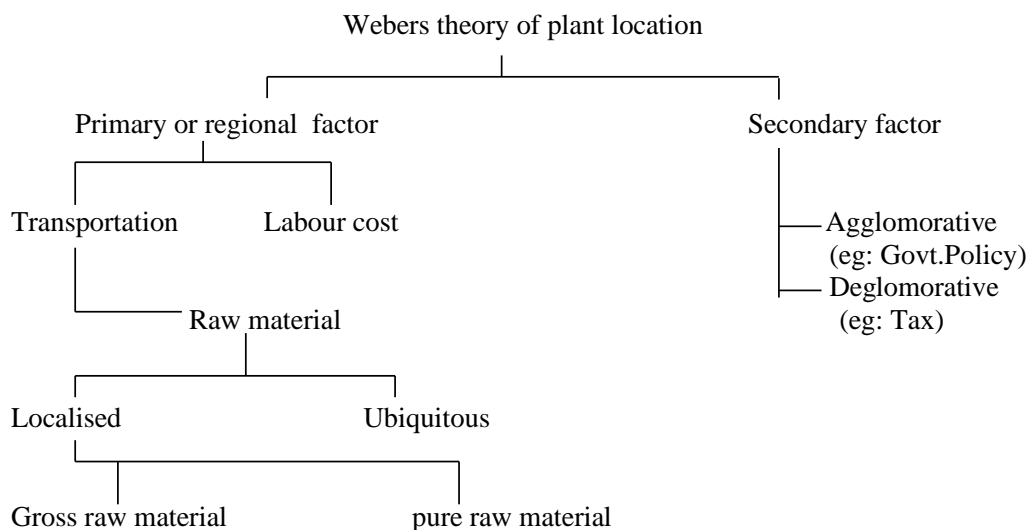
ii) Secondary factors or Agglomerative and Deglomerative factors:

The other factors are Agglomerative and Deglomerative. Agglomeration refers to concentration while deglomeration refers to decentralization. Certain factors encourage the concentration of industrial units while certain others discourage such tendency of concentration.

Assumptions:

Weber made the following assumptions,

- ❖ There are fixed centers of consumption
- ❖ The cost of raw material is same at all places even though there is uneven distribution of deposits of raw materials.
- ❖ Centre of labour supplies are fixed and they have unlimited supplies of labour at constant cost.
- ❖ Transport costs are mainly influenced by weight of material and distance only.



PLANT LAYOUT:

Plant layout means arranging equipment, machinery most effectively to facilitate production.

Object is to minimize the movements of both materials and men and to reduce the cost.

Principles and criteria of plant layout:

The objective of an enterprise is to maximize the production and minimize the cost. The process of plant layout may be said to be an effective one in so far as to help minimize movement of machine and personnel, facilities the manufacturing process and reduces the cost of production. However the following criteria should be satisfied for an effective plant layout.

i) Maximum flexibility:

A good layout will be one which can be modified to meet the changing circumstances. It must be capable of incorporating without major changes, new equipment to meet technological requirements or to eliminate waste.

ii) Maximum Co-ordination:

Layout must be considered as a whole and not in parts. It must be the master blue-print for co-coordinating all operations.

iii) Maximum use of volume:

Maximum use of volume available should be made. For example, converters can be run above the height of personnel at work and tools and equipment can be suspended from the ceiling. This principle is particularly true in stores where goods can be stocked at considerable height without any inconvenience.

iv) Maximum visibility:

The position of workers should be so arranged that there is no difficulty in supervision, coordination and control. There should not be any 'hiding places' into which goods can be mislaid. Raw materials and finished goods must be visible at all times, which will help in reducing pilferage.

v) Maximum accessibility:

All servicing and maintenance points should be readily accessible without causing any hindrance to the production process. There must be sufficient space between different machines. Machines and workers should move easily and comfortably from one place to another.

vi) Minimum (distance) movement:

The layout should be so planned that there must be least movement of goods and workers. Movements which act to the cost of the product without adding to its value should be avoided.

vii) Minimum discomfort:

The layout must be designed in such a manner that may cause minimum discomfort to the working force. Poor lighting, excessive sun light, heat, noise, vibration and bad order should be avoided or minimized. The statutory requirement of the Factories Act 1948, Should be faithfully followed.

viii) Minimum handling:

The best handling is no handling but however, it should be reduced to a minimum by the use of conveyers, lifts, chutes, hoists and trucks. Materials being worked on should be kept at working-height.

ix) Safety aspects:

A layout should be free from causing any danger to machine operators working on the machines. Care must also be taken for the safety of passers-by. Adequate precaution against fire, moisture, theft and general deterioration should be taken in the original layout.

x) Efficient process flow:

Work flow and transport flow should not cross. Every effort must be made to ensure that material flows in one direction only and a layout which does not confirm to this will experience considerable difficulties. The use of gravitational force in certain type of processing can lead to substantial great savings in energy and time.

xi) Identification:

Wherever possible, working group should be provided with their 'own' working space. The need for a defined 'territory' i.e., provision of a space with which a person can identify himself/herself enhances one's morale.

Check your Progress:

Fill Ups

1. Production management is concern with the conversion of _____
2. _____ Means the process of selecting the right place for manufacturing the goods.
3. The advantages of both urban and rural results in _____
4. _____ does not lose weight during the process of manufacturing.
5. _____ loses weight during the manufacturing process.

Points to remember

1. Scope can be studied in two broad areas,
 - Designing or formulating production system.
 - Analysing and controlling of Production Operation.
2. Weber classified raw material into two broad categories.
 - Localized raw materials and
 - Ubiquitous i.e., materials available everywhere.
3. Transportation costs are incurred twice-First, when raw materials are imported and secondly, when a company sends out manufactured goods to the market for sale.
4. Agglomeration refers to concentration while deglomeration refers to decentralization.
5. The objective of an enterprise is to maximize the production and minimize the cost.

Model Questions

1. Discuss the scope of Production Management?

Scope of Production management is wider because of the increased level of production and the stiff competition. Scope can be studied in two broad areas,

- Designing or formulating production system.
- Analyzing and controlling of Production Operation.

Activities relating to production system designing:

This activity concerns the production of tools and jigs, the design, development and installation of equipment and the selection and optimization of the size of the firm.

The selection of plant location, plant layout, and material handling system is the functions of production engineering. Besides, the human factor problems and research and development are also considered.

Activities relating to analysis and control of production:

The main activities related to the analysis and control of production system is production planning and control.

2. Define Plant Location and the functions related to buying?

Plant Location:

- ❖ Plant is a place where men, materials, money, machinery etc., are brought together for manufacturing products.
- ❖ Location means selection of right place.

- ❖ Plant location means the process of selecting the right place for manufacturing the goods.
- ❖ Object is to select the place where economics of all kinds of production are available and to reduce the cost.

Factors relating to buying:

i) Nearness to raw materials:

The cost of obtaining raw materials is an influencing factor on location. The importance of nearness to raw materials varies greatly with the nature of the business. Two sub-division of this factor are to be considered in this regard. One is the assurance of a constant and immediate supply, without dependence on transport or weather conditions. The other is the fact that the cost of transporting bulky raw materials from a long distance may add so much to the cost of production as to make the business unprofitable.

ii) Accessibility to raw materials:

The presence in abundance of any material is not sufficient in itself for finalizing the location. The location must also be easily accessible. The climate should be moderate and adequate transport facilities should be available. The workers who are engaged in getting the raw material should have sufficient supplies of food and water.

3. State the Specific Site Location and the advantages and disadvantages of City-Urban?

Specific site location:

- ❖ Country-Rural-Village
- ❖ City-Town-Urban
- ❖ Semi-Urban/Sub-Urban

City-Urban:

Advantages:

- ❖ A city is very well connected by rail and air.
- ❖ It provides a good market.
- ❖ Right labour force is available.
- ❖ Power is easily available.
- ❖ It has good infrastructural facilities like hospital, bank, transportation, post office etc.
- ❖ Good provision of established building available.
- ❖ For Workers training classes and many other educational facilities are found.

- ❖ Services of experts and specialist are available.
- ❖ Many other small ancillary industries are available.
- ❖ Security is there in city.

Disadvantages:

- ❖ Land is limited in area.
- ❖ Cost of land and building construction is high.
- ❖ Expansion is seldom available.
- ❖ Local taxes etc., are high.
- ❖ Union Problems are more.

4. What is plant layout?

Plant layout means arranging equipment, machinery most effectively to facilitate production.

Object is to minimize the movements of both materials and men and to reduce the cost.

Answer for fill ups

1. input into output
2. Plant location
3. sub-urban area
4. A pure raw material
5. Gross raw material

TYPES OF PLANT LAYOUT:

There are three basic types of plant layout:

- Product or line layout.
- Functional or process layout.
- Stationary layout.
- Combined or mixed layouts (Group technology).

Product or line layout:

Product or line layout is the arrangement of machine and equipment in a line (not necessarily straight) or a sequence in which they would be used in the process of manufacture of the product or group of related products. In this layout, materials are worked out into finished stock through a series of integrated operation (operated one after the other in a sequence) that is arranged in a line. The machines under this plan may be arranged either in 'U shape or in shape of a line'.

Suitability:

This layout is best suited to manufacturing carrying out continuous mass production where raw materials are fed at one end and the finished products are taken out at the other end. There may be a separate product line for each type of product using different types of machines or using machines of the same type.

Advantages of product or line layout:

The advantages of product layout may be summarized as follows:

a) Smooth flow of production:

This plan ensures steady flow of production with economy because bottlenecks or stoppage of work at different points of production is eliminated or avoided due to proper arrangement of machines in sequence.

b) Mechanization of material handling:

Since machines are arranged in sequence of operations, the continuous flow of materials in a line through mechanical devices like conveyers ensured. In this way, materials can move quickly and economically.

c) Economy in manufacturing time:

Since material is fed at one end of the machine and the finished product is collected at the other end, there is no transportation of raw material backward or forward. It shortens the manufacturing time because it does not require any time consuming internal transportation till the completion of the process of production.

d) Saving in material handling costs:

Under this type of layout, since machines are arranged in sequence of operations, materials move from one machine to another automatically and hence no transportation costs for movement of materials are involved till the process of manufacture is completed. In this way, there is saving in the costs of material handling.

e) Lesser work-in-Progress:

The work-in-progress is minimum and negligible under this type of layout because the process of production is directed and uninterrupted.

f) Easy inspection:

Because the production process is integrated and continuous, defective practice can easily be detected and segregated. This makes the job of inspection easy and economical.

g) Introduction of production control:

The continuous nature of production enables the management to introduce and enforce production control. Production control refers to the

planning of operations and the adoption of measures to complete the work according to the prepared plans.

h) Maximum utilization of available space:

Under this type of layout, machines are arranged in sequence of operation and it makes the maximum utilization of space available. It may be adopted even in a congested space by arranging the machines in 'U-Shape'.

i) Effective utilization of available resources:

This type of layout provides for effective utilization of men, machines and materials because of

- Minimum possible movement of workers from one place to another.
- Lesser waste age of materials.
- Lesser work-in-progress and mechanizations of material handling.

j) Production control greatly simplified:

Visual controls replace much of paper work because of which fewer forms and records are used. As the work is checked on and off the production line, fewer work orders, inspection tickets, time tickets are issued, reducing clerical costs.

Disadvantages of product or line layout:

The product or line layout, suffers from the following drawbacks:

a) Expensive:

This type of layout is costly because machines under this system are arranged in sequence of operations and not according to functions. It results in duplication of similar type of machines needed for different line of production. For example, welding or, lathe machines may be fixed for each line of production separately. In this way, it is more expensive in terms of equipment.

b) Inflexible:

This system is quite inflexible as the operations are performed in sequence, adjustment in the course of production cannot be made without much difficulty.

c) Difficulty in supervision:

Since there are no separate department for various types of work, specialization in supervision is also difficult.

d) Difficulty in expansion:

Under this type of layout, it is usually not possible to expand the production beyond the capacity of each line of production.

e) Stoppage of work through break down:

Any break down in any of the machines along the line can disrupt the entire operations.

f) High labour cost:

Under this system, labour cost is high as:

- Absenteeism may create problems because every worker is a specialist of his/her own work or specializes on a particular machine. In order to avoid bottlenecks, surplus workers (who are generalists and who can be fitted on a number of machines) will have to be employed.
- By performing activities of repetitive nature along assembly line, monotony sets in and workers feel bored.
- As machines play a dominant role in production under the system, individual incentive to work is lacking. Workers have no opportunity to demonstrate their talent and
- Noise, vibrations, temperature, moisture, gas, etc., may cause health hazards.

Functional or process layout:

This system is based on the functions performed by a department. Under this system of layout, machines or equipment of the same functions are grouped together in a separate department. In other words, separate department is established for each specialized operation of production and machines relating to such functions are assembled there. The specialized department works for all the lines of production. For example, welding equipment may be placed in one place, i.e., welding department will perform welding operations for the benefit of all the lines of production.

Advantages of process layout:

a) Flexibility:

The process layout is known for its flexibility. Changes in operations as well as their order can be made at any time without disturbing the existing layout any new operation can be added by adding simply a new department.

b) Scope for expansion:

The capacities of different lines can be expanded under this type of layout by adding new machines and labour.

c) Maximum utilization of resources:

Process layout necessitates fuller utilization of machines and equipment because generally purpose machines are used commonly for all departments. Duplication of machines is thus avoided as far as possible.

d) Lower financial investment:

This type of layout requires lesser financial investment in machines and equipment because the general purpose machines, which are usually of low costs, are used. This results in lower investment in machines.

e) Better working conditions:

Process layout facilitates installation of machines and equipment in different areas without any dependence on other operation sequences. The layout makes it easy to isolate machinery that produce excessive noise, vibration, fumes and heat; thereby ensuring healthy working conditions in the work place.

f) High output rate:

Process layouts are less vulnerable to break down. Machine break down in a process layout holds up production only on that particular machine and the whole process does not come to a standstill. It is easier to transfer the work of a broken down machine to another machine of the same type.

g) Enhances the overall skill of workers:

Workers are highly skilled as they are aware of operating all machines-small or big in the group. They are trained in operations such as setting up work, performing special operation, gauging the work and thus qualify as mechanic instead of operators.

Disadvantages of process or functional layout:

a) Inefficient material handling:

Efficient material handling is difficult to practice in process layout because fixed path material handling equipment such as conveyor belts, chutes, etc., cannot be put to use.

b) Dis-economy to floor space:

This type of layout requires more floor space than the product layout because a distinct department is established for each operations.

c) High inventory investment:

Compare to line layout inventory investments are usually higher in case of process layout. The materials have to be carried forward and backward very frequently, resulting in delay and waste. It increases the need of working capital in the form of inventory.

d) High cost of supervision:

Under process layout, costs of supervision are high because:

- The employee per supervisor is less which results in reduce supervisory span of control.

➤ The work is checked only after each operation is completed.

e) Accumulation of work-in-progress.

Each department or operation is independent, the material moves slowly from one department to another. It results in accumulation of work-in-progress or semi-finished goods.

Stationary or fixed or static layout:

Under this type of layout, materials remain at fixed place and the complete job is done at a fixed station. Men and machines are moved to the place of materials for the necessary operations. This type of layout is suitable for big industrial machines, hydroelectric turbines, ship-building, locomotive industry, etc.,

Advantages of stationary layout

a) Flexible:

This layout is fully flexible and is capable of absorbing any sort of change in product and process. The project can be completed according to the needs of the consumers and as per their specifications.

b) Lower labour costs:

People are drawn from functional departments. They move back to their respective departments as soon as the work is over. This is economical, if a number of orders are at hand and each one is in a different stage of progress.

c) Saving in time:

The sequence of operations can be changed if some materials do not arrive or if some workers are absent, since the job assignment is so long, different sets of people can operate simultaneously on the same assignment performing different operations.

d) Occupation of lesser floor space:

It requires less floor space because machines and equipments are in moving positions and there is no need of fixing them. This arrangement is the most suitable way of assembling large and heavy products.

Disadvantages of stationary layout

a) Higher capital investment:

Compared to product or process layout, capital investment is higher in this type of layout. Since, a large number of assignments are taken, investment is heavy in materials, men and machines.

b) Unsuitability:

This type of layout is not suitable for manufacturing or assembling small products in large quantities. It is suitable only in cases where the product is big or the assembling process is complex.

Combination of layout (Mixed layout)

A mixed layout is a combination of process and product layout. Mixed layout is generally used

- When the company's product contains a lot of components and parts and
- When the product requires to be produced in different types and sizes.

In the mixed type of layout, the parts are produced on facilities arranged in a process type of layout and they are assembled using the product type of layout.

Group technology

Concept of group technology is the replacement of traditional job-shop practice. In group technology, operations of the job and the sequence are analysed to form certain families of jobs. Depending on the family, a number of machines are grouped together in each work centre. These work centres are then arranged in a proper sequential order so that these families of jobs flow through the work centre smoothly. The objective here is to minimize the setting time and output time.

PRODUCTION PLANNING AND CONTROL:

Planning may be defined as the determination of a course of action to achieve the desired results. Planning involves the determination of objectives and planning of operation in terms of policies, plans and budgets which will establish the most advantageous course for the organization. Planning is the determination of what is to be done, how and where is to be done, who is to do it and how results are to be evaluated.

Control may be defined as the monitoring of performance through a feedback by comparing the results achieved with the planned targets so that performance can be improved through proper corrective action. This mechanism is also responsible for subsequent adjusting, modifying and redefining plans and targets in order to ensure the attainment of goals.

According to **Gordon B. Carson**, "Production planning and control consists of the organization and the planning of the manufacturing processes routing, scheduling, dispatching and inspection, coordination and the control of materials, methods, machines, tooling and operating time. The ultimate objective is the organization of the supply and the movement of materials and

labour, machine utilization and related activities in order to bring about the desired manufacturing results in the terms of quality, time and price".

Objectives of production planning and control

The principal objectives of the production planning and control are as follows:

a) Quality of the output:

The most important objective of production planning and control is to ensure the safe and economical manufacture of desired products in required quantity and in quality.

b) Plant utilization:

To ensure maximum plant utilization so that productivity of highest degree can be achieved.

c) Process efficiency:

To maintain maximum process efficiency by proper coordination.

d) Delivery of goods:

To deliver the products to the customer whenever they are needed.

e) Maintenance of inventories:

To maintain an adequate supply of a finished goods and having sufficient work-in-process ensure that the deliveries are made to the customers who may want the product in less than the manufacturing time.

f) Flexibility:

To maintain flexibility in manufacturing operations so that an occasional rush can be taken care of.

g) Effectiveness of work:

Production planning and control ensures the right man for the right job, at the right place, at right time on right wages and salaries so that maximum effectiveness is obtained.

h) Absenteeism:

Production planning and control can be introduced to minimize and regulate the absenteeism.

i) Team spirit:

To develop the team spirit and feeling of brotherhood among workers is another aim of production planning and control.

j) Ideas for new methods:

Production planning and control aims at giving encouragement to the workers for new ideas and new methods.

k) Reduced supervision:

The other objective of production planning and control is to reduce supervision by creating interest in work amongst work force.

l) Reduced waiting time:

Production planning and control aims at reducing waiting time arising due to want of material, tools, equipment, supervision, inspection, deliveries etc.

Functions of production planning and control:

The main functions of production planning and control are explained below:

1) Materials:

Raw materials, finished parts and bought-out components should be made available in required quantities and at required time to ensure the correct beginning and end for each operation resulting in uninterrupted production. The function includes the specification of materials (quantity and quality), delivery dates, variety reduction (standardization), procurement and make or buys decisions.

2) Methods:

This function is concerned with the analysis of alternatives and selection of the best method with due consideration to constraints imposed. Developing specification and determination of sequence of operations for the processes are important aspects of production planning and control.

3) Machines and equipment:

This function is related with the detailed analysis of available production facilities, equipment down time, maintenance policy, procedure and schedule.

4) Manpower:

To maintain the availability of appropriate manpower on appropriate machine at the right time.

5) Process planning (Routing):

It is concerned with selection of path route which the raw material should follow to get transferred into finished product. The duties include;

- Fixation of path of travel, giving due consideration to layout.
- Breaking down of operations to define each operation in detail.
- Deciding setup time and process time for each operation.

6) Estimating:

Once the overall method and sequence of operations are fixed and process sheet for each operation is available, then the operations times are

estimated. This function is carried out, using extensive analysis of operations along with methods and routing and a standard time for operation is established using work measurement techniques.

7) Loading and scheduling :

Scheduling is concerned with preparation of machine loads and fixation of starting and completion date for each of the operations. Machines have to be loaded according to their capability of performing the given task and the capacity.

Thus, the duties include:

- Loading the machines as per their capability and capacity
- Determining the starting and completion time for each operation.
- To coordinate with sales department regarding delivery schedules.

8) Dispatching:

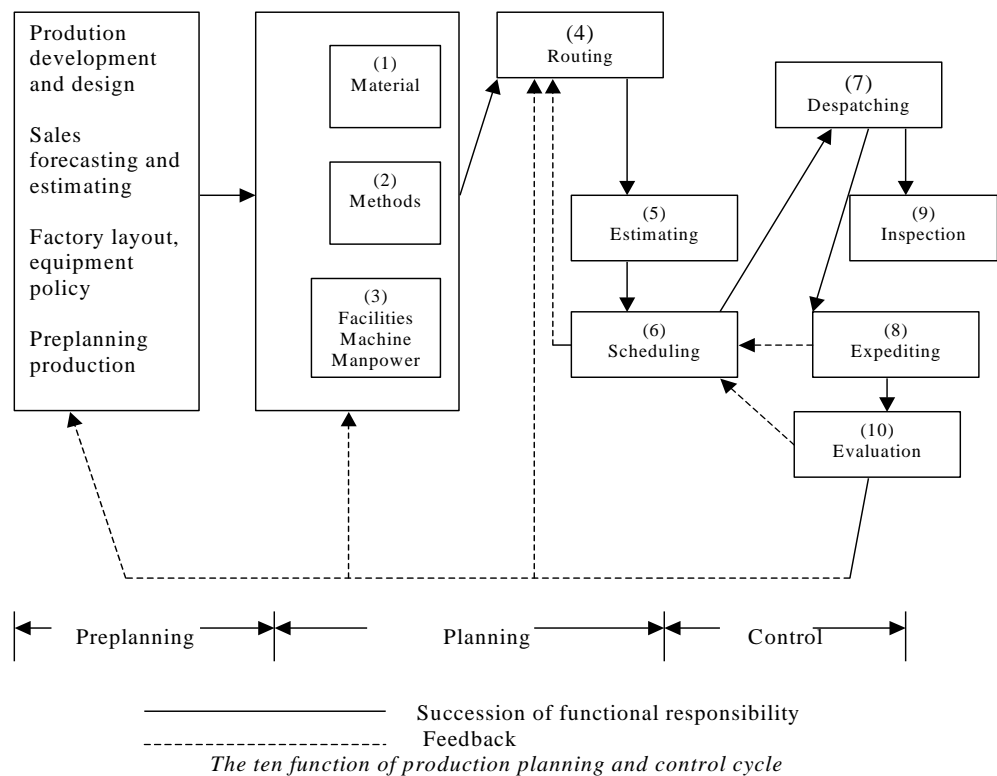
This is the execution phase of planning. It is the process of setting production activities in motion through release of orders and instructions. It authorizes the start of production activities by releasing materials, components, tools, fixtures and instruction sheets to the operators. The activities involved are,

To assign definite work to particular machines, work centers and men.

To issue required material from stores; and also to issue jigs and fixtures and make them available at correct point of use.

Release necessary work orders, time tickets, etc., to authorize timely start of operations.

To record start and finish time of each job on each machine or by each man.



9) Expediting:

This is the control tool that keeps a close observation on the progress of the work. It is a logical step after dispatching which is called follow-up or progress. It coordinates extensively to execute the production plan. Progressing function can be divided into three parts, i.e., follow-up of materials, follow-up of work-in-progress and follow-up of assembly. The duties include;

- Identification of bottlenecks and delays and interruptions because of which the production schedule may be disrupted.
- To devise action plans (remedies) for rectifying the errors.
- To ensure that production rates are in the line with schedule.

10) Inspection:

It is a major control tool. Though the aspects of quality control are elements of a separate function, it is important to production planning and control, both for the execution of the current plans and its scope for future planning. This forms a basis for becoming aware of the limitations with respect to methods, processes, etc.

11) Evaluation:

This stage crucial to the improvement of productive efficiency. A thorough analysis of all the factor influencing the production planning and

control helps to identify the weak spots and the corrective actions with respect to pre-planning and planning will be affected by a feedback. The success of this step depends on the communication, data and information gathering and analysis.

Stages of production planning and control

The ten functions, as listed above in the order of their operations are related to three stages-pre-planning, planning and control.

Pre-planning:

This covers an analysis of data and outline of basic planning policy based on sales report, market research ,and product development and design on the broad aspects of planning, this stage concerned with problems of equipment policy. New process and materials, layout and work-flow. Pre-planning production as a production planning and control.

Responsibility is also preoccupied with data on the '9ms', i.e, on men, money, material, methods, machines, market, minutes and milieu mainly with respect to availability, scope and capacity.

Planning:

When the task has been specified, a thorough analysis of the '9MS' is first undertaken to select the appropriate materials, methods and facilities by means of which the work can be accomplished. As already mentioned, this means of which the work can be accomplished. As already mentioned, this analysis is followed by routing, estimating and scheduling. The more detailed, realistic and precise the planning, the greater conformity to schedules achieved during production, and subsequently the greater the efficiency of the plant. There are two aspects of planning -a short-term one, concerned with immediate production programs, and long-term phase, where plans for the more distant future are considered and shaped. Prominent planning functions are those dealing with standardization and simplification of products, materials and methods.

Control:

This stage is affected by means of dispatching, inspection and expediting. control of inventories ,control of scrap, analysis of work-in-progress, and control and transportation are essential links of this stage. Finally, evaluation takes place to complete the production planning and control cycle. Prof. wiener said of the social system that it, "is an organization like the individual, that it is bound together by a system of communications; and that it has a dynamics, in which the circular processes of a feedback nature play an important part"

3. Continuous production - functions of production planning and control

- Material s function is critical.
- No tool control because of nature of the plant.
- No process planning activity.
- Scheduling is restricted to final quantity required.
- Progressing requires only recording of the final production quantity.

Comparison between production planning and production control:

Production Planning	Production Control
1. Production planning is a pre-production activity.	Production control is set in motion when production activity begins.
2. Planning involves the collection, maintenance and analysis of data with respective time standards, materials, and their specifications, machines and their process capabilities,	Control is concerned with communication of their information and producing reports like output reports, productivity, rejection rate etc.
3. Planning is useful to anticipate the problems and devising remedial measures in case the problem arises.	Control involves in taking corrective steps in case of error to match actual performance against the planned performance.
4. Planning is a centralizes activity and includes functions like materials control, tool control, process planning and control.	Control is a wide spread activity. Includes function such as dispatching, programming and inspection, etc.
5. Planning sees that all the necessary resources are available to make the production at right quality and time.	Control keeps the track of the activities and ensures whether everything is progressing as per schedule or not.

Check Your Progress

Fill ups

1. _____ is the arrangement of machine and equipment in a line (not necessarily straight) or a sequence in which they would be used in the process of manufacture of the product or group of related products.
2. A mixed layout is a combination of _____

3. _____ may be defined as the determination of a course of action to achieve the desired results.
4. Process Planning is otherwise known as _____.
5. _____ is concerned with preparation of machine loads and fixation of starting and completion date for each of the operations

Points to Remember

1. Mixed layout is generally used
 - When the company's product contains a lot of components and parts and
 - When the product requires to be produced in different types and sizes.
2. In group technology, operations of the job and the sequence are analysed to form certain families of jobs.
3. Control may be defined as the monitoring of performance through a feedback by comparing the results achieved with the planned targets so that performance can be improved through proper corrective action
4. Production planning is a pre-production activity.
5. Production control is set in motion when production activity begins.

Model Questions:

1. Write Short notes on;

- | | |
|---------------------------------|-------------------------------|
| a) Product or line layout | b) Stationary or fixed layout |
| c) Functional or process layout | c) Combined or mixed layout. |

Ans:

Product or line layout:

Product or line layout is the arrangement of machine and equipment in a line (not necessarily straight) or a sequence in which they would be used in the process of manufacture of the product or group of related products. In this layout, materials are worked out into finished stock through a series of integrated operation (operated one after the other in a sequence) that is arranged in a line. The machines under this plan may be arranged either in 'U shape or in shape of a line'.

Stationary or fixed or static layout:

Under this type of layout, materials remain at fixed place and the complete job is done at a fixed station. Men and machines are moved to the place of materials for the necessary operations. This type of layout is suitable for big industrial machines, hydroelectric turbines, ship-building, locomotive industry, etc.

Functional or process layout:

This system is based on the functions performed by a department. Under this system of layout, machines or equipment of the same functions are grouped together in a separate department. In other words, separate department is established for each specialized operation of production and machines relating to such functions are assembled there. The specialized department works for all the lines of production. For example, welding equipment may be placed in one place, i.e., welding department will perform welding operations for the benefit of all the lines of production.

Combination of layout (Mixed layout)

A mixed layout is a combination of process and product layout. Mixed layout is generally used

- When the company's product contains a lot of components and parts and
- When the product requires to be produced in different types and sizes.

In the mixed type of layout, the parts are produced on facilities arranged in a process type of layout and they are assembled using the product type of layout

2. What are the advantages of Process layout?

Advantages of process layout:

h) Flexibility:

The process layout is known for its flexibility. Changes in operations as well as their order can be made at any time without disturbing the existing layout any new operation can be added by adding simply a new department.

i) Scope for expansion:

The capacities of different lines can be expanded under this type of layout by adding new machines and labour.

j) Maximum utilization of resources:

Process layout necessitates fuller utilization of machines and equipment because generally purpose machines are used commonly for all departments. Duplication of machines is thus avoided as far as possible.

k) Lower financial investment:

This type of layout requires lesser financial investment in machines and equipment because the general purpose machines, which are usually of low costs, are used. This results in lower investment in machines.

l) Better working conditions:

Process layout facilitates installation of machines and equipment in different areas without any dependence on other operation sequences. The

layout makes it easy to isolate machinery that produce excessive noise, vibration, fumes and heat; thereby ensuring healthy working conditions in the work place.

m) High output rate:

Process layouts are less vulnerable to break down. Machine break down in a process layout holds up production only on that particular machine and the whole process does not come to a standstill. It is easier to transfer the work of a broken down machine to another machine of the same type.

n) Enhances the overall skill of workers:

Workers are highly skilled as they are aware of operating all machines-small or big in the group. They are trained in operations such as setting up work, performing special operation, gauging the work and thus qualify as mechanic instead of operators.

3. Meaning and definition of production of planning and control?

Planning:

When the task has been specified, a thorough analysis of the '9MS' is first undertaken to select the appropriate materials, methods and facilities by means of which the work can be accomplished. As already mentioned, this means of which the work can be accomplished. As already mentioned, this analysis is followed by routing, estimating and scheduling. The more detailed, realistic and precise the planning, the greater conformity to schedules achieved during production, and subsequently the greater the efficiency of the plant. There are two aspects of planning -a short-term one, concerned with immediate production programs, and long-term phase, where plans for the more distant future are considered and shaped. Prominent planning functions are those dealing with standardization and simplification of products, materials and methods.

Control:

This stage is affected by means of dispatching, inspection and expediting. control of inventories ,control of scrap, analysis of work-in-progress, and control and transportation are essential links of this stage. Finally, evaluation takes place to complete the production planning and control cycle. Prof. wiener said of the social system that it ,"is an organization like the individual, that it is bound together by a system of communications; and that it has a dynamics, in which the circular processes of a feedback nature play an important part"

4. Discuss the objective of production planning and control?

Objectives of production planning and control

The principal objectives of the production planning and control are as follows:

m) Quality of the output:

The most important objective of production planning and control is to ensure the safe and economical manufacture of desired products in required quantity and in quality.

n) Plant utilization:

To ensure maximum plant utilization so that productivity of highest degree can be achieved.

o) Process efficiency:

To maintain maximum process efficiency by proper coordination.

p) Delivery of goods:

To deliver the products to the customer whenever they are needed.

q) Maintenance of inventories:

To maintain an adequate supply of a finished goods and having sufficient work-in-process ensure that the deliveries are made to the customers who may want the product in less than the manufacturing time.

r) Flexibility:

To maintain flexibility in manufacturing operations so that an occasional rush can be taken care of.

s) Effectiveness of work:

Production planning and control ensures the right man for the right job, at the right place, at right time on right wages and salaries so that maximum effectiveness is obtained.

t) Absenteeism:

Production planning and control can be introduced to minimize and regulate the absenteeism.

u) Team spirit:

To develop the team spirit and feeling of brotherhood among workers is another aim of production planning and control.

v) Ideas for new methods:

Production planning and control aims at giving encouragement to the workers for new ideas and new methods.

w) Reduced supervision:

The other objective of production planning and control is to reduce supervision by creating interest in work amongst work force.

x) Reduced waiting time:

Production planning and control aims at reducing waiting time arising due to want of material, tools, equipment, supervision, inspection, deliveries etc.,

5. Distinguish between production planning and production control?

Production Planning	Production Control
1. Production planning is a pre-production activity.	Production control is set in motion when production activity begins.
2. Planning involves the collection, maintenance and analysis of data with respective time standards, materials, and their specifications, machines and their process capabilities,	Control is concerned with communication of their information and producing reports like output reports, productivity, rejection rate etc.
3. Planning is useful to anticipate the problems and devising remedial measures in case the problem arises.	Control involves in taking corrective steps in case of error to match actual performance against the planned performance.
4. Planning is a centralizes activity and includes functions like materials control, tool control, process planning and control.	Control is a wide spread activity. Includes function such as dispatching, programming and inspection, etc.
5. Planning sees that all the necessary resources are available to make the production at right quality and time.	Control keeps the track of the activities and ensures whether everything is progressing as per schedule or not.

Answer for the fill ups:

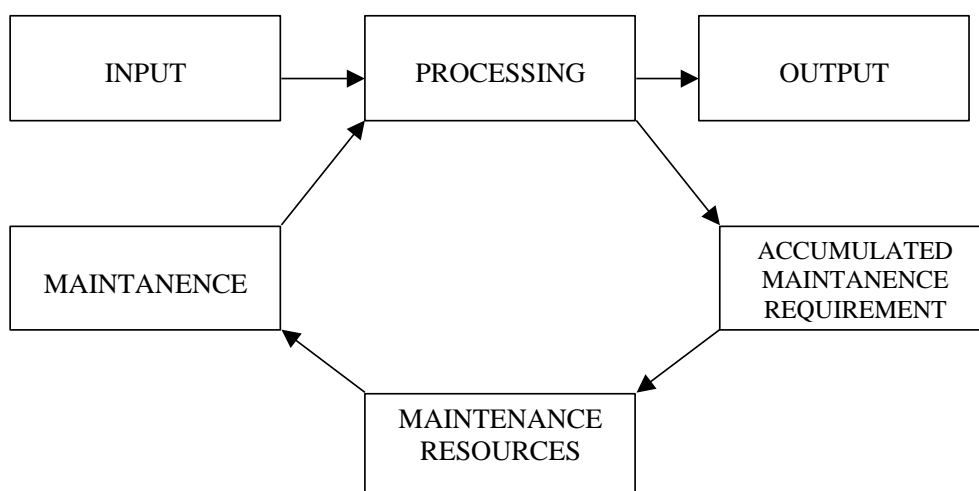
1. Product or line layout
2. process and product layout
3. Planning
4. Routing
5. Scheduling

UNIT - II

MAINTENANCE

MAINTENANCE:

Maintenance is an age function which developed and progressed, knowingly or unknowingly along with the operations of equipment. Maintenance management is concerned with planning and controlling routine, planned and preventive maintenance activities of an organization.



Maintenance System

Areas of Maintenance:

The major areas of maintenance are civil, mechanical and electrical.

1. Civil maintenance:

Building construction and maintenance, maintenance service facilities such as water, gas, compressed air, heating and ventilating, air conditioning, painting, plumbing and carpentry work.

2. Mechanical maintenance:

Maintaining machines and equipment, transport vehicles, material handling equipment, steam generators, boilers, compressors and furnaces.

4. Electrical maintenance:

Maintaining electrical equipment such as generators, transformers, switch gears, motors, telephone systems, electrical installations, lightening, fans, instruments, control panels, and battery maintenance.

Objective of Maintenance:

The main objectives of maintenance are follows:

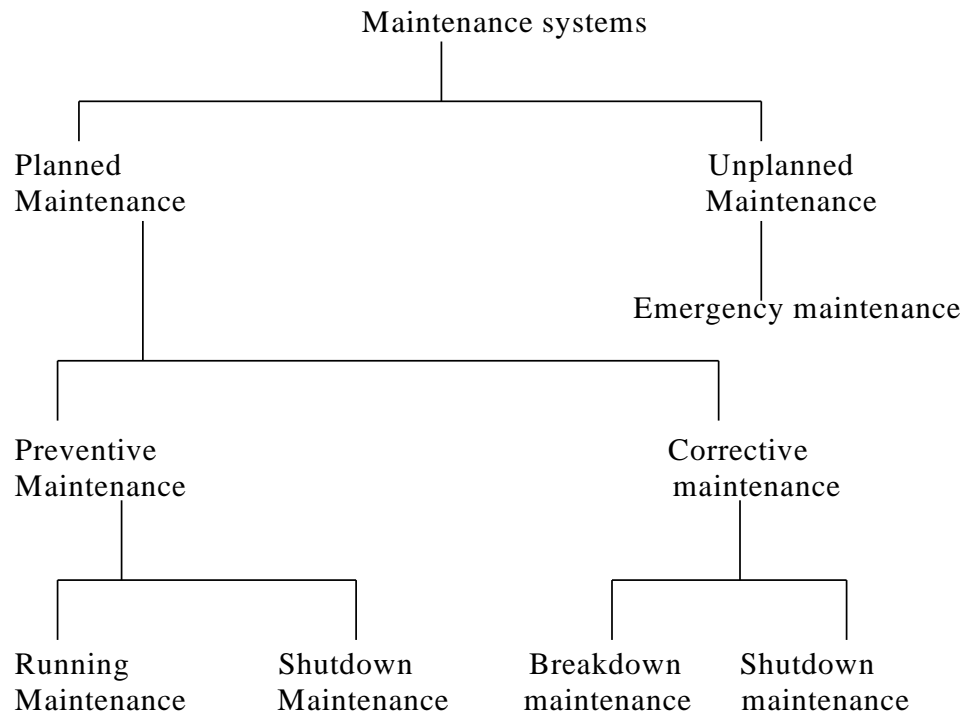
- a. To keep their factory-plants, equipments, machine tools, etc., in an optimum working condition.
- b. To keep equipment safe and prevent the development of safety hazards.
- c. To ensure specified accuracy to products and time schedule of delivery to customers.
- d. To keep the down time of machines to the minimum thus to have control over the production program.
- e. To keep the production cycle within the stipulated range.
- f. To modify the machine tools to meet the augmented needs for production.
- g. To improve productivity of existing machine tools and to avoid sinking of additional capital.
- h. To reduce the maintenance costs as far as possible thereby leading to a reduction in factory overheads.
- i. To minimize the total production or operating costs directly attributable to equipment service and repair.
- j. To prolong the useful life of the factory plant and machinery. Avoid postponing of incurring heavy capital expenditure involved in the replacement.
- k. To help management in taking decisions on replacement or new investment and to actively participate in specification preparation, equipment selection, its erection and commissioning, etc.
- l. Development of resources for equipment and spares, and providing technical help for vendor development and rating and import substitution.
- m. Help in implementation of suitable procedure for procurement, storage and consumption of spares, tools and consumables etc.
- n. Standardization of spares and consumables in conformity with plant, national and international standards and help in adoption of these standards by all users in the plant. Also help in variety reduction and inventory control.
- o. Help in training and development of skilled workmen and executives.

TYPES OF MAINTENANCE

Choice of the suitable maintenance practices can be made from the following:

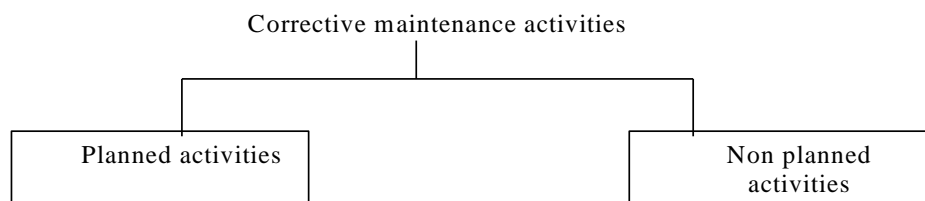
- I. Operator maintenance

- II. Predictive maintenance
- III. Break down maintenance/Corrective maintenance
- IV. Planned maintenance/Routine maintenance-regular and shut down maintenance.
- V. Preventive maintenance/scheduled maintenance



Break-down maintenance:

Breakdown maintenance refers to the repair work taken after the failure of the machine or equipment. For example, a machine stops working because the belt gets torn. Replacement of the torn belt is a case of breakdown maintenance. The materials, spares and labor required in such maintenance are provided in advance. Breakdown maintenance is corrective maintenance as it is under taken to restore equipment to an accepts standard. It involves mainly the repair of defective equipment.



- | | |
|--------------------------------------|-----------------------|
| 1. Normal repairs | 1. Break down repairs |
| 2. Programmed replacement | |
| 3. Large storing actions (overhauls) | |
| 4. Modification to reduce | |
| 5. Maintenance requirements. | |

Corrective maintenance activities, therefore, leads to disruption of production plans. It also makes it impossible to plan the work load and distribution of maintenance work force for a balanced attention of all equipment. It increases overtime payment and involves prolonged down time due to non-availability of requisite manpower and spares. This practice, consequently accepts a lower level of organizational efficiency, and cannot be recommended as general practice for all type of equipment.

Objectives of breakdown maintenance:

Breakdown maintenance seeks to achieve the following objectives:

1. To get equipment back into operation as quickies possible in order to minimize interruption to production. These objectives can directly affect production capacity, production cost, product quality and consumer satisfaction.
2. To control cost of repair, including regular time and overtime labour cost.
3. To control the cost of the operation of repair shops.
4. To control the investment in replacement spare parts that is used when machines are repaired.
5. To control the investment in replacement spare machine, which are also called stand-up or back-up machines; they replace manufacturing machines until the needed repairs are completed.

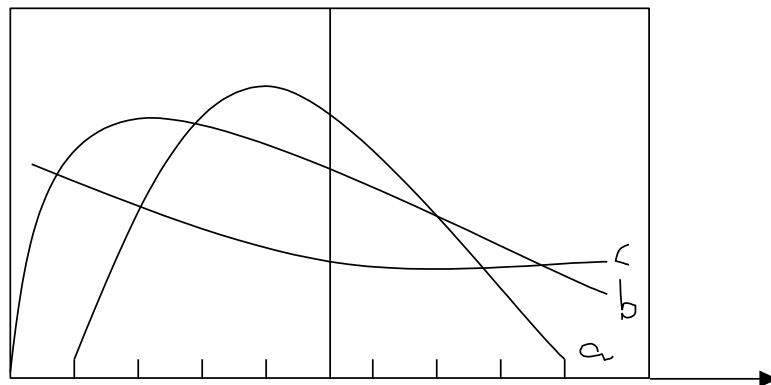
Disadvantages of breakdown maintenance:

1. Breakdowns generally occur at in opportune time. These leads to poor, hurried maintenance causing excessive delay in production and reduction in output.
2. Faster plant deterioration and direct loss of profit.
3. Increased chances of accidents and less safety to both workers and machines.
4. More spoilt materials are waste of materials in process.
5. Breakdown maintenance cannot be employed for those plant items, which are regulated by statutory provisions. For example cranes, lifts, hoists and pressure vessels.

6. Planning of maintenance work is nor possible.
7. Distribution of work load is difficult.
8. Results in imbalanced utilization of maintenance staff.
9. Increased down time of equipment due to non-availability of man power.
10. Excessive inventory of spares.

Break-down time distribution:

Break-down time distribution data are basic to the formulation of any general policies concerning maintenance. Break-down time distributions show the frequency with which machines have maintenance-free performance for a given number of operating hours. Ordinarily, they are shown as distributions of the fraction of break-downs that exceed a given run time. Breakdown time distributions are developed from distributions of run time free of breakdowns, as shown in the figure below



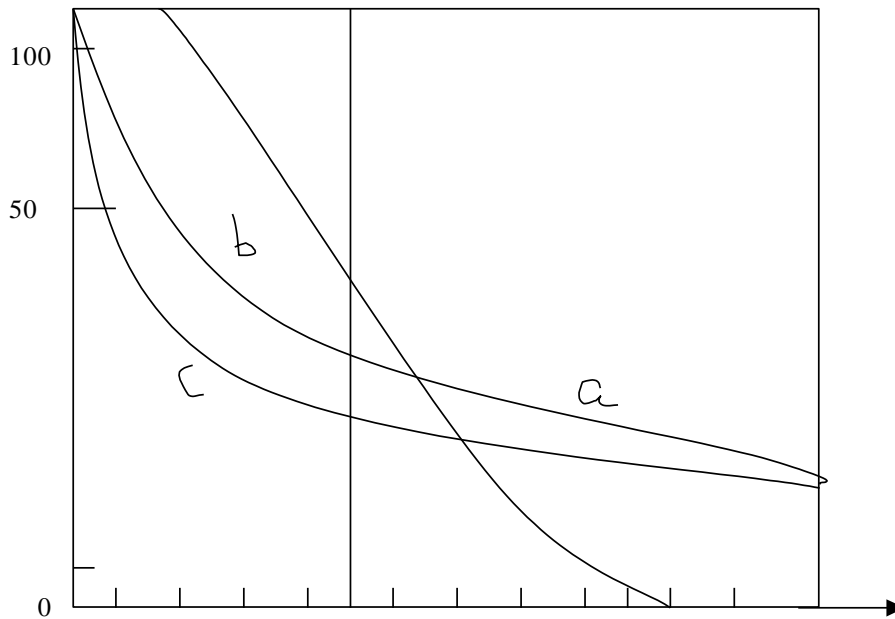
Ta=Average free run time.
 Runtime free of breakdowns →

Frequency distribution of runtime free of breakdowns representing three degree of variability in free run time

Curve (a) shows low variability from the average breakdown time Ta curve

Curve (b) is the negative exponential distribution and exhibits medium variability Curve (c) exhibits high variability.

Vertical lines show constant breakdown times.



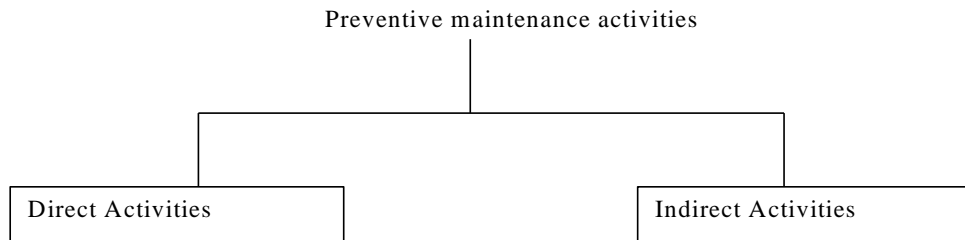
Breakdown time distributions

The above figure shows three breakdown time distributions. These distributions take different shapes, depending on the nature of the equipment with which we are dealing. For example, a simple machine with a few moving parts would tend to break down at nearly constant interval following the last repair. It means that would exhibit minimum variability in breakdown time distributions.

In a more complex machine with many parts, each part would have a failure distribution. When all these parts are grouped together in a single distribution of the breakdown time of the machine for any reason, we would expect to find greater variability. The machine could breakdown for any one of a number of reasons. Some breakdown could occur shortly after the last repair, or at any time. Therefore, for the same average breakdown time T_a we could find much wider variability of breakdown time.

PREVENTIVE MAINTENANCE:

Preventive maintenance consists of routine actions taken in a planned manner to prevent breakdowns. Lubrication and inspection are the two constituents of preventive maintenance.



- | | |
|--------------------------------|-----------------------------|
| 1. Cleaning of the equipment | 1. Condition monitoring |
| 2. Lubricating to prevent wear | 2. Failure statistics |
| 3. Programmed replacement | 3. Adjustment to limit wear |

Preventive maintenance activities

Preventive maintenance of plant services

Preventive maintenance function is sub-divides as

1. Preventive maintenance of production departments and
2. Preventive maintenance of plant services.

Preventive maintenance of production department It includes anticipatory inspection and serving of equipment besides routine maintenance. The important plant services requiring preventive maintenance are building, power, plant, material handling equipment, fleet of transport vehicles, water supply, waste disposal systems, store-room, tool-room, time keeper's office, fire fighting facilities etc.,

Forms of preventive maintenance

Four different forms of preventive maintenance;

1. Time-base preventive maintenance:

Refers to conducting maintenance at regular intervals, e.g., every two months, etc. It is easy to monitor time and this form is used when deterioration is likely to be time rather than usage dependent.

2. Work-base preventive maintenance;

Maintenance performed after a set number of operating hours of volume of work produced.

e.g., every 40,000 photocopies in a Xerox machine, etc. Usage can be more difficult than time to monitor and some form of 'auto-counting' of output should be used, if possible.

3. Opportunity-based preventive maintenance:

Repair or replacement takes place when the equipment or system is devoid of work.

e.g.: During a holiday.

4. Condition-based preventive maintenance:

This method often relies on planned inspection to reveal when maintenance is prudent.

e.g.: Replacement of a brake pad when it has worn to 2mm thickness, This is dependent on monitoring the equipment condition which can be difficult, and impractical if a time-consuming strip-down preceded any examination or inspection.

Several other terms which are often used as synonym for preventive maintenance are:

Running Maintenance where in the preventive maintenance work is carried out while the equipment is in service.

- **Shutdown Maintenance** wherein the preventive maintenance work is carried out when the equipment is out of service.
- **Servicing** wherein the minor activities like cleaning, lubrication etc., are carried out at planned intervals.
- **Scheduling Maintenance system** provides for inspection, over hauling, lubrication and servicing of certain machines at predetermined dates. E.g., Overhauling of machines, cleaning of tanks and while washing of buildings are normally done in this manner.
- **Planned Maintenance** represent an advancement over mentioned types of maintenance practice. Briefly stated, planned maintenance visualizes the work certained in a future job, determines the best method to be adopted and skill required for its execution, estimates the time, material and costs involved in assigned jobs and programmes the work to specific time periods on the basis of priority.
- **Predictive maintenance** a new type of preventive maintenance known as predictive maintenance is becoming popular. It involves the use of sensitive instruments to predict trouble. Such maintenance help in determining the need for and time of overhauling.

Elements of preventive maintenance:

The various elements of a preventive maintenance system in an industry are as follows:

- a) An inventory of all the plant and equipment need to be maintained.

- b) Categorization of equipment to assess the relative importance and there by determine the equipment requiring preventive maintenance.
- c) A well designed inspection system.
- d) A good lubrication system i.e., regular cleaning, greasing and oiling of the moving parts.
- e) Maintenance of adequate records and analysis of the same.
- f) Planning of maintenance work.
- g) Control of maintenance stores and spares
- h) Organization for preventive maintenance work.
- i) Replacement of worn-out parts before they fail to operate.
- j) Provision of stand by machines for critical equipment.

Objectives of preventive maintenance:

- a) To minimize the possibility of unanticipated production interruptions by locating or covering any condition which lead to it.
- b) To make plant equipment and machines always available and ready for use.
- c) To maintain the value of the equipment and machinery by conducting periodic inspection, repairs, overhauling etc.,
- d) To reduce the work content of maintenance jobs.
- e) To ensure safety of life and limits of the workmen.

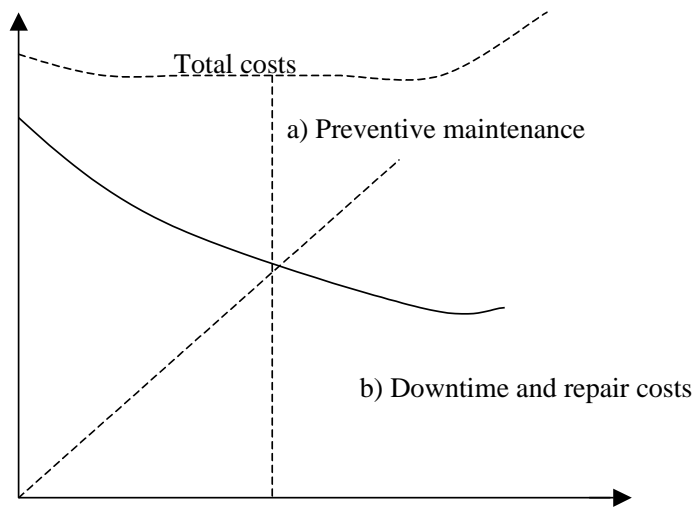
Preventive maintenance versus Break-down maintenance:

Quality control procedures are designed to track characteristics of quality and to take action to maintain quality within action to maintain quality within limits. In some instances the action called for may be equipment maintenance. The maintenance function then acts in a supporting role to equipment operating effectively to maintain quality standards, as well as to maintain the quantitative and cost standards of output.

There are alternate policies that may be appropriate, depending on the situation and the relative costs.

Maintenance cost balance:

The decision concerning the appropriate rests on the balance of costs, as indicated in the below figure,



Manager will want to select the policy which minimizes the sum of preventive maintenance plus repair costs.

Curve (a) represent the increase in costs that results from higher levels of preventive maintenance.

Curves (b) represent the declining costs of breakdown and repair as the level of preventive maintenance casts that result from a breakdown.

The total incremental cast curve is the sum of curves (a) and (b). The optimal policy regarding the level of preventive maintenance is defined by the minimum of that curve.

Check Your Progress

Fill ups

1. _____ is an age function which developed and progressed, knowingly or unknowingly along with the operations of equipment
2. _____ refers to the repair work taken after the failure of the machine or equipment
3. Preventive maintenance consists of _____ taken in a planned manner to prevent breakdowns

Points to remember

1. Break-down time distribution data are basic to the formulation of any general policies concerning maintenance.
2. Corrective maintenance activities, leads to disruption of production plans.
3. Running Maintenance where in the preventive maintenance work is carried out while the equipment is in service.

4. Shutdown Maintenance wherein the preventive maintenance work is carried out when the equipment is out of service
5. Scheduling Maintenance system provides for inspection, over hauling, lubrication and servicing of certain machines at predetermined dates.

Model Question

1. What is Maintenance?

Maintenance is an age function which developed and progressed, knowingly or unknowingly along with the operations of equipment. Maintenance management is concerned with planning and controlling routine, planned and preventive maintenance activities of an organization.

2. Mention the Area of Maintenance?

Areas of Maintenance:

The major areas of maintenance are civil, mechanical and electrical.

1. Civil maintenance:

Building construction and maintenance, maintenance service facilities such as water, gas, compressed air, heating and ventilating, air conditioning, painting, plumbing and carpentry work.

2. Mechanical maintenance:

Maintaining machines and equipment, transport vehicles, material handling equipment, steam generators, boilers, compressors and furnaces.

5. Electrical maintenance:

Maintaining electrical equipment such as generators, transformers, switch gears, motors, telephone systems, electrical installations, lightening, fans, instruments, control panels, and battery maintenance.

3. Discuss the objectives of Break downs?

Objectives of breakdown maintenance:

Breakdown maintenance seeks to achieve the following objectives:

1. To get equipment back into operation as quickies possible in order to minimize interruption to production. These objectives can directly affect production capacity, production cost, product quality and consumer satisfaction.
2. To control cost of repair, including regular time and overtime labour cost.
3. To control the cost of the operation of repair shops.
4. To control the investment in replacement spare parts that is used when machines are repaired.

5. To control the investment in replacement spare machine, which are also called stand-up or back-up machines; they replace manufacturing machines until the needed repairs are completed.

4. List the types of Maintenance?

- a) Operator maintenance
- b) Predictive maintenance
- c) Break down maintenance/Corrective maintenance
- d) Planned maintenance/Routine maintenance-regular and shut down maintenance.
- e) Preventive maintenance/scheduled maintenance

5. Explain Preventive Maintenance and Forms of Preventive Maintenance?

Preventive maintenance consists of routine actions taken in a planned manner to prevent breakdowns. Lubrication and inspection are the two constituents of preventive maintenance.

Forms of preventive maintenance

Four different forms of preventive maintenance;

5. Time-base preventive maintenance:

Refers to conducting maintenance at regular intervals, e.g., every two months, etc. It is easy to monitor time and this form is used when deterioration is likely to be time rather than usage dependent.

6. Work-base preventive maintenance;

Maintenance performed after a set number of operating hours of volume of work produced.

e.g., every 40,000 photocopies in a Xerox machine, etc. Usage can be more difficult than time to monitor and some form of 'auto-counting' of output should be used, if possible.

7. Opportunity-based preventive maintenance:

Repair or replacement takes place when the equipment or system is devoid of work.

e.g.: During a holiday.

8. Condition-based preventive maintenance:

This method often relies on planned inspection to reveal when maintenance is prudent.

e.g.: Replacement of a brake pad when it has worn to 2mm thickness, This is dependent on monitoring the equipment condition which can be

difficult, and impractical if a time-consuming strip-down preceded any examination or inspection.

Answer for fill ups

Maintenance

Breakdown maintenance

routine actions

Advantages of preventive maintenance:

- a) Life of machine and equipment becomes longer.
- b) Production planning becomes easier due to fewer breakdowns.
- c) Higher productivity due to less downtime.
- d) Production system becomes more reliable due to less repetitive repairs.
- e) Safety of plant and employer is enhanced.
- f) Shutdowns and start ups can be scheduled in advance.

METHOD STUDY:

Method study is defined as "A procedure for examining the various activities of problem which ensures a systematic objective and critical evaluation of the existing facts and in addition, an imaginative approach when developing improvements".

There are three different levels and aspects of the application of method study,

❖ **Method study proper:**

Method study proper is the broad investigation and improvement of a total department or section, the layout of machines and equipment, working conditions, etc.

❖ **Motion study:**

Motion study is more detailed investigation of an individual operator, the layout of his bench or machines, the movement of his body as he performs his work.

❖ **Micro study:**

Micro motion study is a much more detailed investigation of rapid movements of the hands and arms. It requires the use of a camera and the analysis of filmed records of hand movements.

Aims/Objects of Method study or Motion study:

- I. Better design of plant equipment and buildings
- II. Improved layout of factory and offices
- III. Better working conditions and environment

- IV. High standards of safety and health
- V. Improved flow of work
- VI. Better quality
- VII. Greater job satisfaction
- VIII. High earnings
- IX. Improved utilization of resources
- X. Effective material handling
- XI. Effective process and procedure
- XII. Optimum inventory
- XIII. Optimum output
- XIV. Improved administration
- XV. Waste reduction
- XVI. Standardization and rationalization

Scope of Method study:

It can be applied to layout, working conditions, movement, quality standards, design, tools and equipments, material handling etc., possible improvements of method study can be:

a) Short-term improvements:

These are improvements which can be introduced quickly and economically.

c) Long-term improvement:

Improvements that require planning, investment and which that cannot be acceptable at present.

Procedure for Method study:

1. Break up operation of the job:

Make a detailed list of all operations in the present method of manufacturing job.

2. Questioning every detail of the job:

The method study expert poses several questions to himself/herself regarding the way in which various operations are to be performed and the tools and equipment needed for the same. This is also known as critical examination, that probes into the following;

- ❖ Place
- ❖ Purpose
- ❖ Sequence

- ❖ Person

- ❖ Means

3. Develop a new method:

Before finalizing the new method, the following aspects should be taken into account during the method study.

- ❖ Elimination

- ❖ Combination

- ❖ Re-arrangement:

- a) Assembling

- b) Storage

- c) Inspection

- d) Despatching

4. Maintaining the new method:

Once a method is installed, it should be maintained in its specified form and not allowed to slip back to its old form or introduction of any other unauthorized changes.

ANALYTICAL APPROACH OF METHOD STUDY

The following are the steps involved in method study.

- ❖ Select - Analysis of the job

- ❖ Record - Record by means of charts and diagrams all relevant facts about and diagrams all relevant facts about the present method

- ❖ Examine - Critical examination of all facts.

- ❖ Develop - Develop an efficient and economical method.

- ❖ Define - The new method to be introduced

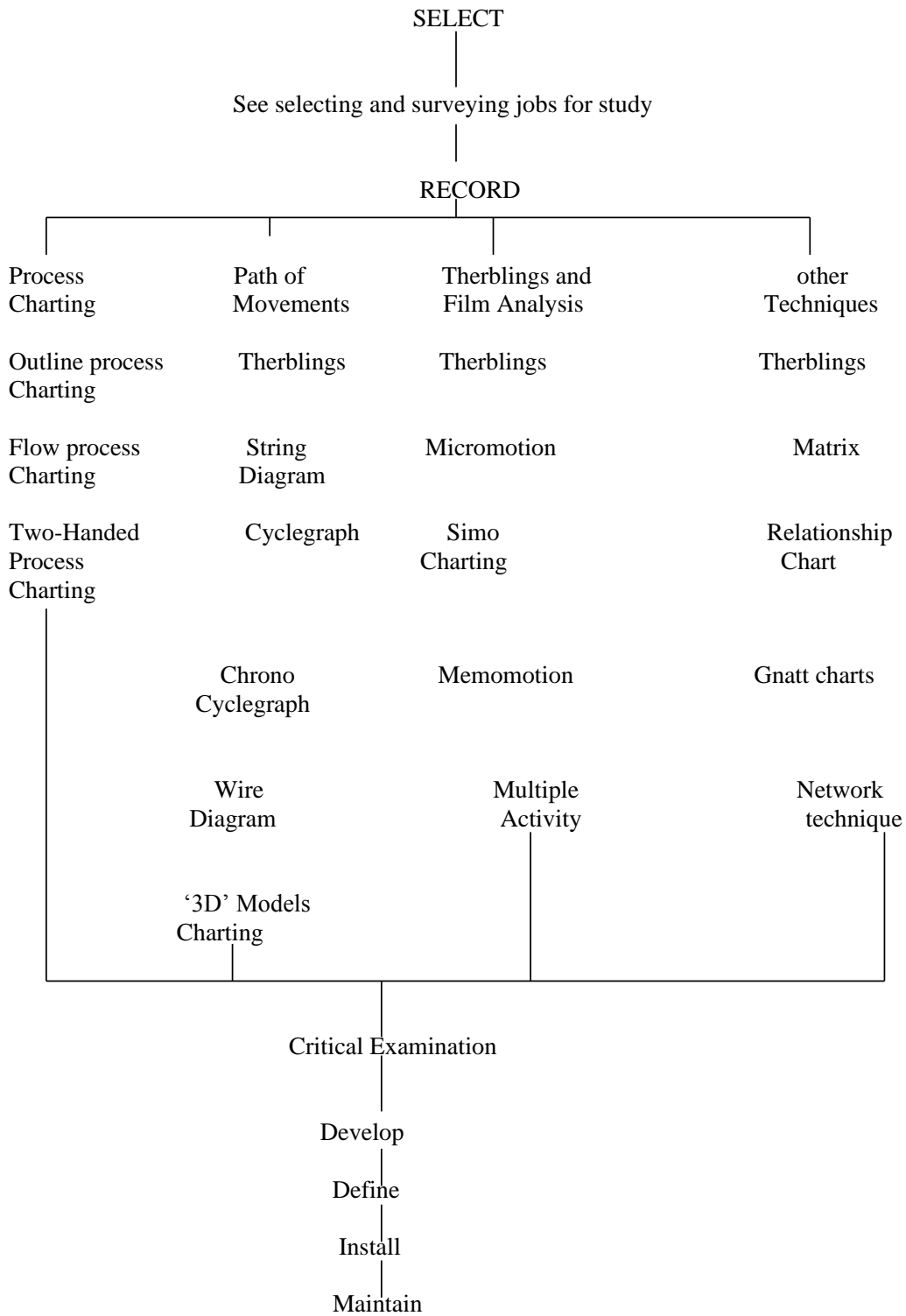
- ❖ Install - The installation of the standard practice

- ❖ Maintain - Maintaining the standard practice.

1. Selection:

Among the basis steps of method study, 'selection' poses the greatest challenge at the initial stages of any project demands exacting and crystalline areas for detailed investigation.

In minor assignments, like the study of a specific process, selection is a comparatively easy task. In major assignments, like the study of a specific process, selection is a comparatively easy task. In major assignments, however, where the problem is large in magnitude, and wide in scope, a preliminary or diagnostic survey may be called for.



a) Diagnostic Approach:

In major assignment of larger magnitude and wider scope, diagnostic approach is useful in selection of specific areas for investigation. The steps involved in diagnostic approach are as follows:

- Breakdown in the capital structure.
- Arrange in terms of succession cost.
- Make spot checks.
- Rearrange in succession in order of feasibility of cost reduction and value added.
- Draw action programme.

b) Consider in selection:

While selecting the subject for study, the following consideration should be borne in mind:

- i. Economic Consideration
- ii. Technical consideration
- iii. Technical consideration
- iv. Human consideration

Work study efforts costs Time and Money:

The value of the anticipated results must commensurate with the efforts put in. Short studies which can yield appreciable dividends quickly are to be preferred to long term studies whose benefits may be difficult to foresee.

Technical consideration:

It should be ensured that adequate technical knowledge is available with which to carry out the study. Where a large problem throws up a number of subjects which are independent of each other, it is better to have small individual studies initiated on each subject.

Human consideration:

Where resistance to change or reaction is likely to be more, the subject should not be proceeded with until acceptance has been gained. A spectacular improvement imposed against the will of the staff, can never be effective compared to a modest improvement in implementation with the co-operation of staff.

Field of choice:

The ranges of jobs which may be tackled by method study vary over a wide area. However, following areas should be considered first:

- i. Optimizing allocation of any specific resources.

- ii. Design of equipment for man- machine equilibrium.
- iii. Improving the working conditions or environment.
- iv. Reducing the time required for performing the activity.
- v. Improving the layout.
- vi. Minimizing improvements.
- vii. Quality improvements.
- viii. System improvements.
- ix. Cost reduction.
- x. Customer satisfaction.
- xi. Standardization / simplification.
- xii. Material handling activities.
- xiii. High accident rate.
- xiv. Excessive over time.
- xv. Excessive scrap.
- xvi. Too much work-in-progress.
- xvii. Idle labour time / idle machine time.

2. Recording techniques:

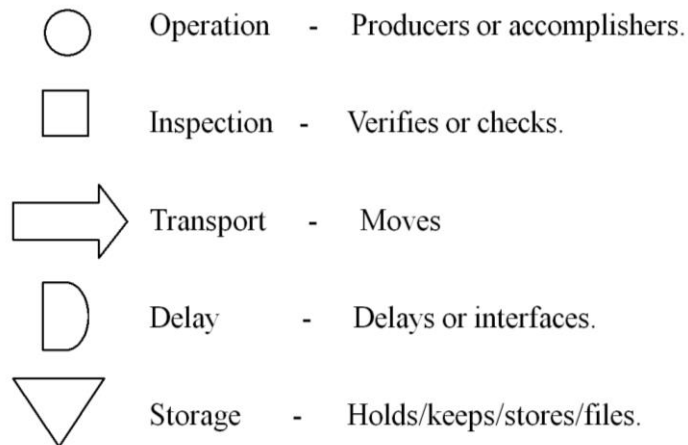
According to the nature of the job being studied and the purpose for which the record is required, the techniques fall into following categories:

- i. Charts.
- ii. Diagrams.
- iii. Templates and models.

<p>Chart:</p> <ul style="list-style-type: none"> ➤ Operation process chart. (Outline process chart) ➤ Flow process chart. <ul style="list-style-type: none"> ○ Man type. ○ Material type. ○ Equipment type. ➤ Two-handed process chart. ➤ Multiple activity charts. ➤ Travel chart. ➤ SIMO chart. <p>Diagram:</p> <ul style="list-style-type: none"> ➤ Flow and string diagrams. ➤ Models and materials. ➤ Cycle graph and chronocycle graph. 	<p>Gives bird's-eye view of process and records. Principle operations and inspecting.</p> <p>Sequence of activities performed by worker Sequence of activities performed on materials Sequence of activities performed by equipment.</p> <p>Activities performed by worker's two hands. Charts, activities of men and / or machines on a common time scale.</p> <p>Movement of materials and / or men between departments.</p> <p>Activities of worker's hand, legs and other body movements on common time scale.</p> <p>Path of movement of men and materials.</p> <p>Work place layout.</p> <p>High speed, short cycle operation recording.</p>
--	--

Method study symbols (Process chart symbols):

Charts are generally represented by symbols because produce a better picture and quick understanding of the facts. Process charts use the following five basic symbols to record different types of events.



Micro motion study:

Some motions require very small time and it is difficult to measure time for them accurately, but the time require for these motions cannot be neglected because they are repeated hundreds of time. There fore, the motion is filmed with the aid of a camera. Even a small time up to 0.00005 minute can be measured by this system, when a picture camera is used, the procedure is known as micro motion study.

This method gives accurate analysis, but being costly, it is used when products are likely to continue for a long time. Micro motion study has the following important advantages. It provides permanent record of study with the help of films.

1. A large number of workers can see the procedure at any time even after the completion of motion study work.
2. Differences in the old and new methods can be demonstrated, if both are filmed.
3. Films can be demonstrated at any desired speed.
4. It gives an accurate time foe each motions or operations than that is recorded by the stop-watch.

SIMO Chart:

Simultaneous motion cycle chart (SIMO chart) is recording technique for micro motion study. ASIMO chart is a chart, based on the film analysis, used to record simultaneously o a common time scale the therbligs or a group of therbligs performed by difference parts of the body of one or more operators.

The format for SIMO chart is given below:

SIMO CHART

Operation :				Film No:			
Part drawing No :				Chart No :			
Method :		Present/proposed		Date :			
Operation No:				Charted by :			
<i>Wink counter reading</i>	<i>Left hand description</i>	<i>Therbligs</i>	<i>Time</i>	<i>Time in 200/m</i>	<i>Time</i>	<i>Therbligs</i>	<i>Right hand description</i>

Memo motion study:

Memo motion photographic is a form of time-lapse photography which records activity by the use of cine camera adopted to take pictures at longer intervals than normal (*time interval normally lies between ½ seconds to 4 seconds).

The filming of these various classes of works can be performed efficiently and economically by a method of time lapse cine photography known as memo motion.

String diagram:

A string diagram also uses a scale drawing of the work place, but here the routs taken by operators, materials or equipment are traced on the diagram by the use of continuous thread fixed with pins. The string diagram is scale layout drawing on which a length if string is used to record the extent a well as the pattern of movement of a worker or apiece of equipment working within a limited area during a certain period of time.

Form of study sheet:

String diagram study				
Man/material/equipment Department Section Operator Operator No		Study No. Sheet No. Date: Time started: Time finished: Study done by:		
1	2	3	4	5
Time dep.	Time arrival	Time elapsed	Destination	Notes

Man-machine chart:

This is a chart prepared for describing graphically the activity of a man and a machine.

1. When in work shop many workers on a number of machines are at work,
2. When it is required to study number of machines a worker can operate or number of workers can operate a machine,
3. When machining cycle is to be determined, and
4. When it is required to scale down the work completion time so as to minimize the idle time of the worker and use the machines to their fullest capacity.







Travel chart:










Travel chart has the following uses:

1. A travel chart shows the mutual dependence of departments and their relative self-sufficiency.
2. It is valuable aid in analyzing and visually showing the flow and end use of materials it indicates interrelationship between different product lines.
3. It is helpful in planning routes and material handling system so maps to reduce manufacturing cycles.
4. A travel chart assist in planning location of production department so a to make best use of available floor space.
5. It is advice for reducing material handling and labor cost.

6. It is useful tool for comparing alternative layouts so as to plan best layout for the plant.

Therbligs:

Symbol	Name	Description	Colour	Pencil No
	SEARCH	Locate an article	<i>Black</i>	67
	FIND	Mental reaction	<i>Grey</i>	69
	SELECT	Selection from a number	<i>Light grey</i>	70
	GRASP	Taking hold	<i>Red</i>	19
	HOLD	Prolonged grasp	<i>Gold ochre</i>	58
	TRANSPORT LOADED	Moving an article	<i>Green</i>	45
9	POSITION	Placing in a definite location	<i>Blue</i>	29
#	ASSEMBLE	Putting parts together	<i>Violet</i>	25
U	USE	Causing a device to perform its function	<i>Purple</i>	22

U	USE	Causing a device to perform its function	<i>Purple</i>	22
	DISASSEMBLE	Separating parts.	<i>Light violet</i>	26
	INSPECT	Examine or test	<i>Burnt ochre</i>	60
	PREPOSITION	Placing an article ready for use	<i>Pale blue</i>	39
	RELEASE LOAD	Release an article	<i>Carmine Red</i>	14
	TRANSPORT EMPTY	Movement of a body member	<i>Olive green</i>	51
	REST	Pause to overcome fatigue	<i>Orange</i>	10
	UNAVOIDABLE DELAY	Idle-outside person's control	<i>Yellow</i>	6
	AVOIDABLE DELAY	Idle-within person's control	<i>Lemon yellow</i>	1
	PALN	Mental process before action	<i>Brown</i>	55

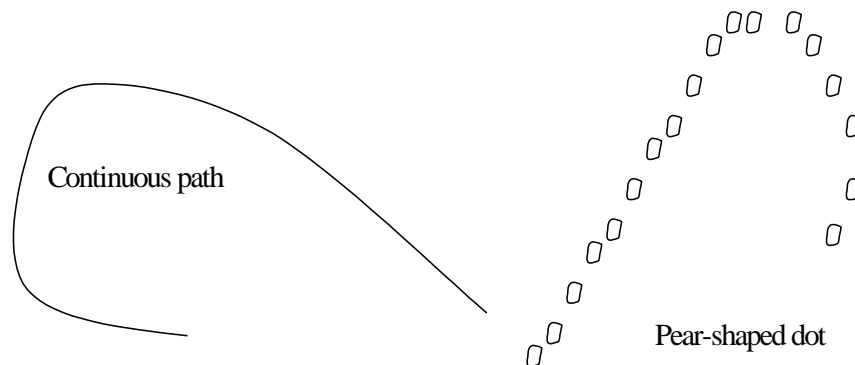
Frank Gilberth developed a set of 18 elementary motions commonly found in manual operations and called them **Therbligs** reverse spelling of his name. We know that motion study is used for deciding the best way of doing work for which present and proposed methods are observed by experts by recording on charts. For the purpose of recording the motions, he split up different motions of a process into 18 fundamental manual events made by various members of human body and each event was allotted a symbol and a letter abbreviation. These symbols and abbreviations are used for preparing motion study charts. To maximize the utility of charts sometimes, color codes are also used.

Cycle graph and chronocycle graph:

These are the photographic techniques for the study of path of movements of an operator's hands, fingers, etc. These are used especially for those movements which are too fast to be traced by human eye.

Cycle graph:

A cycle graph is a record of path of movement usually traced by a continuous source of light on a photograph; A small electric bulb is attached to hand, finger or other part of the body of the operator performing the operation. A photograph is taken by a still camera and the light source shows the path of the motion and the path of the photograph is called "cycle graph".



Cycle graph and chronocycle

Chronocycle Graph:

Cycle graph has a limitation. It will not give the direction or the speed of movements. This limitation is overcome by chronocycle graph.

The chronocycle graph is a special form of cycle graph in which the light source is suitably interrupted so that the path appears as a series of pear-shaped dots, the pointed end indicating the direction of movement and the spacing indicating the speed of movement. The time taken for the movement can be determined by knowing the rate at which the light source is being interrupted and by counting the number of dots.

WORK MEASUREMENT:

Work measurement techniques are intended to reveal the work content of a task, so that different tasks may be compared, the content is always measured in the same units as those of time.

Definition:

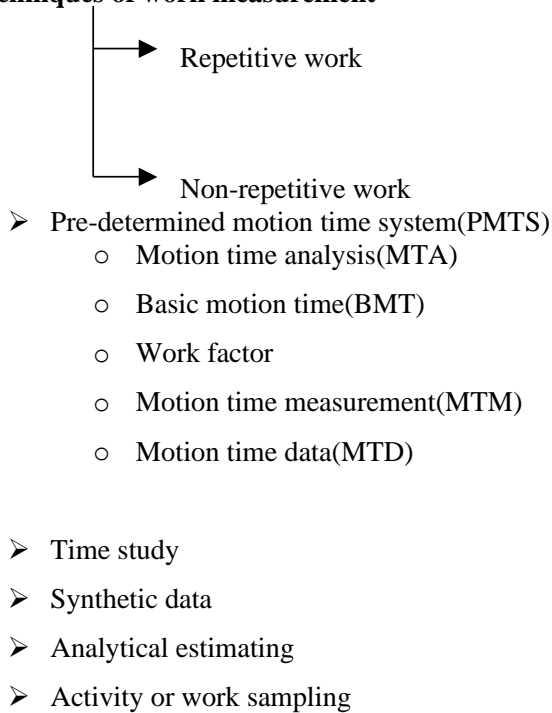
Work measurement is the application of techniques to establish the time for a qualified worker to carry out a specific work at a defined level of performance.

In other words, work measurement is the systematic determination of the proper time for the effective accomplishment of a defined task carried out by a specific method.

Objective of work measurement:

- a) Comparison
- b) Manning
- c) Control
- d) Incentives
- e) Costing
- f) Team work
- g) Delivery

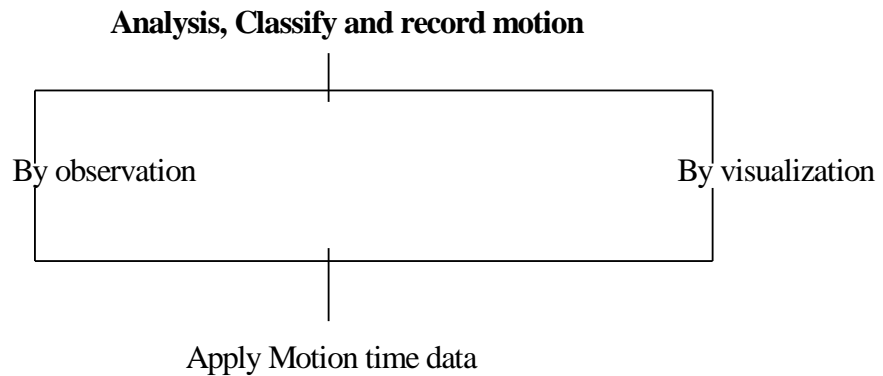
Techniques of work measurement



Predetermined motion time system:

It is work measurement techniques whereby time established for basic human motions used to build up the time for a job at defined level of performance.

The following diagram gives a quick understanding of the nature of the methods/time measurement procedure.



Time study:

A work measurement technique for recording the time and rate of working for the element of a specified job carried out under specified condition and for analysis the data so as to determine the time necessary for carrying out the job at the different level of performance.

Synthetic data:

A work measurement technique for building to the time for a job or parts of the job at a defined level of performance by totaling element time obtained previously from time studies on other jobs containing the element concerned or from synthetic data.

Analytical estimation:

It is a work measurement technique whereby time required to carry out elements of a job at a defined level of performance is estimated from knowledge and practical experience of the elements concerned.

Analytical estimation is widely used to estimate time in engineering, maintenance and construction work.

Activity or work sampling:

It is a work measurement technique in which a large number of instantaneous observation are made over a period of time of a group of machine, processes or workers such observations indicate what is happening at that instant. This concept is that random observations can produce results whose accuracy depend upon the number of observation made. This technique is also known by Random observation work sampling.

Advantages of work sampling:

1. Eliminates stop watch study.
2. Economical in bigger setups.
3. Applicable to activities that are in practical to measure by time study

4. No trained work measurement analyst required.
5. Measurement can be made with pre-assigned degree of reliability.
6. Time study events out of the results of day-today variations
7. A work sampling study may be interpretive any time with out affecting the results
8. Less resented by the workers as most stop watch or other timing devices are needed.
9. Simultaneous work sampling study of several operators is machines can be made by a single observer.

Procedural steps for conducting time study:

For conducting time study average workers and average machine are selected. Stages of time study as follows;

a) Analysis of work:

Time required for the job preparation, cleaning of machine and oiling etc should also be included. Thus time study includes the entire task performed by the workers and not only the effective work.

b) Standardization of methods :

Before conducting time study, all the constituencies of the job such as materials, equipment, tools, working conditions and methods are standardized. This method should be easy, Safe and quickest in the given conditions so that it can be accepted by workers.

c) Conducting time study:

Time study is done on a printed time study record sheet which is fixed on a board known as time study board. Different time readings are recorded in the record sheet. After reading all these readings, average time or observed time is calculated.

This average time is manipulated by a leveling factor also called rating factor. The multiple of average time and rating factors are known as normal time. The standard time is the basis for the calculation of a wages and incentives.

Thus,

Standard time= Average time * Rating factor + other allowance

Difference between method study and work measurement

<i>Point of distinction</i>	<i>Work measurement</i>	<i>Method study</i>
➤ Techniques or element	Time study, work sampling, PMTS, Analytical estimating	Motion study facilities layout, work simplification.
➤ Results	Time standards	Improved methods, equipment and sequence
➤ Uses	Cost estimation, production, scheduling, incentive planning, etc.,	Work design, time standards.

Check your Progress

Fill ups

1. In major assignment of larger magnitude and wider scope, _____ is useful in selection of specific areas for investigation
2. _____ is recording technique for micro motion study
3. A SIMO chart is a chart, based on the, used to record simultaneously o a common time scale the therbligs or a group of therbligs performed by difference parts of the body of one or more operators
4. Memo motion photographic is a form _____ which records activity by the use of cine camera adopted to take pictures at _____ than normal
5. _____ is the application of techniques to establish the time for a qualified worker to carry out a specific work at a defined level of performance.

Points to remember

1. Motion study is more detailed investigation of an individual operator, the layout of his bench or machines, the movement of his body as he performs his work.
2. Micro motion study is a much more detailed investigation of rapid movements of the hands and arms.
3. Once a method is installed, it should be maintained in its specified form and not allowed to slip back to its old form or introduction of any other unauthorized changes

4. The basis steps of method study; 'selection' poses the greatest challenge at the initial stages of any project demands exacting and crystalline areas for detailed investigation.
5. Recording techniques:
According to the nature of the job being studied and the purpose for which the record is required, the techniques fall into following categories:
 - iv. Charts.
 - v. Diagrams.
 - vi. Templates and models.

Model Questions

1. Define method study and state its objectives?

Method study is defined as "A procedure for examining the various activities of problem which ensures a systematic objective and critical evaluation of the existing facts and in addition, an imaginative approach when developing improvements".

Aims/Objects of Method study or Motion study:

- Better design of plant equipment and buildings
- Improved layout of factory and offices
- Better working conditions and environment
- High standards of safety and health
- Improved flow of work
- Better quality
- Greater job satisfaction
- High earnings
- Improved utilization of resources
- Effective material handling
- Effective process and procedure
- Optimum inventory
- Optimum output
- Improved administration
- Waste reduction
- Standardization and rationalization

2. State the procedure for method study?

Procedure for Method study:

- i. Break up operation of the job:

Make a detailed list of all operations in the present method of manufacturing job.

ii. Questioning every detail of the job:

The method study expert poses several questions to himself/herself regarding the way in which various operations are to be performed and the tools and equipment needed for the same. This is also known as critical examination that probes into the following;

- Place
- Purpose
- Sequence
- Person
- Means

iii. Develop a new method:

Before finalizing the new method, the following aspects should be taken into account during the method study.

- a. Elimination
- b. Combination
- c. Re-arrangement:
- e) Assembling
- f) Storage
- g) Inspection
- h) Dispatching

iv. Maintaining the new method:

Once a method is installed, it should be maintained in its specified form and not allowed to slip back to its old form or introduction of any other unauthorized changes.

3. Write a note on:

a) Micro-motion study

b) Time study

Ans:

Micro motion study:

Some motions require very small time and it is difficult to measure time for them accurately, but the time require for these motions cannot be neglected because they are repeated hundreds of time. There fore, the motion is filmed with the aid of a camera. Even a small time up to 0.00005 minute can be measured by this system, when a picture camera is used, the procedure is known as micro motion study.

This method gives accurate analysis, but being costly, it is used when products are likely to continue for a long time. Micro motion study has the following important advantages. It provides permanent record of study with the help of films.

- A large number of workers can see the procedure at any time even after the completion of motion study work.
- Differences in the old and new methods can be demonstrated, if both are filmed.
- Films can be demonstrated at any desired speed.
- It gives an accurate time for each motion or operation than that is recorded by the stop-watch.

Time study:

A work measurement technique for recording the time and rate of working for the element of a specified job carried out under specified condition and for analysis the data so as to determine the time necessary for carrying out the job at the different level of performance.

Synthetic data:

A work measurement technique for building to the time for a job or parts of the job at a defined level of performance by totaling element time obtained previously from time studies on other jobs containing the element concerned or from synthetic data.

Analytical estimation:

It is a work measurement technique whereby time required to carry out elements of a job at a defined level of performance is estimated from knowledge and practical experience of the elements concerned.

Analytical estimation is widely used to estimate time in engineering, maintenance and construction work.

4. Describe Micro motion study

Memo motion study:

Memo motion photographic is a form of time-lapse photography which records activity by the use of cine camera adopted to take pictures at longer intervals than normal (*time interval normally lies between ½ seconds to 4 seconds).

The filming of these various classes of works can be performed efficiently and economically by a method of time lapse cine photography known as memo motion.

5. Distinguish between method study and work measurement?

<i>Point of distinction</i>	<i>Work measurement</i>	<i>Method study</i>
➤ Techniques or element	Time study, work sampling, PMTS, Analytical estimating	Motion study facilities layout, work simplification.
➤ Results	Time standards	Improved methods, equipment and sequence
➤ Uses	Cost estimation, production, scheduling, incentive planning, etc.,	Work design, time standards.

Answer for fill ups

1. diagnostic approach
2. Simultaneous motion cycle chart (SIMO chart)
3. film analysis
4. of time-lapse photography
5. longer intervals
6. Work measurement

UNIT - III

MATERIALS MANAGERMENTS

MATERIALS MANAGERMENTS is one of the areas covered by the whole process of management for balance growth and effective running of the enterprise. It is necessary that material cost, Material supply and material utilization are so controlled that they lead to,

- Maximization of production
- Reduction in the cost of production and distribution
- Maximization of the profit.

Classification of materials:

Various items carried in a store are generally divided into the following major types and order to help the material executives and staff in maintaining the records,

1. Raw materials
2. Work-in-progress
3. Spares
4. Purchased components
5. Finished goods
6. Consumables
7. Machinery and equipments
8. Inflammables
9. Chemicals
10. Furniture
11. General stores
12. Furniture scrap materials
13. Packing materials
14. Fuel stock

Definition of material management:

- a) **BAILEY** and **FORMER** defines Materials Management as the management of flow of material into an organization to the point where there materials are converted into the firms' end product.
- b) American production and inventory control society dictionary defines Materials Management as it is a term to described the grouping of management functions related to the complete cycle of material flow, from the purchase and internal control of production materials to the

planning and control of work-in-progress, to the ware housing, shopping and distribution of the finished product. It differs from the materials control in that the latter term, traditionally is limited to the internal control of production materials.

Importance of materials management cannot be over-emphasized in this complex industrial world. It affects not only a particular industry but the entire economic activity of a whole nation. Materials contribute to the quality of the end product. The amount spend on materials is increasing in related to the expenditure on their inputs.

Materials add value to a product. The margin between the value of raw materials and the finished product is known as the value added by production.

➤ **Material management as a service function:**

Certainly materials permeate almost all activities of a manufacturing concern. Materials Management is a staff function and it serves essentially the production and marketing of manufacturing goods. However, DATTA holds that Management of materials "is some activity".

➤ **Material Management as a science or art:**

Material Management is both a science as well as an art of managing materials. It is an application to achieve the desired results:

Three segment of Management;

1. Arranging for finance:

Making provision for the operation of the enterprise for which the management has to ensure the availability of adequate finance for a smooth functioning of the organization without any interruption.

2. Assembly, acquisition, storage and production of materials:

This in fact is the function of actual operation of the enterprise for an efficient and purposeful operation of the enterprise, materials are to be produced so that the organization may move ahead uninterrupted with speed and goodwill.

3. Distribution:

The organization operates for the ultimate consumer. It is the basic function of any management to arrange the distribution so as to get the goods and services reach the ultimate consumer.

Obviously management of materials largely depends on;

- I. Adequate availability of finance
- II. Proper procurement storage and utilization of materials

III. Effective handling, issuance and disposal of incoming and outgoing materials.

Integrated approach to materials management:

The essence of materials management is the coordination of the various departments of a company.

Only an integrated approach to the various problems of materials management can result in optimum benefits.

An integrated approach to materials management is only a concentrated and co-coordinated effort for obtaining greater efficiency in the field of materials utilization and costs.

I. Purchasing:

Purchasing department procures materials as per requirements to meet quality and time specifications. The main activities include:

- Selecting acceptable vendors and negotiating with them on purchase terms, price, quality and other related factors.
- Interacting with vendors to develop materials specifications, to control quality and to solve problems involved in receipt and usage of materials.
- Placing purchase orders for materials, and services, considering economic levels, blanket or open orders and vendor performance.
- Expediting delivery of materials.
- Keeping a breast of prevailing market conditions and knowing that results cost reduction.

II. Receiving and store:

The receiving and store functions accepts, store handle and issue materials and process the necessary documents to record transactions.

Their major activities include:

- a) Receipt of materials, verification of quality and preparation of material received reports
- b) Storage of materials in accordance with pre-specific use of stores by using the right facilities and equipment and practicing a system to enable the easy identification of materials.
- c) Issuing materials upon authorized requisition.
- d) Physical check of stock to verify accuracy of transactions through constant, special and annual inventories.

Objectives of Materials Management

Objectives of materials managements are listed below:

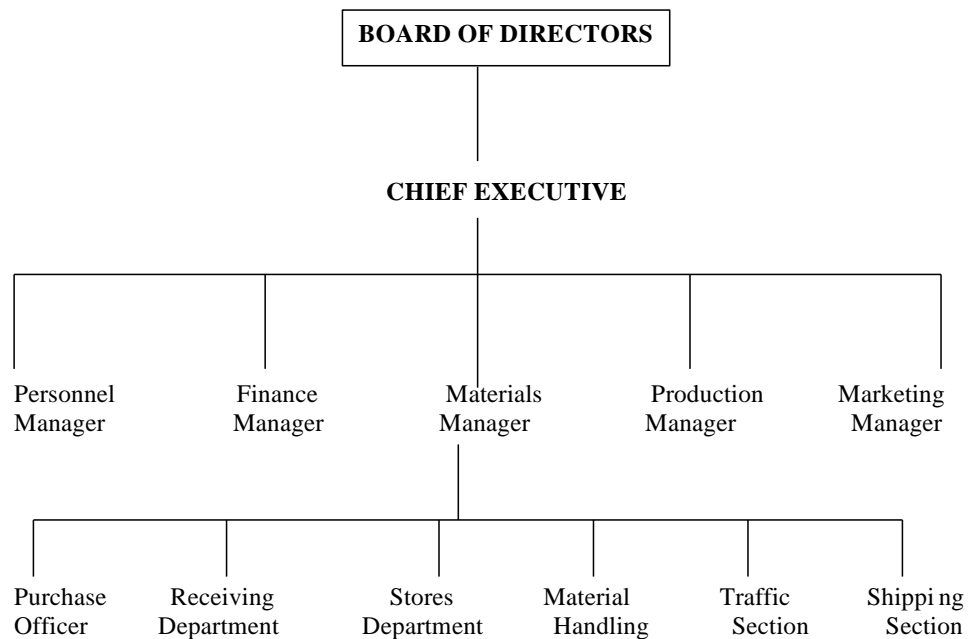
- ❖ To ensure an uninterrupted production or operation, by maintaining a steady flow of materials.
- ❖ To effect economies in the costs of materials by purchasing materials of the right quality, in the right quantity, at the right time, from the right source, and at the right price.
- ❖ To effort economies in the costs incurred on materials purchased through storage, processing and warehousing, till the finished goods reach the customer ultimately.
- ❖ To reduce working capital requirements through proper and scientific inventory control.
- ❖ To be alive to the changes in the market in respect of new products, etc.
- ❖ To improve the quality of manufactured goods by the use of better raw materials or components and thereby increase the competitiveness of goods put on sale.
- ❖ To also increase the competitiveness of manufactured goods by reducing their prices through cost reduction and value analysis.
- ❖ To save foreign exchange through import substitution and economizing on foreign purchases.
- ❖ To ensure proper co-operation among all departments of the organization to meet objectives of the materials management, both at the corporate and functional levels.
- ❖ To conserve material resources within the organization, thereby contributing to the conservation of national resources.

Functional areas of Material Management:

Functions of materials management, thus, may broadly be identified to the following areas:

1. Planning and sourcing
2. Budgeting
3. Researching and analyzing
4. Indenting and procuring
5. Receiving and dispatching; and
6. Accounting and controlling
7. Issuing and dispatching; and
8. Disposing

Organization of Materials Management



Functional Areas of Material Management:

a) Materials Management as a prime corporate function:

Material Management plays a key role in the management of the organization and is considered as a top-level corporate activity. The Material Manager directly reports to the chief executive. Materials Management is treated as an important area of management like production, Marketing, finance and personnel.

e.g: In process industries, where little layout is added to the raw materials for the conversion into finished products, the cost of the materials may be as high as 60% to 70% of the production costs.

In such situation financial considerations are greater than manufacturing responsibilities, and hence instead of considering the materials manager subordinate to the works manager, he is put at par with him.

b) Materials management as an operating function:

Under this, the function of materials management is considered subordinate to the production function. The material manager acts as an subordinate to the works manager. Material Management is considered as a service function to operations and is regulated with the other operations under the control and superintendence of the works manager.

Check the progress:

Fill ups

1. _____ as the management of flow of material into an organization to the point where there materials are converted into the firms' end product.
2. The margin between the value of raw materials and the finished product is known as the _____
3. _____ is the basic function of any management to arrange the distribution so as to get the goods and services reach the ultimate consumer.
4. _____ procures materials as per requirements to meet quality and time specifications.
5. Material Management plays a key role in the management of the organization and is considered as _____

Points to remember

1. Materials Managements is one of the areas covered by the whole process of management for balance growth and effective running of the enterprise
2. It is necessary that material cost, Material supply and material utilization are so controlled that they lead to,
 - Maximization of production
 - Reduction in the cost of production and distribution
 - Maximization of the profit.
3. The receiving and store functions accepts, store handle and issue materials and process the necessary documents to record transactions

Model Questions

1. Define Material Management and classification of materials?

Definition of material management:

BAILEY and FORMER define Materials Management as the management of flow of material into an organization to the point where there materials are converted into the firms' end product.

American production and inventory control society dictionary defines "Materials Management" as it is a term to descried the grouping of management functions related to the complete cycle of material flow, from the purchase and internal control of production materials to the planning and control of work-in-progress, to the ware housing, shopping and distribution of the finished product. It differs from the materials control in that the latter term, traditionally is limited to the internal control of production materials.

Classification of materials:

Various items carried in a store are generally divided into the following major types and order to help the material executives and staff in maintaining the records,

- Raw materials
- Work-in-progress
- Spares
- Purchased components
- Finished goods
- Consumables
- Machinery and equipments
- Inflammables
- Chemicals
- Furniture
- General stores
- Furniture scrap materials
- Packing materials
- Fuel stock

2. Explain Material Management as a science or art?

Material Management is both a science as well as an art of managing materials. It is an application to achieve the desired results:

Three segment of Management;

i. Arranging for finance:

Making provision for the operation of the enterprise for which the management has to ensure the availability of adequate finance for a smooth functioning of the organization without any interruption.

ii. Assembly, acquisition, storage and production of materials:

This in fact is the function of actual operation of the enterprise for an efficient and purposeful operation of the enterprise, materials are to be produced so that the organization may move ahead uninterrupted with speed and goodwill.

iii. Distribution:

The organization operates for the ultimate consumer. It is the basic function of any management to arrange the distribution so as to get the goods and services reach the ultimate consumer.

Obviously management of materials largely depends on;

- Adequate availability of finance
- Proper procurement storage and utilization of materials
- Effective handling, issuance and disposal of incoming and outgoing materials

3. Describe integrated approach to material management?

Integrated approach to materials management:

The essence of materials management is the coordination of the various departments of a company.

Only an integrated approach to the various problems of materials management can result in optimum benefits.

An integrated approach to materials management is only a concentrated and co-coordinated effort for obtaining greater efficiency in the field of materials utilization and costs.

i. Purchasing:

Purchasing department procures materials as per requirements to meet quality and time specifications. The main activities include:

- Selecting acceptable vendors and negotiating with them on purchase terms, price, quality and other related factors.
- Interacting with vendors to develop materials specifications, to control quality and to solve problems involved in receipt and usage of materials.
- Placing purchase orders for materials, and services, considering economic levels, blanket or open orders and vendor performance.
- Expediting delivery of materials.
- Keeping a breast of prevailing market conditions and knowing that results cost reduction.

ii. Receiving and store:

The receiving and store functions accepts, store handle and issue materials and process the necessary documents to record transactions.

4. Write the objectives of materials management?

Objectives of materials managements are listed below:

- ❖ To ensure an uninterrupted production or operation, by maintaining a steady flow of materials.
- ❖ To effect economies in the costs of materials by purchasing materials of the right quality, in the right quantity, at the right time, from the right source, and at the right price.

- ❖ To effort economies in the costs incurred on materials purchased through storage, processing and warehousing, till the finished goods reach the customer ultimately.
- ❖ To reduce working capital requirements through proper and scientific inventory control.
- ❖ To be alive to the changes in the market in respect of new products, etc.
- ❖ To improve the quality of manufactured goods by the use of better raw materials or components and thereby increase the competitiveness of goods put on sale.
- ❖ To also increase the competitiveness of manufactured goods by reducing their prices through cost reduction and value analysis.
- ❖ To save foreign exchange through import substitution and economizing on foreign purchases.
- ❖ To ensure proper co-operation among all departments of the organization to meet objectives of the materials management, both at the corporate and functional levels.
- ❖ To conserve material resources within the organization, thereby contributing to the conservation of national resources.

5. What are the functional area of material management?

The functional area of material management

a) Materials Management as a prime corporate function:

Material Management plays a key role in the management of the organization and is considered as a top-level corporate activity. The Material Manager directly reports to the chief executive. Materials Management is treated as an important are of management like production, Marketing, finance and personnel.

e.g: In process industries, where little layout is added to the raw materials for the conversion into finished products, the cost of the materials may be as high as 60% to 70% of the production costs.

In such situation financial considerations are greater than manufacturing responsibilities, and hence instead of considering the materials manager. Subordinate to the works manager, he is put at par with him.

b) Materials management as an operating function:

Under this, the function of materials management is considered subordinate to the production function. The material manager acts as an subordinate to the works manager. Material Management is considered as a

service function to operations and is regulated with the other operations under the control and superintendence of the works manager.

Answer for fill ups

1. Materials Management
2. value added by production
3. Distribution
4. Purchasing department
5. a top-level corporate activity.

MATERIAL PLANNING:

Material planning is a part of production planning. In fact for an effective inventory control production plan should be converted into materials plans. This enables the management in clearly defining the quantity and the time schedule of the requirements. In the integrated materials management, production and materials planning get a pride of place. Inventories consume a larger part of working capital. Material planning provides a mechanism for inventory control.

Definition:

"Material planning" say P.Gopalakrishnan and M.Sundaresan, "is then scientific way of determining the requirements of raw materials, components, spares and other items that go into meeting production needs within the economic investment policies."

Technique of Materials Planning:

The under mentioned two techniques usually used for materials planning:

1. Bill of material technique and
2. Past consumption Analysis technique

Bill of materials technique:

A bill of materials indicates the name, part number, and usage of each component and the sub-assembly in which it is to be used. Each product has a bill of materials since each of the products has its own requirements dependent on its design and according to the engineering designs and the components consisting of standard parts needed for a particular product to be manufactured.

When any of the units of the organization receives a work order or a production programme is finalized, the concerned foremen prepare a list of all the materials required for the execution of the order or manufacturing of the product as per production programme.

Once the production programme is finalized each product is exploded into its basic requirement with the help of its bill of materials.

The Bill of Material (BOM) - is the simplest technique of material planning. The Bill of Material required lead time and necessary contingency provisions are drawn which eventually turns into indents for procurement. It also acts as a guide to delivery and inventory requirements. A bill of materials is also helpful in avoiding the locking of funds unnecessarily by proper scheduling the orders, delivery and arrival of materials.

Past consumption analysis technique:

Where material is consumed on continuous basis the technique of Past consumption analysis for materials planning is conveniently used by the organization. According to the technique future projection is made on the basis of the past consumption data, which is analyzed taking into account the past as well as future production plans. Statistical tools like Mean, Median, Mode and Standard deviation are used in analyzing the past consumption, projecting the future and tackling mild as well as wild fluctuations in consumption. This technique can be successfully used in process industries.

MATERIAL BUDGETING:

A budget is a coordinated financial estimate of the income and expenditure of an organization related to a specific future period. "Budget", Says A.K.Datta, "is plans of action quantified in money terms for some future period in time. He further adds: "It serves as the predetermined criterion which is essential for any control system. The most important single concept of budgeting, therefore, is to determine what should be the results or at least what is expected from a given plan of action."

Material Budget

A material budget is a coordinated estimate of the consumption and purchases of materials in an organization relating to a specified period.

The purpose of a materials budget is as given below:

1. To plan the purchases
2. To control purchases
3. To assess the financial requirement for the budgeted purchases
4. To make provision for finances as per the requirements
5. To plan the consumption of the materials in the concerned departments
6. To control the consumption of the materials
7. To take into account the production schedule while planning and controlling the consumption of materials
8. To watch the performance of the purchase and materials control departments

9. To detect the deviations trace the defects and apply correctives
10. To make adjustment for error made in the compilation of a materials budget, and
11. To suggest ways and means for improvement in the next budget.

Materials budgeting and accounting

Accounting has to play a very important role in materials budgeting. The technique help of cost and stores accounting by way of providing up-to-date, reliable and required data to the materials control department enables it to base its forecasts on the data so supplied. The cost and stores accounting are both to supply the required information. Both of them are complementary to each other in this respect. To watch the performance and to suggest corrective measures, the help of accounting has to be taken. Accounting and materials budgeting go together for achieving the set objectives of the organization.

A material budgeting helps in controlling the costs and thus makes the organization cost conscious. Material budgeting aims at cost reduction.

Techniques of Drawing up a Materials Budget:

One of the following positively correlated techniques is generally made use of drawing up a materials budget:

1. Budget Summaries
2. Manufacturing and/or Trading Account.
3. Savings on investment in materials.

1. Budget Summaries

Budget summaries are summaries of various individual budgets of the organization. They are placed in proper relationship with one another. They are viewed and analyzed and help is taken from them in arriving at a certain conclusion for the purpose of incorporation of a budget estimate. A material budget is drawn up in relation to production, sales and purchase budgets.

The merits of the technique:

- a) Budget summaries are concrete numerical standards which provide a good base for the next budget estimates.
- b) Budget summaries describe the position briefly and are arranged in such an analytical and comparable form that they help in drawing conclusions correctly.
- c) Budget summaries throw light on the activities of various departments. This makes planning effective.

The Limitations of the technique:

- a) Budget variations are always there. The variations may be of minor as well as major nature. Budget summaries may give equal importance to both types of variations which ought not to have been treated on equal terms.
- b) Budget figures are often manipulated so as to balance the requirements and funds available. This may result in faulty conclusions and thus the next budget estimate may also become faulty.
- c) Budget summaries are merely numerical standards. They speak only about estimates and a little bit of performance, but they do not ensure profitable operations.

2. Manufacturing and/or trading account

This technique is comparatively result-oriented. As it is based on the performance of the budget vis-à-vis the result. This account reveals in detail various item relating to the opening stock, purchases, expenses on purchases, production, closing stock, work-in-progress, etc., and finally the cost of the production and/or profit made out of manufacturing and/or trading process.

The Merits of the technique:

- (a) This technique is result-oriented and thus a good base for budget estimates.
- (b) It stresses profitability aspect on each of the correlated budget of the various departments. Thus efficiency and performance becomes the keynote of various budgets.
- (c) Pro-rata analysis of the result is possible. Thus periodical and flexible budgets become a possibility.

The Limitation of the technique:

- (a) It involves much paper work and thus becomes too heavy a burden for an organization of relatively small size.
- (b) There may be cases in which proper allocation of expenses to one or other of the items may not be feasible.
- (c) The result-oriented budget framing technique may result in inter-departmental rivalry, which ultimately may not prove to be good for the organization as a whole.

3. Savings on Investment in Materials

The overall performance of an organization can be judged by the profit it has made during a specified period and a budget is a means to setting the objective of profit making in a right perspective through its estimates based on

returns on investment. The materials budget consumes the major portion of funds available in the organization, hence it is appropriate to measure the performance of materials budget by finding out the saving on the investment made in the past and possible expected saving in future.

The ratio of savings achieved to total investment may be analyzed on the basis of the following equation:

$$\frac{\text{Savings}}{\text{Investment}} = \frac{\text{Savings}}{\text{Value of material utilized}} * \frac{\text{Value of materials utilized}}{\text{Investment}}$$

The merits of the technique:

- (a) Objectives are clearly defined, which give a realistic approach in materials budgeting.
- (b) It can also be effectively used in other inter related departments.
- (c) As detailed analysis is possible, a remedial action for disturbing trends may be taken.
- (d) It makes possible the effective use of scarce means available to the organization.

The limitation of the technique:

- (a) It lays too much emphasis on the financial aspects.
- (b) The savings so arrived at are based on past performances. Future budgeting is based on calculations. The result, thus, may be misleading.
- (c) Much paper work, labour and calculation are required, but they may not be worthwhile for a small-sized business.

The framers of material should take into consideration the points enumerated below:

- i. The objectives and policies of the organization.
- ii. The period of budget.
- iii. The data available.
- iv. Flexibility of a budget.
- v. Repetition of past targets.
- vi. Ambitious budgeting.

Check the progress:

Fill ups

- 1. _____ Provides a mechanism for inventory control.
- 2. _____ is helpful in avoiding the locking of funds unnecessarily by proper scheduling the orders, delivery and arrival of materials.

3. A budget is a coordinated financial estimate of the _____ of an organization related to a specific future period
4. _____ are merely numerical standards
5. A material budgeting helps in _____ and thus makes the organization cost conscious.

Points to remember

1. Material planning is a part of production planning.
2. In fact for an effective inventory control production plan should be converted into materials plans. This enables the management in clearly defining the quantity and the time schedule of the requirements
3. The under mentioned two techniques usually used for materials planning:
 - Bill of material technique and
 - Past consumption Analysis technique
4. A bill of materials indicates the name, part number, and usage of each component and the sub-assembly in which it is to be used
5. Budget is plans of action quantified in money terms for some future period in time.
6. The ratio of savings achieved to total investment may be analyzed on the basis of the following equation:

$$\frac{\text{Savings}}{\text{Investment}} = \frac{\text{Savings}}{\text{Value of material utilized}} * \frac{\text{Value of materials utilized}}{\text{Investment}}$$

Model Questions

1. What is material planning and its techniques?

MATERIAL PLANNING:

Material planning is a part of production planning. In fact for an effective inventory control production plan should be converted into materials plans. This enables the management in clearly defining the quantity and the time schedule of the requirements. In the integrated materials management, production and materials planning get a pride of place. Inventories consume a larger part of working capital. Material planning provides a mechanism for inventory control.

Definition:

"Material planning" say P.Gopalakrishnan and M.Sundaresan, "is then scientific way of determining the requirements of raw materials, components, spares and other items that go into meeting production needs within the economic investment policies."

Technique of Materials Planning:

The under mentioned two techniques usually used for materials planning:

3. Bill of material technique and
4. Past consumption Analysis technique

Bill of materials technique:

A bill of materials indicates the name, part number, and usage of each component and the sub-assembly in which it is to be used. Each product has a bill of materials since each of the products has its own requirements dependent on its design and according to the engineering designs and the components consisting of standard parts needed for a particular product to be manufactured.

When any of the units of the organization receives a work order or a production programme is finalized, the concerned foremen prepare a list of all the materials required for the execution of the order or manufacturing of the product as per production programme.

Once the production programme is finalized each product is exploded into its basic requirement with the help of its bill of materials.

The Bill of Material (BOM) - is the simplest technique of material planning. The Bill of Material required lead time and necessary contingency provisions are drawn which eventually turns into indents for procurement. It also acts as a guide to delivery and inventory requirements. A bill of materials is also helpful in avoiding the locking of funds unnecessarily by proper scheduling the orders, delivery and arrival of materials.

Past consumption analysis technique:

Where material is consumed on continuous basis the technique of Past consumption analysis for materials planning is conveniently used by the organization. According to the technique future projection is made on the basis of the past consumption data, which is analyzed taking into account the past as well as future production plans. Statistical tools like Mean, Median, Mode and Standard deviation are used in analyzing the past consumption, projecting the future and tackling mild as well as wild fluctuations in consumption. This technique can be successfully used in process industries.

2. Explain material budgeting and its purpose of a materials budget?

Material Budget

A material budget is a coordinated estimate of the consumption and purchases of materials in an organization relating to a specified period.

The purpose of a materials budget is as given below:

- To plan the purchases

- To control purchases
 - To assess the financial requirement for the budgeted purchases
 - To make provision for finances as per the requirements
 - To plan the consumption of the materials in the concerned departments
 - To control the consumption of the materials
 - To take into account the production schedule while planning and controlling the consumption of materials
 - To watch the performance of the purchase and materials control departments
 - To detect the deviations trace the defects and apply correctives
 - To make adjustment for error made in the compilation of a materials budget, and
 - To suggest ways and means for improvement in the next budget.
3. Write a note on material budgeting and accounting?

Materials budgeting and accounting

Accounting has to play a very important role in materials budgeting. The technique help of cost and stores accounting by way of providing up-to-date, reliable and required data to the materials control department enables it to base its forecasts on the data so supplied. The cost and stores accounting are both to supply the required information. Both of them are complementary to each other in this respect. To watch the performance and to suggest corrective measures, the help of accounting has to be taken. Accounting and materials budgeting go together for achieving the set objectives of the organization.

A material budgeting helps in controlling the costs and thus makes the organization cost conscious. Material budgeting aims at cost reduction.

4. Define Budget Summaries its merits and limitations?

1. Budget Summaries

Budget summaries are summaries of various individual budgets of the organization. They are placed in proper relationship with one another. They are viewed and analyzed and help is taken from them in arriving at a certain conclusion for the purpose of incorporation of a budget estimate.

A material budget is drawn up in relation to production, sales and purchase budgets.

The merits of the technique:

- Budget summaries are concrete numerical standards which provide a good base for the next budget estimates.

- Budget summaries describe the position briefly and are arranged in such an analytical and comparable form that they help in drawing conclusions correctly.
- Budget summaries throw light on the activities of various departments. This makes planning effective.

The Limitations of the technique:

- Budget variations are always there. The variations may be of minor as well as major nature. Budget summaries may give equal importance to both types of variations which ought not to have been treated on equal terms.
- Budget figures are often manipulated so as to balance the requirements and funds available. This may result in faulty conclusions and thus the next budget estimate may also become faulty.
- Budget summaries are merely numerical standards. They speak only about estimates and a little bit of performance, but they do not ensure profitable operations.

5. Explain savings on investments in materials?

Savings on Investment in Materials

The overall performance of an organization can be judged by the profit it has made during a specified period and a budget is a means to setting the objective of profit making in a right perspective through its estimates based on returns on investment. The materials budgets consumes the major portion of funds available in the organization, hence it is appropriate to measure the performance of materials budget by finding out the saving on the investment made in the past and possible expected saving in future.

The ratio of savings achieved to total investment may be analyzed on the basis of the following equation:

$$\frac{\text{Savings}}{\text{Investment}} = \frac{\text{Savings}}{\text{Value of material utilized}} * \frac{\text{Value of materials utilized}}{\text{Investment}}$$

Answer for fill ups

Material planning

A bill of materials (BOM)

income and expenditure

Budget summaries

controlling the costs

UNIT - IV

INVENTORY CONTROL

INVENTORY CONTROL:

Inventory is a stock of physical goods held at a specific location and at a specific time. Each distinct item in the inventory at a location is termed stock keeping unit (SKU); and each skill has a number of units in stock. Each location is a stock point.

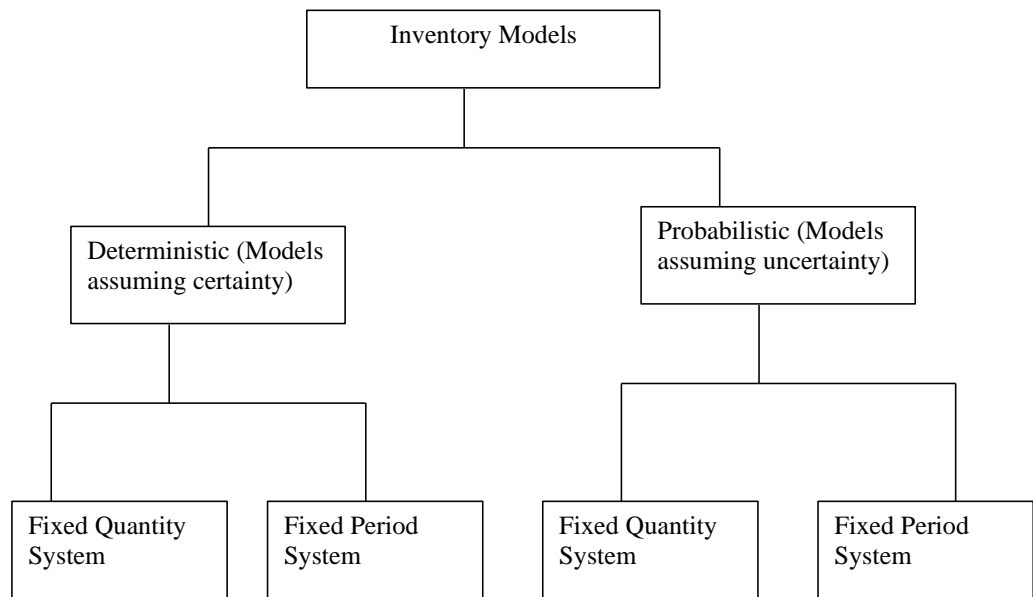
Inventory Control Techniques

In most manufacturing concerns, inventories are controlled through the following techniques:

- (i) Economic Order Quantity
- (ii) Determination of stock Levels (Min-Max Plan)
- (iii) Inventory Control Ratios and Indexed
- (iv) Ageing Schedule of inventory
- (v) Input-Output Ratio Analysis
- (vi) Perpetual and periodic stock taking systems
- (vii) Order cycling system
- (viii) Two Bin systems
- (ix) Selective Inventory control
- (x) Materials requirement planning
- (xi) Just-in-Time
- (xii) Value Analysis

Inventory Models

One of the basic problems of inventory management is to find out the order quantity so that it is most economical from overall operational point of view. Here, the problem lies in minimizing the two conflicting costs, i.e., ordering cost and inventory carrying cost. Inventory models help to find out the order quantity which minimizes the total costs (Sum of ordering costs and inventory carrying costs). Inventory models are classified as shown in the following figure.



Inventory Models

Costs Associated with Inventory Decisions

They are the four major costs, associated with inventory decisions. They are:

a) Material Cost:

It is the costs of material itself. It is the purchasing (or production) cost, i.e., the value of an item is its unit purchasing (production) cost. This cost becomes significant while availing price discount. This cost is expressed as Rs./Units.

Opportunity Cost:

The amount invested in an item, (Capital costs) is an amount of capital not available for other purposes. If money were invested somewhere else, a return on the investment is expected.

A charge to inventory expenses is made to account for this return not received. The amount of charge reflects the percentage of return expected from other investment.

b) Ordering (Procurement) Costs:

These costs are associated with the purchasing or ordering of materials, i.e., processing and generating an order with its related paper work. They consist of -

- ❖ Rent for the space used by the purchase department.
- ❖ Salaries payable to the purchasing staff.
- ❖ Paper work i.e., stationery and other consumables required by the purchase department.

- ❖ Cost of inviting quotations/tenders.
- ❖ Costs of processing quotations/tenders.
- ❖ Cost of placing the purchase order.
- ❖ Postage, telegram, telex, fax, e-mail, etc., for expediting orders.
- ❖ Traveling expenses.
- ❖ Depreciation of furniture, etc., in the purchase department.
- ❖ Entertainment and refreshment expenses to vendors.
- ❖ Legal and court fee due to legal matters arising out of purchase, etc.,

Inventory carryings costs:

These costs are incurred for carrying the inventory i.e., maintaining a particular level of inventory. These costs consist of seven different elements:

1. Financing cost (4 to 6%):

If the inventory is financed by bank borrowing, the interest paid on such bank loans is its financing costs.

2. Insurance charges (1 to 2%):

These are incurred for protecting the company against loss of inventory due to fire, theft, etc.

3. Property taxes (1 to 2%):

As with insurance, property taxes are levied on the assessed value of a firm's assets. The greater the inventory value, the greater the asset value, and consequently the higher the firm's expenses on tax.

4. Storage expenses (3 to 4%):

These includes salaries payable to store keeping staff, rent for space, cost of storage facility like bins, racks, etc., lighting, cooling and other expenses incurred where inventory is stored.

5. Handling expenses (3 to 4%):

They are incurred for moving the inventory from stores to shops-floor and back. Certain handling expenses may become necessary for movement of inventory, especially work-in-process from one section to another on the shop floor.

6. Cost of deterioration, spoilage, pilferage, etc., (2 to 4%):

For many items, there is usually a specified shelf-life such as drugs, chemicals, photo films, vulcanized rubber, etc.; If the expiry date is over for these products they become totally useless.

7. Cost of obsolescence (3 to 5%):

Industries which are fashion-based such as readymade apparels or technology oriented such as manufacture of electronic calculators, incur a heavy loss if their products become obsolete and out of date.

c) Stock-out costs:

They are invisible, yet very important costs which a company has to incur if there is a stock-out, resulting in a loss of production. These costs are in the form of loss of profit on lost production, loss of good will, adverse impact on future orders, and adverse impact on machinery, etc., because of lack of use. Stock-out indicates poor service.

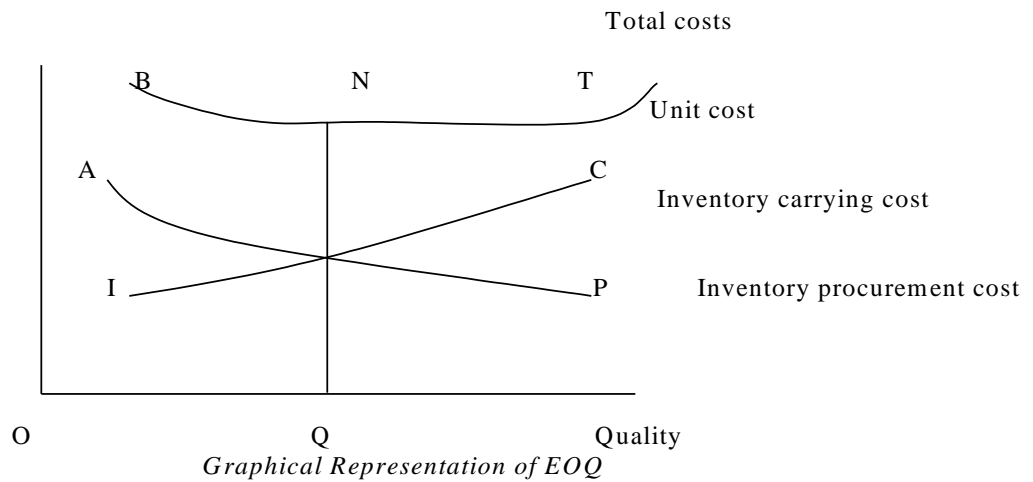
The stock-out and the carrying costs are counter balancing. The larger the safety stock, the larger the carrying stock and vice versa. Conversely, the larger the stock, the smaller the stock-out costs. In other words, if the firm minimizes the carrying out costs, the stock-out costs are likely to raise. On the other hand, an attempt to minimize the stock-out costs implies increased carrying costs. The object of a materials manager should be to have the lowest total costs (i.e., carrying cost plus stock-out costs). In brief, the appropriate level of safety stock is determined by the trade-off between the stock-out costs and the carrying out costs.

Different Between excess stock and stock-outs

<i>Cost of carrying</i>	<i>Cost of non carrying enough</i>
➤ Interest on investment in inventory	Foregone quantity discounts
➤ Insurance charges	Disruption in production schedule
3. Warehousing and storage expenses	Inability to meet consumers' requirements
➤ Material handling and clerical charges	Loss of profit on lost sales
➤ Deterioration and spoilage	Loss of consumers' goodwill
➤ Obsolescence	Foregone fortuitous purchases
➤ Personal and property taxes	Emergency purchasing cost

ECONOMIC ORDER QUANTITY

The economic order quantity refers to the quantity ordered to be purchased at the lowest total costs. This is the most economical purchase quantity which maintained a balance between two opposing costs of procurement and carrying. The economic order quantity is also known as economic lot size. So, the quantity to be ordered at a time is determined by the cost of procurement and the cost of carrying the inventories. The economic order quantity will be the one where the cost of procurement and the cost of carrying are equal. At this point the total cost is minimum.



Bulk buying reduces the frequency of ordering and therefore, the ordering costs.

The determination of Economic Order Quantity (EOQ) is primarily intended to balance the ordering costs and the carrying costs.

EOQ can be determined with the help of the following formula:

$$EOQ = \sqrt{\frac{2 * \text{Annual consumption in units} * \text{costs per order}}{\text{Price per unit} * \text{carrying cost expressed as a percentage of total investment in inventory}}}$$

BASIC ASSUMPTIONS OF EOQ MODEL

The basic EOQ model, like all fixed order quantity models, is based on a number of assumptions. If an organization's inventory situation matches the model's assumptions, the model's results will be valid. The assumptions for the basic *EOQ model include the following:*

- Annual carrying costs per unit and costs per order can be accurately estimated and are the only relevant costs.
- Annual demand can be estimated and is linearly consumed by customers. This assumption requires the annual demand estimate to be known with certainty. We know that annual demand estimates can seldom be known with certainty.
- Average inventory level is the order quantity 'Q' divided by 2. This safety stock is left over from a previous period, then average inventory would be greater than Q/2.

- With demand linear and certain, their need not be any stock-out costs.
- There are no quantity discounts on large orders.
- Lead time is known, fixed and independent of demand.
- Inventory has one stock point. Stock (Storage) point is a location of inventory.

Weakness of EOQ formulae:

i) Erratic usages:

The formulae we have used assume that the usage of materials is both predictable and even disturbed. When this is not the case the formulae are useless. Different and far more complex formulae can be developed for wide swings in usage, so long as these swings can be predicted. But if usage varies unpredictably, as it often does, no formula will work well.

ii) Faulty basic information:

EOQ calculations are only as accurate as the order cost and carrying cost information in which they are based.

iii) Costly calculations:

It is not an easy job to estimate the cost of acquisition and cost of possession accurately. This requires hours of work by skilled cost accountants. In many cases, the cost of estimating cost of possession and acquisition and calculating EOQ exceeds the savings made by buying that quantity.

iv) EOQ ordering must be tempered with judgment:

Certain operating goals must be followed in managing an inventory sometimes; the guidelines provide a conflict in ordering. EOQ restriction might include the following:

- Items purchased to order, and items subject to rapid product improvement will be restricted from EOQ use.
- Shelf life items (goods to be consumed within a specific period of time) should be restricted to a limited quantity.
- Items with unusual sales will be identified, with annual sales reduced by appropriate quantities, prior to calculating EOQ.
- Critical supply items (those having most effect on customer's service). The time of supply of quantities selected will over-ride EOQ.

Objectives of EOQ Models:

Some of the objection that are frequently heard about EOQ are as follows;

- i. Often the inventory holding costs and the ordering costs cannot be accurately calculated and some times cannot even be identified properly.

- ii. The EOQ calculated is often an inconvenient number.
- iii. The use of EOQ usually leads to random orders so that supplier receives an irregular stream of orders.
- iv. EOQ applied without due regard to the possibility of falling demand can lead to a high value of obsolescent inventory.
- v. EOQ may not be applicable when the requirements are irregular, or t where there is an impending price raise.

Limitation of EOQ:

Some of the limitations of EOQ are as follows;

1. Ordering in package sizes:

Ordering to the nearest "Trade" quantities are or as per convenient packages. For e.g., Instead of ordering 11 dozens, the order may be for 1 gross.

2. Economical Freight rate:

The saving in freight may more than compensate the extra inventory carrying costs.

3. Simplification of routine:

Instead of ordering for e.g., 14 times a year, order may be placed every month.

4. Perishables are articles having low shelf life:

In case of perishable or bulky items with diminishing consumption or for items whose market prices are likely to decline, it is better to order less than the theoretically worked out quantities.

5. Seasonal articles:

Seasonal supply factors, market conditions, availability of transport facilities etc., may indicate purchase of larger or smaller quantities. In such situations, proper judgment alone helps.

6. Consolidates discounts:

Liberal discount or concessional freight rates may suggest larger quantities. The "pros" and "cons" of such purchases should be weighed carefully before a decision is taken.

7. Imports:

EOQ cannot be successfully applied in case of imports with attained problems of obtaining import license, and certain lead-times, etc.,

General Procedure for implementing ABC Techniques:

Given below are the various types of selective inventory control and their application criteria.

<i>Classification</i>	<i>Criteria</i>
ABC (sometime nick-named Always Better Control)	Annual value of consumption of the items concerned. (It has nothing to do with the unit value of the item)
VED (Vital, essential and desirable) (Vir-Vital, important and routine)	By the Priority and critical nature of the components or material with respect to production.
FSN (Fast moving, Slow moving and Non-moving)	Issues from stores (frequency of consumption)
XYZ analysis	The inventory value of items stored.

Control through ABC analysis

Different types of analysis, each having its own specific advantages and purposes, help in bringing a practical solution to the inventory control. The most important of all such analysis is ABC analysis which is believed to have originated in the General Electric Company of United States of America.

An effective inventory control system should classify inventories according to their values so that the most valuable items may be paid greater attention regarding the safety and care as compared to others. Hence, it is desirable to classify the production and supply items, both purchased and manufactured, depending upon their importance, each class or group of items to control commensurate with importance. This is the principles of Control by Importance and Expectations (CIE) or selective control as applied to inventories and the technique of grouping is termed as ABC analysis or classification which is said to be "Always Better Control". As the items are classified in the importance of their relative values this approach is also known as proportional, Parts Value Analysis (PVA) or Annual Usage Value (AUV) Analysis.

General procedure for Implementing ABC techniques:

The general procedure for implementing the ABC techniques is as follows:

- Classify the items of inventories.
- Determine the expected use in (Physical) units over a give period.
- Determine the price per unit of each item.
- Determine the total cost of each item by multiplying the expected units by its unit price.

- Rank the items in accordance with total cost, allotting first rank to the item with highest total cost and so on (i.e., Arrange in descending order).
- Find out the total number of units i.e., total units of all items and calculate the percentage of each item.
- Calculate the percentage of total cost of each item to total cost of all items.
- Combine items on the basis of their relative value to form three categories-A, B and C e.g., classify the inventory as A, B or C. Class A items having high consumption 15%, class B items having moderate consumption 30% and class C items having low consumption value from the remaining 55%.
- Decide cut-off points and methods of control.
- Tag the inventory with A, B, C classification and record these classifications in the item inventory master record.

Control policy guidelines for class A items:

Close control is required for inventory items that have high stock-out costs and those items that account for a large fraction of the total inventory value. Purchasing items may arrange for a contracts with vendors for the continues supply of these materials at rates that match usage rates. In such instances, the purchase of raw materials is not guided by either economical quantities or cycles. Changes in the flow are made periodically as demand and inventory position change. Minimum supplies are made to guard against demand fluctuations and interruptions of supply.

Control policy for guidelines for class B items:

These items should be monitored and controlled preferably by a computer based system, with periodic review by the management. Many of the models discussed in this chapter are relevant for these items. However, model parameters are reviewed less often for class A items. Stock-out costs for class B items should be moderate low, and buffer stocks provide adequate control for stock-outs, even though ordering occurs less often.

Control policy for guidelines for class C items:

Class C items account for the bulk of items, and carefully designed routine controls should be adequate. A recorder point system that does not require a physical stock evaluation such as "two bin system" will do. For each item, action is triggered off when inventories fall to the recorder point. If usage rate changes, orders will be sent earlier or later than average, providing the needed compensation. Semi-annual or annual reviews of the system parameters should be performed to update usage rates, estimates of supply lead times, and

costs that might result in changes in EOQ. A periodic review at a long interval can also be used.

Sum up the type of control that is required on different types of items.

<i>Nature</i>	<i>Class A-items having high consumption value</i>	<i>Class B items having moderate consumption value</i>	<i>Class C –items having low consumption value</i>
1. value(monetary)	High consumption	Moderate consumption	Low consumption
2. Subdivision helps the selective control- A1, A2, A3 and so on depending on the value of the items.	Further subdivision possible if necessary	Subdivision is however ,necessary	No subdivision
3. Extent of control.	Very strict control	Moderate control	Loose control
4. Frequency of order.	Frequent ordering	Once in 3 months	Once in 6 months
5. Lead time	Maximum time to reduce lead times	Moderate time to reduce lead times	minimum time to reduce lead time
6. Level of management	Should be taken care by the senior officers	Can be supervised by the middle management	Can be supervised by the clerical staff
7. Period review	Review of waste, obsolete and surplus items after a month or every 15 days.	Review of waste, obsolete and surplus items after every 3 months.	Annual review over obsolete and surplus items.
8. Sources of supply	As many sources as possible	Three or more reliable sources	Three reliable sources for each item
9. Follow up	Maximum follow up (attention)	Periodic follow up	Follow up only in exceptional cases
10. Safety stocks	Very low safety	Moderate safety stocks	High level of stocks
11. Centralisation (purchasing & storage)	Centralized purchasing	Combined i.e., centralized and decentralized purchasing	Decentralized
12. Value analysis	Rigorous	Moderate	minimum
13. Control system	Weekly control statements	Monthly control statements	Quarterly control statements
14. Type of analysis (coding colour)	Rigorous value analysis colour- Red	Moderate value analysis colour- Pink	Minimum value analysis colour- Blue
15. Forecasting	Accurate forecasting in material planning	Estimated based on present plans	Rough estimates for planning
16. Posting in ledger	Individual posting	Small group postings	Group posting

Application of ABC analysis:

This approach helps the materials manager to exercise selective control and focus his\her attention only on a few items when he\she is confronted with thousands of stores items.

a) Degree of control:

A class items form a substantial part of total consumption in rupees .greater attention should be paid and accurate records maintained for those items. The inventory should be kept at a minimum by placing blanket orders, covering annual requirements and then arranging frequent deliveries from vendors.

'B' class should have normal or moderate control made possible, by good records and regular attention.

A little or no control is required for 'C' class items .Large inventories should be maintained to avoid stock-outs.

b) ordering procedure:

'A' class item requires careful and accurate determination of order quantities and order points based n exact requirements. they should be subjected to frequent reviews possibility of overstocking.

A reasonably good analysis for order quantities and order points is required for class 'B' class items but the stock may be reviewed less frequently or only when major changes occur.

No such detailed records are necessary for the C class items.

Any routine method that ensures good and accurate records is enough for 'B' class items.

c) Stock records:

Detailed records of goods reserved, received, ordered, issued and on hand need to be maintained for 'A' class items. Tight and accurate controls are required for such items.

No such detailed records are necessary for the 'C' class items.

Any routine method that ensures good and accurate records is enough for 'B' class items.

d) Priority treatment:

Top priority may be accorded to A class items in all activities such as processing of purchase orders, receiving, inspection, movement on the shop floor, etc., with an object to reduce lead time and average inventory.

No such priority is necessary for B class items. Normal plant procedures should take care of inward and outward flow of these items.

No priority is assigned to C class items at all.

e) Safety stock:

All the three stocks of items are equally important from production point of view. For example, shortage of bolts may be one of the reasons for stopping the production process. Shortage may occur even when accurate and realistic order points have been compute. Safety stock is provided to safe guard against such shortages.

Safety stock should be less for 'A' class items. The possibility of stock-outs can be cut down considerably by closer forecasting, frequent reviewing and more processing.

The following may be the ideal safety stock for the 3 classes of items.

'A' class items	:	1\2 month stock
'B' class item	:	1 month stock
'C' class item	:	2 month stock

f) Stores layout:

ABC analysis can be efficiently utilized for the stores layout as well. By storing the fast moving items near the points of issue, considerable time and effort can be saved, which otherwise is lost in locating such items. Most of 'A' class items belong to this category.

'B' and 'C' class items which are less fast moving can be stored slightly further in less accessible area. 'C' class items, because of there low unit price and not because of there low consumption, may be located readily accessible areas.

g) Value analysis:

To secure maximum benefits, it is essential to select those items for the value analysis which offer the highest scope for cost reduction .The ABC analysis is a helpful step in this direction.

Purchasing policy and procedure should be so formulated that, for 'A' class items greater attention is paid to pre-design and pre-purchase value analysis, market research, source development and follow-up. Placing of order for source item should be based on ABC principle. Generally, 'A' class items are ordered more frequently in small quantities, while 'C' class item are ordered once or twice a year to obtain the entire years requirement.

Advantages of ABC analysis:

By concentrating on 'A 'class item the materials manager is able to control inventories and show 'Visible' results in a short span of time. By

controlling the 'A' class item and doing a proper inventory analysis, absolute stocks are automatically pin pointed.

Many organizations have claimed that the ABC analysis has helped in reducing the clerical costs and resulted in better planning and improved inventory turnover. ABC Analysis has to be restoring to because equal attention to 'A', 'B' and 'C' items is not worth while and would be very expensive. Concentrating on all items is likely to have a defused effect on all the items irrespective of their priorities.

Limitations of ABC analysis:

ABC analysis, in order to be fully expensive, should be carried out with standardization and codification. ABC analysis is based on grading the items according to the importance of the performance of an item, i.e., vital, essential and desirable analysis.

Some items, though negligible in monetary value may be very vital for running the plant, demanding constant attention.

The results of ABC analysis have to be reviewed periodically and updated. It is a common experience that a 'C' class item, like diesel oil in a firm, will become the most high-value item during a power crisis. However, ABC analysis is a powerful tool or approach in the direction of cost reduction as it helps to control items with a selective approach.

VED classification:

VED stands for vital, essential and desirable. This type of classification is applicable mostly in the case of spare parts. The peculiarity about spare parts is that they do not follow a predictable demand pattern as in the case of raw-materials.

The result is that if we follow the usual method out lined earlier, we might get into difficulties when the demand pattern suddenly changes. For example, the older a machine gets, the greater will be the spares required for maintenance. Hence, past trends do throw much light on stocking policies. To get over this difficulty, VED classification is used. Here, the categorization is made in terms of importance or criticality of the part of the operation of the plant. It is very vital; it is given a 'V' classification.

If an item is important it is classified as 'E' item. If it is not so important, it is given a 'D' classification. How such a classification is done? This purely depends on the machinery or equipment involved and one's own experience ease of availability of the parts, etc., for example, if some items are available off the self of the suppliers' show room, there is no point, in categorizing them as 'V'. On the other hand, a minor imported item automatically gets a 'V'

classification. In other words, the classification is not purely in terms of the criticality of the items for proper working of the machine but it is a combination of several factors, including price, availability, etc.,

For 'V' items, a reasonably large quantum of stocks might be necessary, while for 'D' items, no stocks are perhaps, required to be kept, especially if that item also happens to be in the 'A' or 'B' classification. For 'V' items of 'A' classification, a close control should be kept on stock levels, but if it is a 'C' item, then large quantities may be stored.

The whole objective is to select items for special control and thus expend time and effort in a prudent way.

FSN classification:

This classification takes into account the pattern of issues from stores. The three letters stands for fast-moving, slow-moving and non-moving. This classification comes in very handy when we desire to control obsolesce. Items classified as 'S' and 'N' require attention. Especially 'N' items require greater attention. They may be several reasons why an items has got into 'N' category there may have been a change in technology or change in the specification or a particular spare part. When a FSN classification is made, all such information stand out prominently, enabling manages to act it in the best interests of the organization.

Check the progress:

Fill ups

1. _____ is a stock of physical goods held at a specific location and at a specific time.
2. The stock-out and the carrying costs are _____.
3. The _____ refers to the quantity ordered to be purchased at the lowest total costs.
4. The economic order quantity will be the one where the _____ and the _____ are equal.
5. _____ reduces the frequency of ordering and therefore, the ordering costs.

Points to remember

1. Each distinct item in the inventory at a location is termed stock keeping unit (SKU); and each skill has a number of units in stock. Each location is a stock point.
2. Seasonal supply factors, market conditions, availability of transport facilities etc., may indicate purchase of larger or smaller quantities. In such situations, proper judgment alone helps.

3. EOQ cannot be successfully applied in case of imports with attained problems of obtaining import license, and certain lead-times, etc.,
4. VED stands for vital, essential and desirable. This type of classification is applicable mostly in the case of spare parts.
5. The peculiarity about spare parts is that they do not follow a predictable demand pattern as in the case of raw-materials

Model questions

1. Define inventory control and inventory control technique?

INVENTORY CONTROL:

Inventory is a stock of physical goods held at a specific location and at a specific time. Each distinct item in the inventory at a location is termed stock keeping unit (SKU); and each skill has a number of units in stock. Each location is a stock point.

Inventory Control Techniques

In most manufacturing concerns, inventories are controlled through the following techniques:

- (i) Economic Order Quantity
- (ii) Determination of stock Levels (Min-Max Plan)
- (iii) Inventory Control Ratios and Indexed
- (iv) Ageing Schedule of inventory
- (v) Input-Output Ratio Analysis
- (vi) Perpetual and periodic stock taking systems
- (vii) Order cycling system
- (viii) Two Bin systems
- (ix) Selective Inventory control
- (x) Materials requirement planning
- (xi) Just-in-Time
- (xii) Value Analysis

2. Distinguish between cost of carrying and cost of non carrying enough?

<i>Cost of carrying</i>	<i>Cost of non carrying enough</i>
➤ Interest on investment in inventory	Foregone quantity discounts
➤ Insurance charges	Disruption in production schedule
3. Warehousing and storage expenses	Inability to meet consumers' requirements
➤ Material handling and clerical charges	Loss of profit on lost sales
➤ Deterioration and spoilage	Loss of consumers' goodwill
➤ Obsolescence	Foregone fortuitous purchases
➤ Personal and property taxes	Emergency purchasing cost

3. Discuss the objectives and limitations of EOQ Models?

Objectives of EOQ Models:

Some of the objection that are frequently heard about EOQ are as follows;

- Often the inventory holding costs and the ordering costs cannot be accurately calculated and some times cannot even be identified properly.
- The EOQ calculated is often an inconvenient number.
- The use of EOQ usually leads to random orders so that supplier receives an irregular stream of orders.
- EOQ applied without due regard to the possibility of falling demand can lead to a high value of obsolescent inventory.
- EOQ may not be applicable when the requirements are irregular, or t where there is an impending price raise.

Limitation of EOQ:

Some of the limitations of EOQ are as follows;

1. Ordering in package sizes:

Ordering to the nearest "Trade" quantities are or as per convenient packages. For e.g., Instead of ordering 11 dozens, the order may be for 1 gross.

2. Economical Freight rate:

The saving in freight may more than compensate the extra inventory carrying costs.

3. Simplification of routine:

Instead of ordering for e.g., 14 times a year, order may be placed every month.

4. Perishables are articles having low shelf life:

In case of perishable or bulky items with diminishing consumption or for items whose market prices are likely to decline, it is better to order less than the theoretically worked out quantities.

5. Seasonal articles:

Seasonal supply factors, market conditions, availability of transport facilities etc., may indicate purchase of larger or smaller quantities. In such situations, proper judgment alone helps.

6. Consolidates discounts:

Liberal discount or concessional freight rates may suggest larger quantities. The "pros" and "cons" of such purchases should be weighed carefully before a decision is taken.

7. Imports:

EOQ cannot be successfully applied in case of imports with attained problems of obtaining import license, and certain lead-times, etc.,

4. What are the general procedure for implementing ABC techniques?

General procedure for Implementing ABC techniques:

The general procedure for implementing the ABC techniques is as follows:

- Classify the items of inventories.
- Determine the expected use in (Physical) units over a give period.
- Determine the price per unit of each item.
- Determine the total cost of each item by multiplying the expected units by its unit price.
- Rank the items in accordance with total cost, allotting first rank to the item with highest total cost and so on (i.e., Arrange in descending order).
- Find out the total number of units i.e., total units of all items and calculate the percentage of each item.
- Calculate the percentage of total cost of each item to total cost of all items.

- Combine items on the basis of their relative value to form three categories-A, B and C e.g., classify the inventory as A, B or C. Class A items having high consumption 15%, class B items having moderate consumption 30% and class C items having low consumption value from the remaining 55%.
- Decide cut-off points and methods of control.
- Tag the inventory with A, B, C classification and record these classifications in the item inventory master record.

5. Write a note on,

- a) VED classification b) FSN classification

Ans:

VED classification:

VED stands for vital, essential and desirable. This type of classification is applicable mostly in the case of spare parts. The peculiarity about spare parts is that they do not follow a predictable demand pattern as in the case of raw-materials. The result is that if we follow the usual method outlined earlier, we might get into difficulties when the demand pattern suddenly changes. For example, the older a machine gets, the greater will be the spares required for maintenance. Hence, past trends do throw much light on stocking policies.

To get over this difficulty, VED classification is used. Here, the categorization is made in terms of importance or criticality of the part of the operation of the plant. It is very vital; it is given a 'V' classification. If an item is important it is classified as 'E' item. If it is not so important, it is given a 'D' classification. How such a classification is done? This purely depends on the machinery or equipment involved and one's own experience ease of availability of the parts, etc.,

For example, if some items are available off the shelf of the suppliers' show room, there is no point, in categorizing them as 'V'. On the other hand, a minor imported item automatically gets a 'V' classification. In other words, the classification is not purely in terms of the criticality of the items for proper working of the machine but it is a combination of several factors, including price, availability, etc.,

For 'V' items, a reasonably large quantum of stocks might be necessary, while for 'D' items, no stocks are perhaps, required to be kept, especially if that item also happens to be in the 'A' or 'B' classification. For 'V' items of 'A' classification, a close control should be kept on stock levels, but if it is a 'C' item, then large quantities may be stored.

The whole objective is to select items for special control and thus expend time and effort in a prudent way.

FSN classification:

This classification takes into account the pattern of issues from stores. The three letters stands for fast-moving, slow-moving and non-moving. This classification comes in very handy when we desire to control obsolesce. Items classified as 'S' and 'N' require attention. Especially 'N' items require greater attention. They may be several reasons why an items has got into 'N' category there may have been a change in technology or change in the specification or a particular spare part. When a FSN classification is made, all such information stand out prominently, enabling manages to act it in the best interests of the organization.

Answer for fill ups

1. Inventory
2. counter balancing
3. economic order quantity
4. cost of procurement, cost of carrying
5. Bulk buying

QUALITY CONTROL:

Definition of quality:

Quality may be defined as the sum total of all characteristics and attributes of a certain products are an object which go to make it to the people for whom it is meant, and it is the sum total of these characteristic an attributes that determine the demand or utility or price of a product or an object.

According to professors Wasting and zeno, "Quality is an expression of the measured properties, conditions or characteristic of a product or process, usually stated in terms of grades, classes or specifications and determine by the application that is involved".

Thus, quality of a product, object or a process refers to its,

- Characteristics
- Attributes
- Properties and
- Conditions

Which are stated either in terms of certain specification or gradation and is determined by the user by its application who ultimately determines the,

1. Demand

2. utility
3. Price of the product, object or process in terms of the quality when he/she receives from his/her use.

Definition of Quality Control:

"Quality Control may be defined as that industrial management technique is group of techniques by means of which products of uniform acceptable quality or manufacture". -Alford and Beatty.

Objectives of Quality Control:

The following are the main objectives of a quality control programme:

- To assess the quality of raw materials, semi-finished goods and finished products at various stages of production process.
- To ensure whether the product conform the pre-determined standards and specifications and whether it satisfies the needs of the customers.
- If the quality of the product deviates from the specifications, it should be possible to locate the reason for deviations and take necessary remedial steps so that the deviations do not recur.
- To suggest suitable improvements in the quality or standard of goods produced without much increase or no increase in the cost of production.
- To develop quality consciousness in the various sections of the manufacturing units.
- To assess the various techniques of quality control, method and processes of production and suggest improvement in them to be more effective.
- To reduce the wastage of raw materials, men an machines during the process of production.

Principles of Quality Control:

The principles that govern the quality control in manufacturing are the following:

1. The quality of manufacture goods is a variable with an upward, trend under conditions of competitive manufacture.
2. Control of quality increases out of saleable goods, decreases cost of production and distribution, and makes economic mass production possible.
3. The conformance of finished products to its design specification and standards should be accomplished by avoiding the production of non-conforming material than by sorting the good from the bad after the manufacture is completed.

Importance and advantages of Quality Control system:

The programme of quality control is advantageous to both producers and consumers. On one hand, a quality product will satisfy the consumers' needs and consequently the demand of the product will increase resulting in, large scale production. On the other hand, the goodwill of the firm increases as a producer of quality goods. The importance of quality control lies in the following facts;

➤ **Reduction in costs:**

An efficient quality control system reduces the cost of production of the product due to,

1. Reduction in wastage of raw-materials, semi-finished and finished goods.
2. Large-scale production of standard quality product.
3. Rework costs of a sub standard goods is minimum.

➤ **Improvement in the morale of employees:**

By quality control programme, the employees become quality conscious. They understand the standards of the product well and try to improve them and produce quality goods to the best of their efforts. Thus, it improves the morale of the employees.

➤ **Maximum utilization of resources:**

By establishing the quality control system, the necessary control over the machines, equipment, men and materials and all other resources of the company is exercised. The system will also control the misuse of facilities, waste age of all types and low standard production. Thus, the resources of the organization are put to maximum use.

➤ **Increase in sales:**

Increase in sales of the product is the main objective of the quality control system. By introducing quality control programme, in manufacturing process, a quality product is made available to the consumers and that too at lower rates because of lower costs of production. It, in turn increases the demands of company products.

➤ **Consumers satisfaction:**

Consumers always get quality products of standard specifications to their utmost satisfaction.

➤ **Minimize variation:**

It is a well-known fact that some variations are born to exist in the nature of production in spite of careful planning. The magnitude of variations depends upon the production process, namely, machines, materials, operations, etc. The

techniques of quality control help in the study of these variations in quality of the product and serves as a useful tool for the solution of many manufacturing problems which cannot be solved so well by any other method.

X Chart:

X chart is constructed to show the fluctuations of the means of samples about the mean of the process and can be used to determine whether are not the fluctuations are due to random causes or to an assignable cause.

It shows changes in process average and is affected by changes in process variability.

1. It is a chart for the measure of central tendency,
 2. It shows a erratic or cyclic shifts in the process,
 3. It detects steady process changes like tool wear, and
 4. It is commonly used in variable charts.
- (a) When used along with R chart, it tells when to leave the process along and when to chase and go for the cause for leading to variation.
- (b) It secures information in establishing or modifying processes, specifications or inspection procedures and
- (c) It can control the quality of incoming material. The control limits of X Chart or given as:

$$\text{Upper control limit} = \bar{X} + A_2 \bar{R}$$

$$\text{Central line} = \bar{X}$$

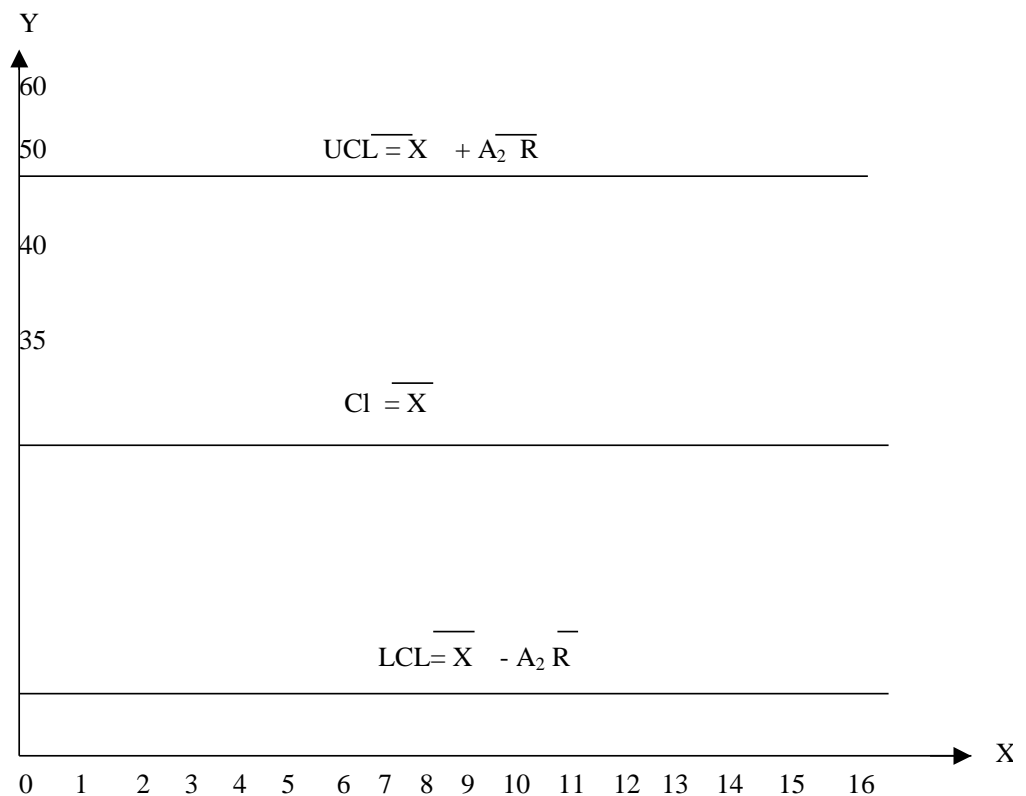
$$\text{Lower control unit} = \bar{X} - A_2 \bar{R}$$

Where, \bar{X} = Mean (average) of sample means

\bar{R} = Mean of sample ranges

A_2 = Control factor for mean chart.

(Value depends on the size of the sample and is available in standard tables)



Range chart (R chart):

It can be used to show fluctuations of the ranges of the samples about the average range (\bar{R}). This control general variability of the process and is affected by changes in variability. It is used along with X Chart.

The control limits for R chart are given as:

$$\text{Upper control limit} = D_4 \bar{R}$$

$$\text{Lower control limit} = D_3 \bar{R}$$

Where \bar{R} = Average of sample ranges.

D_4 = Control factor for UCL for R- Chart

D_3 = Control factor for LCL for R-Chart.

D_4 and D_3 depend on sample size chosen and their values are available from standard table.

QUALITY CIRCLE:

The quality control circle are more popularly known as quality circle concepts where formed in Japan in 1960 and in Unites States it started in 1977.

Definition

A Quality Circle is defined as a small group of employees who voluntarily cooperate to solve problems relating to:

1. Production, wastage of materials,
2. Quality of raw material, tool Semi-finished and finished goods,
3. Work- environment, energy consumption,
4. Scheduling, delay,
5. Maintenance,
6. Safety and anything that affect these factors.

Characteristic of Quality Circle:

The quality circle that has the following characteristic:

1. A small group of people who do similar work:

The quality circle essentially consists of people who do similar wok.

2. The members in the circle should not be many:

It is argued that smaller the circle betters the coordination and homogeneity. The circle should look like a team and not a committee.

3. Voluntarily meeting together:

People are invited to join the quality circle but they are not compelled. The members feel the need to meet together to discuss and devise ways to improve the functioning of their areas concerned. Hence, joining a quality circle is voluntary and not force upon.

4. Meeting regularly every week:

The duration and frequency of meeting even vary in Japan (Where this concept originated), It is favor to have meeting at least an hour every week. But actually, the frequency and duration of each meeting should be decided by the circle members who will take all factors into account such as the severity of the problem, urgency of the problem, number of the problem etc.

5. Under the leadership of the own supervisor:

The quality circle is purely concerned with work-related problems. Therefore, supervisors of the work area proved to be the best persons to lead the group, as they are thorough with the functioning of the department.

6. Identification, Analysis and Solutions:

The circle identifies their own problems in their own work area. The circle members are not encouraged to highlight the fault of others.

7. Presenting solutions to management:

After collection of data, working out new ideas in consultation with all kinds of people, the members come to a conclusion which if implemented will deliver the goods. The final idea (Solution) should be presented to the management together by the group members(not by the leader alone or any other member) interestingly the circle solutions(projects) are so meticulously thought out that their outright rejection (not favored for implementation) by the management is rare.

8. Self implementation:

The quality circles are made for implementation of their solutions as they deal with the problems over the fence in the next department are completely isolated from it. Only each department has to care for their babies.

9. Meeting time any time:

The meeting of the circle members may not be arranged essentially during their normal working hours. As it may affect their working and thereby production. Also, if the work is done in shifts when the circle members may come different shift and a common free time for all may be difficult to spare within normal working period. Hence, such meeting could be held any time in a working day and holiday.

Advantages of Quality Circle:

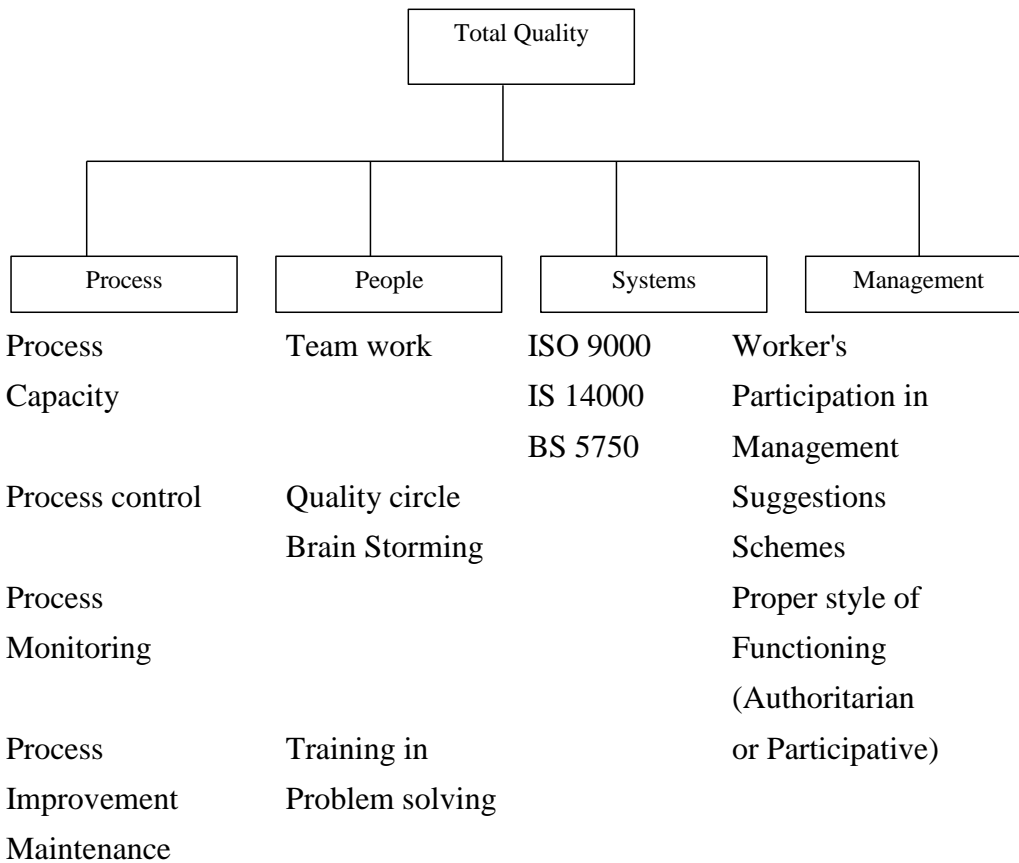
1. It infuses team spirit among the workers.
2. It improves decision making ability.
3. It improves employee communication at all levels of the organization.
4. It improves problem solving ability.
5. It improves leadership skill.
6. It builds confidence/trust.
7. It incorporates a sense of belonging to their organization.
8. It creates a sense of corporate loyalty and corporate pride.
9. It improves the relationship between managers and the work force.

10. It improves quality, production and productivity.
11. It improves the self-image of the employees.
12. It reduces cost of production.
13. It enhances customer satisfaction.
14. It increases demand for production/services of the organization.
15. There is greater job security and more employment opportunity.

Total Quality management:

There are four fundamental elements of Total Quality. These are:

1. Processes
2. People
3. Systems
4. Management



The four elements of Total Quality

1. Processes:

Look after the processes and the product looks after itself-a saying in Japan. As the saying goes, the processes are the most vital elements to achieve quality products. It is a fact that if the processes do not have requisite capability

then it cannot be expected to deliver requisite quality. Hence, the processes should be continuously monitored and maintenance. Effort should be applied not only for process control but for process improvement too.

2. People:

People run machines, people maintained machines and equipment. It should be inculcated into their minds that quality is everybody's concern. They should be trained and educated in problem solving. It is said quality begin with education and end with education.

3. Systems:

The principles of Quality Systems are prescribed in 1987 in various documents such as:

ISO 9000, British Standard (BS) 5750

Allied Quality Assurance Publications

Indian Standards (IS) etc.,

For example, ISO 9000 is a series of quality standards that outline the requirements for Quality Managements Systems.

4. Management:

The style of functioning of a management could be authoritarian or participative. The authoritarian style of management functioning takes the following measures for achieving the goals.

INSPECTION :

Definition:

Inspection is the process of examining an object for identification or checking it for verification of quantity and quality in any of its characteristics. It is an important tool for ascertaining and controlling the quality of product.

In the words of Afford and Beaty "Inspection is the art of applying tests preferably by the aid of measuring appliances to observe whether the given item or product is within the specified limits of variability or not.

Objectives of Inspection:

The objectives of the Inspection are as follows:

- Inspection separates defective components from non-defective ones and thus ensures the adequate quality of the product.
- Inspection identifies defects in raw materials and flows in processes which otherwise cause problems at the final stage.
- To detect sources of weakness in the finished products.

- Inspection prevents further work being done on semi-finished products already detected as spoiled.
- Inspection builds up the reputation of the concern as it helps reducing the number of complaints from the customers.

Functions of inspections:

- To determine whether the incoming goods are physically or chemically desire characteristics in accordance with specifications.
- To determine whether a part is correctly formed and dimensioned in accordance with the specifications.
- To determine if the patterns and tools which are purchased or are capable of producing the parts in accordance with specifications.
- To determine if the metallic structure, hardness and other properties have been performed.
- To assure management that product below the pre-determined quality specifications will not be dispatched to customers.
- Reporting source of manufacturing difficulties to management.
- Ensuring inspection equipment in good condition.
- Employing best methods of inspection at lowest cost.

Kinds of inspection:

There are number of different kinds of inspection, each carried on because of the necessity for ensuring quality of work in the best possible manner and detecting spoilage as early as possible so that further, loss can be prevented.

1. Receiving Inspection:

Inspection while receiving the material-raw material or semi-finished is called receiving inspection. If the raw materials are not of acceptable quality, the output cannot be accrued. Receiving attains even more significant, when the organization is dependent upon vendors for final product. Inspection at vendors' site can reduce congestion and delay.

2. Roving Inspection/Floor/Decentralised Inspection:

The inspector walk round on the shop floor from machine to machine and checks sample of the work of various machine operators or workers. In this type, the semi finished goods are inspected either on the machine or in the product line. It is also known as in-process inspection. The possibility of handling the items is considerably reduced and the discrepancy or defects if any are located. Floor inspection ranges from mere patrolling supervision by

keeping an eye on work at machine to careful testing by intricate measurement of products by means of measuring appliances.

Advantages of Decentralized Inspection

- (a) Production delays, scrap and defective work may be reduced.
- (b) Handling cost and time to bring materials/semi finished work at centre place from the work area will be reduced.
- (c) Promptness in inspection may result in increased rate of production. Decrease in process inventories and utilizing better utilization of the production capacity.
- (d) This kind of inspection is more appropriate for product layout.
- (e) It is ideal for products very large in size which weigh more.

Disadvantage of decentralized inspection:

- (a) Less freedom of movement to the operator.
- (b) Sufficient space is not available for inspection work.
- (c) Floe of work from machine to machine is distributed on account of accumulation of work on the floor.
- (d) Work-in-progress is scattered resulting in inspection difficulties.
- (e) Dust, vibration, noise and other floor conditions are less suitable for close inspection.

3. Centralized or Crib Inspection:

Under this method, there will be single inspection unit for the whole plant or each section that will have its own inspection unit to inspect the components, produced by them. The components are shifted to the inspection unit for the necessary action. The inspection staff in each unit is likely to be more experienced and skilled in their work. Also they can use more sophisticated and reliable instruments and techniques to measure the item. Thus, centralized inspection is likely to be more reliable and accurate.

Advantages of Centralized Inspection:

- No chances of collusion between production men and inspectors.
- Machines sites are free from awaiting inspection, offering operators more freedom foe movement.
- There is accurate counting for good and bad items.
- Priorities of inspection may be planned to loads on the production department.
- More sophisticated instruments for inspection can be used.

Disadvantages of centralized Inspection:

- Errors are not resolved quickly.
- Requires more material handling.
- May result in bottlenecks due to delay in inspection of items.
- There may be larger work-in-progress inventory.
- Defect of a job are not known before it is completed. Thus, remedial measures cannot be taken on the spot.
- Not suitable for heavy and unwieldy components.

Comparison between Centralized and Floor Inspection

Centralized Inspection	Floor Inspection
➤ Definition: Inspection is done at one place. All the items are brought at the centralized space for inspection.	Inspection is done on the machines or at shop floor. The measuring instruments are taken to the job.
(ii) <i>Material handling:</i> More material handling is involved.	Very less material handling is involved. Job is stationary and measuring instruments move.
(iii) <i>Detection of errors of products:</i> Difficult.	Very easy.
(iv) <i>Collusion between production and inspection:</i> Very difficult	May be possible.
(v) <i>Shop cleanliness:</i> Very good	Congested shops.
(vi) <i>Remedial steps:</i> Possible but time-consuming	Easily and immediately done.
(vii) <i>Inspection time:</i> More	Less
(viii) Skilled staff required	Moderately skilled staff is required.
(ix) <i>Process inventory level:</i> High	Low
(x) <i>Utility/Application:</i> For more accurate small jobs.	For heavy jobs.

4. Trail run Inspection:

In this type, the tool/machine is checked against its drawing and specifications before commencement of operations. A trail run is made with a single piece conforms with specifications, then the production is allowed to be carried on, otherwise remedial measure are taken.

5. First off Inspection:

The items produced in the first production run are inspected and examined with respect to specifications thoroughly. The method is concerned with checking the set up of the machine. The reasons for discrepancy in actual and specified standards are located and corrected. This inspection reduces the chance of scrap at later stages.

6. Pilot-piece Inspection:

A further step beyond first-piece inspection is the running of a part through its entire sequence of operations on a series of machines set up for its production, especially in the case of product layout or equipment. Each tool and each machine set-up is thus tested and all defective tools are replaced and all wrong adjustment line is released for actual operation.

7. Tool Inspection:

Tool inspection is the application of inspection methods of tools, fixtures, jigs and gauges in advance of the work of production. If the tools are alright, the results will be satisfactory.

8. Working Inspection:

It means that the inspector should check the pieces at periodic intervals in order to ascertain that they are being produced according to specifications. Tools wear or break and the operator may neglect to grind or replace them.

Automatic Machinery requires that the same precaution be taken, periodic inspection during the run is necessary. Many automatic machines are now equipped with automatic signals or stops which act to shut down the machine when tool or machine develops trouble.

9. Operation Inspection:

This is done immediately after a critical or expensive operation, first to avoid doing expensive work on a part already not up to the standard and second to check the accuracy of critical work before proceeding with succeeding operations. It implies inspection at the completion of an operation before the work-in-progress passes along further.

10. Final Inspection:

It is concerned with inspection after an article has been completely manufactured and is ready to be sent to the stores. It is also known as finished goods inspection.

11. Inspection by Self Control

The operator himself inspects the item, controlling the operations at different levels of the production processes.

12. Percentage inspection:

Amount of inspection to be done is sometimes expressed in terms of percentage, for e.g., cent per cent, meaning inspection of each and every piece in the entire lot. Inspection may be in excess of 100% meaning each part is subject to inspection as it passes from one operator to the next.

Example: In assembly of time fuses for projectiles, each individual visually inspects each piece to see that the previous individual contributed his/her part before adding the next component. In this way, each assembler in turn becomes an inspector verifying the performance of the previous assembler.

13. Efficiency Inspection:

This inspection is synonymous with the trial run of a completed ship, locomotive, turbo, turbo-generator, or other equipment, for the purposes of securing performance data to check against anticipated results.

14. Endurance Inspection:

This is given to assemblies to determine how much usage they can withstand and to locate weaknesses, if any, for rectification e.g., army rifles, etc.

15. Destructive Inspection

It is carried on to determine the ultimate resistance or effectiveness of the objects tested. It is regularly carried on at firing to test guns, projectiles, and armour. Guns are sometimes tested to destruction to check the factor of safety calculations. A few shells are selected random from a lot and fired to determine fragmentation or ability to penetrate armour. Sample armour plate is used as a target to determine resistance to penetration. This kind of inspection differs from other inspection in that the specimen is destroyed.

16. Product Inspection:

Product inspection is the art of applying tests, by the aid of measuring appliances, to observe whether a given item of product is within the specified limits of variability.

17. Tests Allied to Completed Mechanism:

After parts of a mechanism have been assembled, a final operating test or series of tests should be made, stimulating maximum demands to be carried out on the mechanism after it is placed in service. Strength tests are in themselves the maximum limit.

18. Piecework Inspection:

Work produced on a piece work basis requires much more scrutiny than work produced on a straight line basis. Operators anxious to earn more become

careless and a poor quality of work is the likely result. A change-over from a careless and poor quality of work is the likely result. A change-over from a time basis to a piece work basis generally requires an increase in inspection costs which must be offset by the advantages of the latter over the former system.

Check the progress:

Fill ups

1. Quality may be defined as the sum total of all _____ of a certain products
2. _____ is constructed to show the fluctuations of the means of samples about the mean of the process and can be used to determine whether are not the fluctuations are due to random causes or to an assignable cause.
3. _____ is defined as a small group of employees who voluntarily cooperate to solve problems
4. _____ is the process of examining an object for identification or checking it for verification of quantity and quality in any of its characteristics
5. Inspection while receiving the material-raw material or semi-finished is called _____
6. In _____ is done at one place. All the items are brought at the centralized space for inspection.

Points to remember

1. Quality of a product, object or a process refers to its,
 - Characteristics
 - Attributes
 - Properties and
 - Conditions
2. "Quality Control may be defined as that industrial management technique is group of techniques by means of which products of uniform acceptable quality or manufacture".
3. An efficient quality control system reduces the cost of production of the product due to,
 1. Reduction in wastage of raw-materials, semi-finished and finished goods.
 2. Large-scale production of standard quality product.
 3. Rework costs of a sub standard goods is minimum.

4. Range can be used to show fluctuations of the ranges of the samples about the average range (R)

5. Total Quality management:

There are four fundamental elements of Total Quality. These are:

- Processes
- People
- Systems
- Management

6. Product Inspection:

Product inspection is the art of applying tests, by the aid of measuring appliances, to observe whether a given item of product is within the specified limits of variability.

Model questions

1. Define Quality control and its objectives?

Definition of Quality Control:

"Quality Control may be defined as that industrial management technique is group of techniques by means of which products of uniform acceptable quality or manufacture". -Alford and Beatty.

Objectives of Quality Control:

The following are the main objectives of a quality control programme:

- To assess the quality of raw materials, semi-finished goods and finished products at various stages of production process.
- To ensure whether the product conform the pre-determined standards and specifications and whether it satisfies the needs of the customers.
- If the quality of the product deviates from the specifications, it should be possible to locate the reason for deviations and take necessary remedial steps so that the deviations do not recur.
- To suggest suitable improvements in the quality or standard of goods produced without much increase or no increase in the cost of production.
- To develop quality consciousness in the various sections of the manufacturing units.
- To assess the various techniques of quality control, method and processes of production and suggest improvement in them to be more effective.
- To reduce the wastage of raw materials, men an machines during the process of production.

2. Write down the importance and advantages of Quality Control System?

Importance and advantages of Quality Control system:

The programme of quality control is advantageous to both producers and consumers. On one hand, a quality product will satisfy the consumers' needs and consequently the demand of the product will increase resulting in, large scale production. On the other hand, the good will of the firm increases as a producer of quality goods. The importance of quality control lies in the following facts;

➤ **Reduction in costs:**

An efficient quality control system reduces the cost of production of the product due to,

1. Reduction in wastage of raw-materials, semi-finished and finished goods.
2. Large-scale production of standard quality product.
3. Rework costs of a sub standard goods is minimum.

➤ **Improvement in the morale of employees:**

By quality control programme, the employees become quality conscious. They understand the standards of the product well and try to improve them and produce quality goods to the best of their efforts. Thus, it improves the morale of the employees.

➤ **Maximum utilization of resources:**

By establishing the quality control system, the necessary control over the machines, equipment, men and materials and all other resources of the company is exercised. The system will also control the misuse of facilities, waste age of all types and low standard production. Thus, the resources of the organization are put to maximum use.

➤ **Increase in sales:**

Increase in sales of the product is the main objective of the quality control system. By introducing quality control programme, in manufacturing process, a quality product is made available to the consumers and that too at lower rates because of lower costs of production. It, in turn increases there demands of company products.

➤ **Consumers satisfaction:**

Consumers always get quality products of standard specifications to their utmost satisfaction.

➤ **Minimize variation:**

It is a well-known fact that some variations are born to exist in the nature of production in spite of careful planning. The magnitude of variations depends

upon the production process, namely, machines, materials, operations, etc. The techniques of quality control help in the study of these variations in quality of the product and serves as a useful tool for the solution of many manufacturing problems which cannot be solved so well by any other method.

3. Explain \bar{x} chart and R-Chart?

X Chart:

\bar{x} chart is constructed to show the fluctuations of the means of samples about the mean of the process and can be used to determine whether are not the fluctuations are due to random causes or to an assignable cause.

It shows changes in process average and is affected by changes in process variability.

- 5. It is a chart for the measure of central tendency,
 - 6. It shows a erratic or cyclic shifts in the process,
 - 7. It detects steady process changes like tool wear, and
 - 8. It is commonly used in variable charts.
- (a) When used along with R chart, it tells when to leave the process along and when to chase and go for the cause for leading to variation.
- (b) It secures information in establishing or modifying processes, specifications or inspection procedures and
- (c) It can control the quality of incoming material. The control limits of \bar{X} Chart or given as:

$$\text{Upper control limit} = \bar{\bar{X}} + A_2 R$$

$$\text{Central line} = \bar{\bar{X}}$$

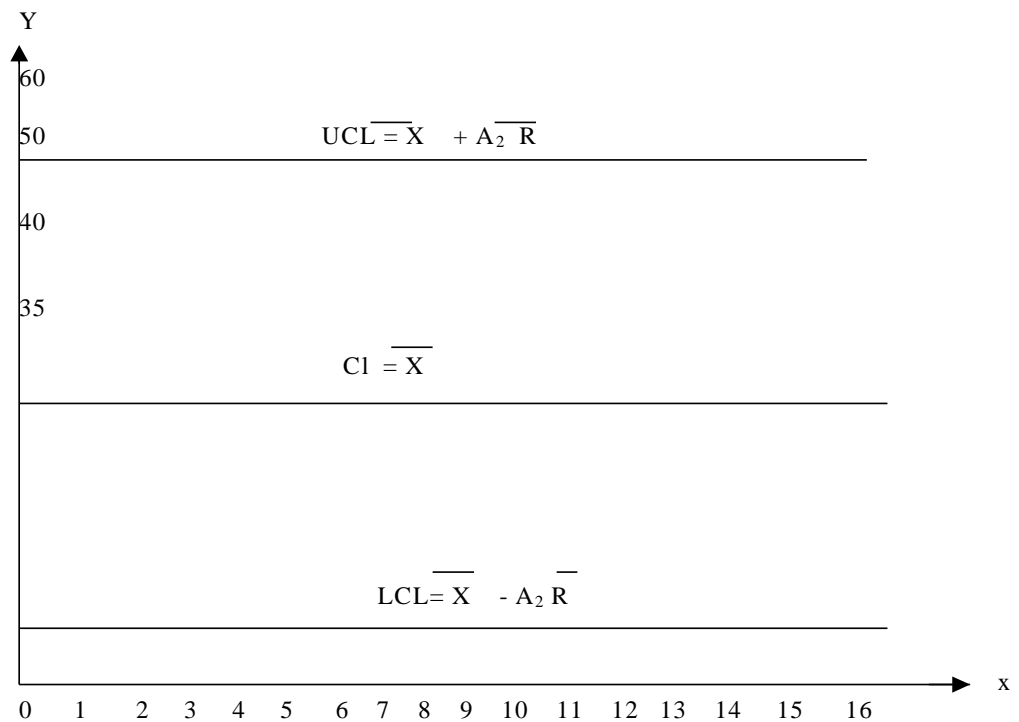
$$\text{Lower control unit} = \bar{\bar{X}} - A_2 R$$

Where, $\bar{\bar{X}}$ = Mean (average) of sample means

R = Mean of sample ranges

A_2 = Control factor for mean chart.

(Value depends on the size of the sample and is available in standard tables)



Range chart (R chart):

It can be used to show fluctuations of the ranges of the samples about the average range (R) . This control general variability of the process and is affected by changes in varianilty. It is used along with X Chart.

The control limits for R chart are given as:

Upper control limit = D4 R

Lower control limit = D3 R

Where R = Average of sample ranges.

D4 = Control factor for UCL for R- Chart

D3 = Control factor for LCL for R-Chart.

D4 and D3 depend on sample size chosen and their values are available from standard table.

4. Discuss the characteristics of Quality Circles?

Characteristic of Quality Circle:

The quality circle that has the following characteristic:

1. A small group of people who do similar work:

The quality circle essentially consists of people who do similar wok.

2. The members in the circle should not be many:

It is argued that smaller the circle betters the coordination and homogeneity. The circle should look like a team and not a committee.

3. Voluntarily meeting together:

People are invited to join the quality circle but they are not compelled. The members feel the need to meet together to discuss and devise ways to improve the functioning of their areas concerned. Hence, joining a quality circle is voluntary and not force upon.

4. Meeting regularly every week:

The duration and frequency of meeting even vary in Japan (Where this concept originated), It is favor to have meeting at least an hour every week. But actually, the frequency and duration of each meeting should be decided by the circle members who will take all factors into account such as the severity of the problem, urgency of the problem, number of the problem etc.,

5. Under the leader ship of the own supervisor:

The quality circle is purely concerned with work-related problems. Therefore, supervisors of the work area proved to be the best persons to lead the group, as they are thorough with the functioning or the department.

6. Identification, Analysis and Solutions:

The circle identifies their own problems in their own work area. The circle members are not encouraged to highlight the fault of others.

7. Presenting solutions to management:

After collection of data, working out new ideas in consultation with all kinds of people, the members come to a conclusion which if implemented will deliver the goods. The final idea (Solution) should be presented to the management together by the group members(not by the leader alone or any other member) interestingly the circle solutions(projects) are so meticulously thought out that their outright rejection (not favored for implementation) by the management is rare.

8. Self implementation:

The qualities circles are made for implementation of their solutions as they deal with the problems over the fence in the next department are completely isolated from it. Only each department has to care for their babies.

9. Meeting time any time:

The meeting of the circle members may not be arranged essentially during their normal working hours. As it may affect their working and thereby production. Also, if the work is done in shifts when the circle members may

come different shift and a common free time for all may be difficult to spare within normal working period. Hence, such meeting could be held any time in a working day and holiday.

5. What are Total Quality Management?

Total Quality management:

There are four fundamental elements of Total Quality. These are:

- Processes
- People
- Systems
- Management

The four elements of Total Quality

1. Processes:

Look after the processes and the product looks after itself-a saying in Japan. As the saying goes, the processes are the most vital elements to achieve quality products. It is a fact that if the processes do not have requisite capability then it cannot be expected to deliver requisite quality. Hence, the processes should be continuously monitored and maintenance. Effort should be applied not only for process control but for process improvement too.

2. People:

People run machines, people maintained machines and equipment. It should be inculcated into their minds that quality is everybody's concern. They should be trained and educated in problem solving. It is said quality begin with education and end with education.

3. Systems:

The principles of Quality Systems are prescribed in 1987 in various documents such as:

ISO 9000, British Standard (BS) 5750

Allied Quality Assurance Publications

Indian Standards (IS) etc.,

For example, ISO 9000 is a series of quality standards that outline the requirements for Quality Managements Systems.

4. Management:

The style of functioning of a management could be authoritarian or participative. The authoritarian style of management functioning takes the following measures for achieving the goals.

6. Define Inspection and Kinds of Inspection?

Kinds of inspection:

There are number of different kinds of inspection, each carried on because of the necessity for ensuring quality of work in the best possible manner and detecting spoilage as early as possible so that further, loss can be prevented.

1. Receiving Inspection:

Inspection while receiving the material-raw material or semi-finished is called receiving inspection. If the raw materials are not of acceptable quality, the output cannot be accrued. Receiving attains even more significant, when the organization is dependent upon vendors for final product. Inspection at vendors' site can reduce congestion and delay.

2. Roving Inspection/Floor/Decentralised Inspection:

The inspector walk round on the shop floor from machine to machine and checks sample of the work of various machine operators or workers. In this type, the semi finished goods are inspected either on the machine or in the product line. It is also known as in-process inspection. The possibility of handling the items is considerably reduced and the discrepancy or defects if any are located. Floor inspection ranges from mere patrolling supervision by keeping an eye on work at machine to careful testing by intricate measurement of products by means of measuring appliances.

3. Centralized or Crib Inspection:

Under this method, there will be single inspection unit for the whole plant or each section that will have its own inspection unit to inspect the components, produced by them. The components are shifted to the inspection unit for the necessary action. The inspection staff in each unit is likely to be more experienced and skilled in their work. Also they can use more sophisticated and reliable instruments and techniques to measure the item. Thus, centralized inspection is likely to be more reliable and accurate.

4. Trail runs Inspection:

In this type, the tool/machine is checked against its drawing and specifications before commencement of operations. A trail run is made with a single piece conforms to specifications, then the production is allowed to be carried on, otherwise remedial measure are taken.

5. First off Inspection:

The items produced in the first production run are inspected and examined with respect to specifications thoroughly. The method is concerned with checking the set up of the machine. The reasons for discrepancy in actual

and specified standards are located and corrected. This inspection reduces the chance of scrap at later stages.

6. Pilot-piece Inspection:

A further step beyond first-piece inspection is the running of a part through its entire sequence of operations on a series of machines set up for its production, especially in the case of product layout or equipment. Each tool and each machine set-up is thus tested and all defective tools are replaced and all wrong adjustment line is releases for actual operation.

7. Tool Inspection:

Tool inspection is the application of inspection methods of tools, fixtures, jigs and gauges in advance of the work of production. If the tools are alright, the results will be satisfactory.

8. Working Inspection:

It means that the inspector should check the pieces at periodic intervals in order to ascertain that they are being produced according to specifications. Tools wear or break and the operator may neglect to grind or replace them.

Automatic Machinery requires that the same precaution be taken, periodic inspection during the run is necessary. Many automatic machines are now equipped with automatic signals or stops which act to shut down the machine when tool or machine develops trouble.

9. Operation Inspection:

This is done immediately after a critical or expensive operation, first to avoid doing expensive work on a part already not up to the standard and second to check the accuracy of critical work before proceeding with succeeding operations. It implies inspection at the completion of an operation before the work-in-progress passes along further.

10. Final Inspection:

It is concerned with inspection after an article has been completely manufactured and is ready to be sent to the stores. It is also known as finished goods inspection.

11. Inspection by Self Control

The operator himself inspects the item, controlling the operations at different levels of the production processes.

12. Percentage inspection:

Amount of inspection to be done is sometimes expresses in terms of percentage, for e.g., cent per cent, meaning inspection of each and every piece

in the entire lot. Inspection may be in excess of 100% meaning each part is subject to inspection as it passes from one operator to the next.

Example: In assembly of time fuses for projectiles, each individual visually inspects each piece to see that the previous individual contributed his/her part before adding the next component. In this way, each assembler in turn becomes an inspector verifying the performance of the previous assembler.

13. Efficiency Inspection:

This inspection is synonymous with the trail run of a completed ship, locomotive, turbo, turbo-generator, or other equipment, for the purposes of securing performance data to check against anticipated results.

14. Endurance Inspection:

This is given to assemblies to determine how much usage they can withstand and to locate weaknesses, if any, for rectification e.g., army rifles, etc.

15. Destructive Inspection

It is carried on to determine the ultimate resistance or effectiveness of the objects tested. It is regularly carried on at firing to test guns, projectiles, and armour. Guns are sometimes tested to destruction to check the factor of safety calculations. A few shells are selected random from a lot and fired to determine fragmentation or ability to penetrate armour. Sample armour plate is used as a target to determine resistance to penetration. This kind of inspection differs from other inspection in that the specimen is destroyed.

16. Product Inspection:

Product inspection is the art of applying tests, by the aid of measuring appliances, to observe whether a given item of product is within the specified limits of variability.

17. Tests Allied to Completed Mechanism:

After parts of a mechanism have been assembled, a final operating test or series of tests should be made, stimulating maximum demands to be carried out on the mechanism after it is placed in service. Strength tests are in themselves the maximum limit.

18. Piecework Inspection:

Work produced on a piece work basis requires much more scrutiny than work produced on a straight line basis. Operators anxious to earn more become careless and a poor quality of work is the likely result. A change-over from a careless and poor quality of work is the likely result. A change-over from a time basis to a piece work basis generally requires an increase in inspection

costs which must be offset by the advantages of the latter over the former system.

7. List out the Functions of Inspections?

Functions of inspections:

- To determine whether the incoming goods are physically or chemically desire characteristics in accordance with specifications.
- To determine whether a part is correctly formed and dimensioned in accordance with the specifications.
- To determine if the patterns and tools which are purchased or are capable of producing the parts in accordance with specifications.
- To determine if the metallic structure, hardness and other properties have been performed.
- To assure management that product below the pre-determined quality specifications will not be dispatched to customers.
- Reporting source of manufacturing difficulties to management.
- Ensuring inspection equipment in good condition.
- Employing best methods of inspection at lowest cost.

Answer for fill ups

1. characteristics and attributes
2. X chart
3. A Quality Circle
4. Inspection
5. receiving inspection
6. Centralized Inspection

UNIT - V

PURCHASE MANAGEMENT

Purchasing is a function of procuring goods and services from sources external to the organization. In the words of ALFORD and BERRY purchasing is procuring of materials supplies machines, tools and services require for the equipment maintenance and operation of a manufacturing plant.

Functions of manufacturing department:

1. Locating, selecting and developing qualified sources of supply.
2. Scrutinizing purchase indents and deciding the method of purchase.
3. Plotting enquires, processing quotation conducting negotiations and releasing purchase order.
4. Pre-delivery follow-up and storage chasing.
5. Co-coordinating with invert inspection including timely return of defective materials back to suppliers.
6. Endorsing suppliers' invoices for payment.
7. Processing suppliers request for price increase including renegotiation of price.
8. Attending on to suppliers' representatives and traveling sales men.
9. Arranging for a meeting between suppliers' representatives and company's officials.
10. Disposal of surplus, absolute and scrap materials.
11. Advising the management with regard to new material, new products forward buying etc.,
12. Acting as a link between company's finance department and supplier for timely settlement for suppliers' bills.
13. Attending to periodical activities like applying for important license quota, etc.,
14. Study the market conditions and enter into rate contact with the large suppliers to ensure availability of materials all the time.

Responsibility of the purchase department:

Given below is the list of responsibilities of the purchase department. Some of which are wholly its own, and some of which it shares with other departments.

1. Responsibilities which belong exclusively to the purchase department
 - ❖ Selecting the right suppliers

- ❖ Obtaining materials at the best price (quite obtain the lowest price need not necessarily be the best price or the right price)
- ❖ Placing purchase orders with the suppliers. Following of with the suppliers up to ensure timely delivery.
- ❖ Ensuring that the relationship with the suppliers is always cordial.
- ❖ Enquiring into complaints both from suppliers and user departments.
- ❖ Selecting the appropriate managers and staff for the purchasing function (one the prime considerations is integrity of the highest order)
- ❖ Important training to purchase personnel to improve efficiency

2. Responsibilities with the purchase:

Department shares with other departments,

- ❖ Obtaining technical information and advice the materials.
- ❖ Establishing and developing a specification for materials (The main object is Assuring that quality is just right-neither too high or nor too low, both of which will affect cost and profitability.
- ❖ Scheduling order for materials on suppliers and fixing delivery dates for supplies.
- ❖ Specifying mode for delivery and transportation.
- ❖ Inspecting materials received the ensuring that the specification laid down has been complied with.
- ❖ Accounting of materials purchased, including payment of bills.
- ❖ Inventory control.
- ❖ Receiving, store-keeping and warehousing.
- ❖ Entering into construction contracts or service is contracts or agreement.
- ❖ Sale of scrap-surplus and salvaging.
- ❖ Transportation of materials including clearing of goods.
- ❖ Determining whether to make or buy.

Duties of a purchasing department

The usual duties that are assigned to a purchasing department are;

1. Finding and approving suppliers:

In this context, the term suppliers refer to include both those who supply goods and those who supply services. This should be done not only by discussions with representatives and perusal of catalogues and sample, but also by visiting the suppliers' premises the approval in technical aspects of the vendor's product or services may be the responsibility of the quality or the

design department, but the purchaser should be convinced that the source of the supply is stable, reliable, and will be able to fulfill the demands made upon it.

2. Purchase at least total cost:

While the quality and quantity of goods or services may be specified, elsewhere, the purchaser must purchase the materials at the most advantageous terms. He must be prepared to assist in or lead all discussions on order qualities, and give advice on imponderables - such as anticipated services from the supplier - which can effect the decision on the choice of vendor.

3. Receipt of Quotations:

A purchaser should obtain a list of satisfactory suppliers and should send out as many enquires as convenient, requesting information on quality, price, delivery, etc. These enquires must be marked clearly FOR QUATATION ONLY. Quotations received should be examined for such item as delivery charges, discount structure (e.g., discount for prompt payment), supplementary charges and any restrictions. The use of the learning curve as a negotiating into a value analysis team is a well established and a useful practice.

4. Ensuring delivery of goods and services at right time:

This involves contacting suppliers before the due date of dispatch of items and ensuring timely dispatch. It must be revised that deliveries which are too early may form a source may form a source of embarrassment, not only because payment may be demanded early, but also because excessive space might be occupied in stores.

In practice, in some organizations, the delivery date and indeed even the time of delivery may have to specify to avoid congestion.

1. Warning all concerned against delay in delivery:

If, it is clear that a delivery date is could not be met, the appropriate departments must be informed so that work can be rescheduled, if necessary.

2. Verifying invoices presented by suppliers:

The purchase department verifies and ensures that all conditions like price, quantity, quality (grade), etc., that were earlier agreed upon are in order. A further need for verification of invoices arises from the problem of defective material being supplied. To help resolve this problem, a note of every 'rejection' should be passed to purchasing. The recording of these rejected materials will also help in building up a case against the supplier, and this may as well affect the placing of future orders.

3. Speculative buying:

Speculative buying is sometimes the duty of purchase department and it implies purchasing of goods, not from reasons of immediate need but become

of favorable market conditions. Thus, it may seem to the purchaser, from his intimate knowledge of the market, that a particular commodity is likely to become difficult to obtain or that its price is likely to rise sharply. Buying in the permit material bought cheaply to be resold at a profit. Speculative buying is both difficult and potentially dangerous and can result in a company carrying huge stocks which are difficult to clear.

4. Assisting in pricing:

Advising on prices for materials or services to be used in new markets or in modified design of a product. This aspect can be of substantial value since it may help in deciding major policy matters - For example, the feasibility of meeting a marketing requirement on price, or the likely cost of re-equipping a unit.

5. Acting as a 'window-to-the-world':

Purchasing brings continual contact with outside organisation's, and this can prove a valuable channel of communication whereby news of novel processes, materials, services and equipment are brought to the notice of the department.

Purchase Parameters - Eight Rights (8R's) of Purchasing:

Scientific purchasing is not a mere procurement of needed materials at the lower price but procuring them in a way that minimizes the overall cost of the product. To ensure this scientific, purchasing is governed by eight well known parameters called basis elements of scientific purchasing or also called principles of purchasing or simply "8R's go buying"- Right quality, right quantity, right price right time right source right place of delivery transportation , right procedure and right contract.

1. Right quality

Quality of a product is measured in terms of its design chemical; composition heat treatment surface, manufacturing processes mechanical and electrical properties, workmanships, etc. Two distinct but closely inter related as elects of quality are quality of design and quality of conformance.

Quality of design for purchased items refers to the quality specified by the company's design departments in the form of specifications while quality of conformance refers to the extent to which the goods and service purchased complies with the specification laid down.

To determine the quality of conformance or purchased items, samples plans are used. Different methods of providing quality specification are brand or trade name commercial standard, performance standard blue print, samples etc.

2. Right quantity

Right quantity is yet other important parameters in buying. Quality decisions are influenced by "REPLENISHMENT METHODS" AND "BUYING METHODS". Replenishment methods such as reorder two bin system review system -optional replenishment and review system-compulsory replenishment help to provide broad guidelines. For examples order quantity under first three replenishment systems is fixed and is generally the economic order quantity yet the same might have been modified in the light of constraints. However, the re-order quantity under the forth system (i.e., review period- compulsory replenishment) varies and it equals the difference between the maximum level less the sum of stock on hand and stock on pipeline".

Buying methods followed by the buyer too has an influence on order quantity,

- For example reorder quantity under:-
- Hand to mouth buying quantity is too small.
- Forward buying is generally very large covering long period of consumption.

Besides the above mentioned factors consumption markets condition lead time source of supply etc., too influence the decisions of right quantity.

3. Right price

Right price does not mean lowest price but the price which minimize the overall cost. Right price is not very easy to determine to arrive at the right price, the following techniques are employed.

Negotiation is used-

- (i) When there are limited vendors
- (ii) When time available to make purchase is short, and
- (iii) when items belong to a fixed price category.

Tender system is followed in public sector undertakings to identify the lowest potential bidder.

Learning curve is employed to determine the price of items with high labour content.

4. Right time.

Right time and lead time are closely related. Right time implies that time at which the goods requested should be received while lead time refers to the time between the communication of the need for an item to be purchased by the indenter till the item is actually received and it is made available for consumption. The buying department has the sole responsibility of developing lead time information for all items and make it available to those concerned -

mainly planning and stores - so that they indent their requirements well in advance and avoid the need for rush purchases. Basic elements of lead time are advance and avoid the need for rush purchases. Basic elements of lead time are:

- I. Time required by the indicator to communicate requirement to purchase.
- II. Time required by purchase to locate, select and develop qualified source of supply including finalization of agreement, etc.
- III. Transmit time for the purchase order to reach supplier.
- IV. Time required by the supplier to route buyer's order through his administrative channels.
- V. Time required by supplier to fill buyer's order through his administrative channels.
- VI. Time required by supplier to fill buyer's order (i.e., time required by the suppliers to manufacture goods).
- VII. Transportation time for the goods to reach buyer's destination.
- VIII. Time required by buyer's receiving department to collect materials from transporter's godowns, verify the quality received and prepared necessary documents.
- IX. Time required by the buyer's inward inspection section to verify the quality of goods.
- X. Time required by the main stores to take possession of the goods, deposit them into appropriate bins and update inventory.
- XI. Issuing materials and carrying them to the place of work.

5. Right Source:

Only the right source can give quality of materials in the right quantities at the right price and at the right time. Right source aspect involves decisions as to

- (a) The kind of items to be purchased directly from the manufacturers,
- (b) From which dealers and:
- (c) From which open market, etc.

Right source also requires the analysis of transportation costs along with the basic source also requires the analysis of transportation costs along with the basic price to make selection between a distance supplier and a local one.

6. Right Place of Delivery/Transportation:

In most of the cases, items have to be supplied directly to the consuming units, which may be located at far distance places from the headquarters. The place of delivery should be clearly mentioned in the supply order.

7. Right Procedure:

The right procedure to be adopted has to be formally developed for the pre-purchase, ordering, and post-purchase systems. Pre-purchased means initiating the purchase through requirement of indents, planning, and selection of suppliers, obtaining quotations and evaluating them. Along with the purchase order, an acknowledgement copy is also sent to the supplier, who returns the same duly signed as a token of acceptance of the purchase order and to abide by the terms and conditions mentioned in the order.

8. Right Contract:

Purchase order is a legal document that binds the selling company with the buying company. Various terms and conditions about insurance, sales tax, octroi, excise, customs, breach of contract, settlement of dispute, etc.,

Factors in source selection:

The selection of particular availability of source(s) must be such factors as reliability, technical abilities, after sale service, buying convenience, past experience, location, financial position, labour relations, reciprocal relations etc.

Methods of Purchasing:

The purchasing department of the company is responsible to provide goods and services required by the company at the minimum cost and in optimum quantities. The request to procure may be received either from stores department or from one of the functional departments. Such requests may be received-

- i) either for direct materials or for indirect materials;
- ii) either for production items or for non-production items;
- iii) either for low priced items or for expensive items.
- iv) either for the items which are controlled by the forces of supply and demand or for the items which are available off the shelf;
- v) either for items to be procured from manufacturers or for items to be bought from middlemen;
- vi) either for items sold at premium or for items sold at discount;
- vii) either at time when prices are at their peak or at a time when prices are stable;
- viii) either to meet immediate needs or to satisfy needs at a later date;
- ix) either for seasonal items or for non -seasonal items;
- x) either for items produced to buyer's design or for items produced to commercial standards.

Different methods of purchasing can be classified according to the demand and conditions in the market.

1. Hand-to-mouth purchase:

Hand-to-mouth, also called purchase according to the requirements refers to the frequent purchase of an item in small quantities. Important characteristics of hand-to-mouth buying are:

1. Purchase are made only when demands arises.
2. Purchases are made to cover immediate requirements.
3. Quality purchased is generally small through at times large quantity may be purchased.
4. The terms of contract are negotiated. Competitive bids are generally not obtained as there is no sufficient time.

Advantages of the Hand-to-Mouth purchased method

- i. Lower inventory investment.
- ii. Low carrying charges.
- iii. Reduced deterioration and obsolescence of materials.
- iv. Loss is minimized when prices decline.

Disadvantages of the Hand-to-Mouth purchase method

- i. Comparatively higher price due to urgencies.
- ii. Loss of quantity discounts.
- iii. Loss is incurred when prices increase.
- iv. Possible interruption of production schedules because of shortage of materials at the time of need.
- v. Higher clerical costs due to frequency purchases.
- vi. Acceptance of sub-standard goods in emergency.

2. Scheduled Purchasing:

Scheduled purchasing is the process of procuring an item in staggered deliveries according to the delivery schedule furnished to the supplier by the buyer. The salient characteristic of scheduled buying are:

- i. A purchase order covering annual requirements (alternatively a purchase order without specifying the order quantity called open order) is placed with the supplier.
- ii. The supplier is given the estimate of the procurement needs, covering a mutually agreed period of time. It is a common practice to give a confirmed scheduled for a period ranging from 2-3 months and also a tentative schedule for 2-3 months.

- iii. Fresh delivery schedules are given to the supplier prior to completion of the previous schedule. Fresh schedule supersedes the previous schedule. Fresh schedule usually retains the confirmed scheduled of the overlapping period while it specifies confirmed as well as tentative schedules of the next few periods.
- iv. Monthly deliveries are usually specified except for perishable materials, bulky items and others required in large quantities or where supplier has set up production facilities specifically for the buyer. In such cases, monthly schedules may be split up further into weekly schedule.

Advantages of scheduled purchasing

- i. Both buyer and seller enjoy the savings resulting from regularity of production and smaller inventories.
- ii. Buyer is assured of supply of goods while supplier is assured of business.
- iii. Supplier can effectively plan his factors of production while the buyer can plan his requirements of finance.

3. Market Purchasing:

Market purchasing also called forward buying, refers to the procurement of sufficient quantity of an item, at a time when prices are low (and or expected to rise) to meet the requirements of production in advance of the future needs. Important characteristic of forward buying are:

- i. Purchases are made to cover production requirements for a considerable period.
- ii. Quantity purchased is generally large.
- iii. The atmosphere is usually favourable for negotiation of price, etc.
- iv. Purchases are made when the prices are low. The buyer also gets discount on large purchases.

Advantages of market purchasing

Market purchasing results in lower purchase price, greater margin of profit on finished goods, saving in procurement expenses as purchases are usually consolidated, and security against shortage.

Disadvantages of the market purchasing method

- i. The entire needs of production requirement may not be served.
- ii. Price expectations, if not realized may result in financial loss to the firm.
- iii. Inventory holding charges are considerably higher.
- iv. Large scale obsolescence may result if design changes occur

4. Speculative Purchasing:

Speculative purchasing refers to the buying of an item in large quantities when its price is low with an intention to sell a bulk of it at a higher price for speculative profits. Important characteristics of speculative buying are:

- ❖ Purchases are in no way related to the company's production programme. An item which is not even required for production may be purchased.
- ❖ Speculative buying does not base decisions on quantity. Its single object is to make speculative profits. The quantity purchased is thus generally high and is much as the company's financial resources permit to buy.

5. Contract purchasing

Though all purchases are made through contracts, the term contract buying is applied to those special contracts which call for deferred delivery over the period. According to Spriegel "contract buying is the purchasing made under contract, usually formal, of needed materials, delivery of which is frequently spread over a period of time."

6. Blanket Orders

Blanket orders refer to the purchase of a variety of items from a single source, usually, a middleman. Important characteristics of blanket orders are:

- a) A blanket order specifies the category of items covered by the order.
- b) The items covered by the order generally have low unit value.
- c) More than one middleman may be selected to avoid holds-ups in case of non-availability of an item with one.
- d) "Market-price" is generally specified in the order which may include a specified method of determining price variations.
- e) The supplier is informed of the requirements over telephone who supplies and bills at the "prevailing price less agreed discount". The records of the supplier are open to inspection on demand.

7. Tender Purchasing

Government departments and public sector undertakings in India follow this method of buying. Private sector organizations too adopt tender buying if the value of the purchase exceeds the prescribed limits, say Rs.25000 or Rs. 50,000 fixed by a management as a policy decision.

8. Seasonal Purchasing

Seasonal buying refers to "buying of the annual requirements of an item during its season". This method is used for items available in particular season only. Such items may be required for food processing and other processing and other similar industries. Important characteristics of seasonal buying are:

- a) Certain items like oranges, sugarcane, apples, etc., may be available during a particular season only and hence they need to be purchased and stocked in sufficient quantities till the arrival of the next season.
- b) The items covered may be small in size but they may be required in large quantities.
- c) Market price is the lowest during the season, therefore, the items can be purchased at the cheapest at the cheapest rates;
- d) Usually, the manufacturers are contacted during the season and direct purchases are made.

9. Group Purchasing

Group purchasing refers to buying of items of trivial value in a single purchase order. Important characteristic of group purchasing are:

- a) Items required in small quantities are classified into few basic groups; the basic group being dependent is classified into few basic groups, the basic group being dependent on the source of purchase.
- b) Minimum and maximum levels are fixed for each item within each classified group.
- c) One purchase order-one for each group-covering a number of varied items within its group is placed with the supplier.
- d) Stock-on-hand is reviewed periodically, say, once a month or once in two months.
- e) Quantity, equal to the difference between the 'maximum level' and 'stock on hand' is procured for each item.

10. Sub-Contracting

Sub-contracting is the work placed with outside supplier to manufacture a particular item as per the instructions/specifications of the main contractors for economic reasons or to augment the existing manufacturing facilities. Sub-contracting is the hiring of another firm to perform some of the manufacturing operations or to furnish certain parts and sub-assemblies to be incorporated into the buyer's end product.

11. Purchasing by requirement

Purchases are made whenever a need arises and that too only the quantity required is purchased. This method is suitable for made to order jobs goods used infrequently, etc.

12. Purchasing for a specified future period

This method is suitable when goods are regularly used whose price fluctuations are negligible.

13. Just-in-Time Purchasing (JIT Purchasing)

JIT purchasing is wrongly perceived as the activity of pushing inventory on to the suppliers. It is in fact the technique of eliminating wastes in purchase functions by developing long term, mutually beneficial relationship, with fewer but better suppliers. It aims at:

- i. eliminating wastes in the purchase process (e.g., order processing costs, follow up costs, stock out costs, packaging and packing costs, freight costs, cost of handling, etc.
- ii. eliminating wastes at suppliers; end (transport costs, rejection costs, etc.,)
- iii. Eliminating purchased inventory.

Centralised versus Decentralised Buying

Centralised buying refers to the procurement of the requirements of the entire department of the firm or of all the plant by a central purchase organization.

Advantages of the centralized buying:

- i. Consistency in buying policies since all purchase contracts and related decisions are taken by one department.
- ii. Economy in buying due to better bargaining on price and better terms and conditions with vendors, reduced in transport costs, etc., on account of large scale purchasing.
- iii. Uniformity in purchase records since only one department handles all purchases.
- iv. Economy in maintenance of records in the purchase (few purchase indents), receiving and inspection (fewer receipts) and accounts (fewer payments) departments.
- v. Low inventory investment.
- vi. Reduction in handling and storage costs due to centralisation of receiving, inspection and storage.
- vii. Performance of specialist functions by non-specialists.

Decentralised buying refers to the system of procurement of requirements of the different divisions or different plants by themselves, vested with all the power of the purchase department, each attached to the division or situated at the plant concerned.

Advantages of Decentralised Buying

- i. Greater flexibility: Decentralisation enables individual buyers to reach rapidly to change in requirements of the divisions/plans to which they are attached.

- ii. **Close Liaison:** Since local buyers are in close contact with their respective divisions, they can render greater assistance to them by providing information on probable price, delivery schedule, and performance of items to the departments concerned.
- iii. **Accountability:** A local buyer under the decentralized system is under the control of a senior executive of the division/plant and the executive concerned can be held responsible for the production lost due to failure attributable to the buyer.

International Purchase:

In many cases the materials, parts or components required may not be available within the country and might have to be imported from abroad. There are two factors involved in importing materials from abroad -

- i. A contract with the foreign supplier for the purchase of materials. This involves primarily a clear understanding of the quality of the product and the price and other terms of the scale.
- ii. The procedure involved in the import. First, one has to obtain, if required an import license for the material. The other is the arrangement of payment to the supplier, payment for insurance, shipping, customs, etc.

Import Sourcing

After a decision has been taken to import a particular item, the first step would be to identify and select the supplier from whom the import can be made. International purchasing has several problems unlike purchasing from within the country. Even if we are able to identify and select the supplier from whom the import can be made. International purchasing has several problems unlike purchasing from within the country. Even if we are able to identify the country of a manufacturer who can supply the product, it is possible that the rules and regulations of the country may not permit exports to India or the government of India's regulations may not allow imports from country.

The secondary problem is ensuring that the goods are purchased competitively, are of the required quality, the goods are available in the required quantity and in time. Unlike an Indian supplier, we would have very little information about the foreign supplier expect what may be found in a written document or a catalogue.

There are several source of information on foreign suppliers, like journals and periodicals, both Indian and international, which identify foreign manufacturers as also several organisation's, both Indian and international which provide information on the possible sources.

Some of the considerations that may go into source selection are as follows:

1. Ensure that there is no political embargo on imports from the foreign country concerned.
2. In certain cases, import trade might be very highly restricted and may be confined to a small number of items and only as per the bilateral agreement between the two nations.
3. Geographical location may be an important criterion. For example, obtaining goods from Latin America may involve very high freight charges.
4. Some countries are known for maintaining high standards in quality especially with regard to capital goods (Machinery and equipment), industrial raw materials, instructions, etc. In such cases, it would be desired to focus on the major developed countries like, USA, Japan, etc.
5. In certain cases, it would be necessary to have an efficient after-sales service, and in such cases, it is beneficial to select suppliers who have agents in India to render such services.
6. With regard to mass consumption items like edible oils, several sources would be available and it might be desirable to float international tender inviting suppliers to quote. The same applies to industrial raw materials. An important source of information would be the catalogues of foreign manufacturers.
7. In certain cases, there might be only one source of supply of a specific type of machinery or raw materials.
8. In many cases, imports can be made only through the canalized agencies like State Trading Corporation (STC), Minerals and Metals Trading Corporation (MMTC), etc., and it is not allowed to make any import directly.
9. In many cases, imports can be made only through the canalized agencies like State Trading Corporation (STC), Minerals and Metals Trading Corporation (MMTC), etc,

Steps involved in Import Purchase:

- i. Need Identification: A prospective importer has to identify the need for import of a specific material. This may be promoted by various reasons. A decision is taken of a specific material. This may be promoted by various reasons. A decision is taken after due deliberations about the necessity to import a particular material.
- ii. In-depth study: This step necessitates an in-depth study of the import export policy currently in force. If material needs an 'import licence', an

- application is made for the same and necessary steps taken for obtaining it.
- iii. Source development/supplier selection: The next step would be locating possible foreign source for the material. This would include obtaining information about various sources, their terms and conditions of offer, etc. An inquiry may have to be floated for inviting quotation from prospective sources. The quotations received in response to the inquiry would need to be analysed and tabulated for the purpose of evaluation and selection in terms of capacity.
 - iv. Negotiations: On the basis of data developed in respect of the selected few parties, negotiations are carried out with them in order to determine the suppliers with whom the final contract may be entered into.
 - v. Import license: On the basis of the firm offer from the foreign party an import license, if required, is applied for and obtained.
 - vi. Contract: On the basis of the negotiation duly concluded, an agreement or a contract is entered into between the supplier and the importer, which must embody all the terms and conditions. This contract is necessary for various purposes, concerning, banks, customs authorities, etc.
 - vii. Opening of Letter of Credit (L/C): The contract usually stipulate stipulates for opening a letter of credit by the importer in favor of the overseas supplier. For this, the importer approaches his banker for getting a L/C opened and the same is communicated to the supplier.
 - viii. Follow-up on shipment: Upon communication of L/C to the supplier, the importer precedes to follow-up the shipment by having constant rapport with the supplier.
 - ix. Shipping and Insurance: Unless the contract happens to be cost, insurance, and freight (C.I.F) type, the importer has to arrange for freight, insurance, etc. these arrangements have serious repercussions on lead time as well as cost, hence the need for precaution.
 - x. Arrival of documents: Once the shipment is effected, the foreign supplier proceeds to prepare documents in conformity with L/C and submits them for the purpose of negotiation to his bankers.
 - xi. Acceptance/payment of documents: The documents negotiated under L/C are duly presented to the importer, through the bank that opened the L/C for acceptance and payment. If the documents are 'clean' or 'free from any discrepancies', the importer is duly-bound to accept them. The payment has to be made by the importer depending upon the tenure of the L/C.

- xii. **Clearance Formalities:** Once the materials arrive, the importer has to precede further with the 'clearance' formalities. He has to obtain the documents in original, viz., commercial invoice, bill of lading, packing list, certificate of origin and other certificates and declarations, as may be necessary.
- xiii. **Port Clearance:** Once the clearance is obtained from the customs authorities, steps may be taken to obtain physical possession of the material and have it transported to the place of ultimate use/consumption.
- xiv. **Receipt and accounting:** As soon as the imported material arrives at its final destination, it has to be duly 'stored' in the appropriate manner. Legal formalities should be complied with before the material is 'accounted' for in the stores records.

Import Substitutions:

Substitution refers to replacement of one material by another for performing the same function. Import substitution, on the other hand, refers to indigenous, source of development so as to

- i. get the materials indigenously,
- ii. to conserve valuable foreign exchange,
- iii. to reduce the cost of production, and
- iv. encourage and develop local industry and trade.

The responding organizations attribute the slow progress in import substitution due to the following reasons:

- i. Technical experts of the organization unwilling to take the risk of indigenous items.
- ii. Drawings not readily available for several facilities.
- iii. Lack of indigenous production facilities.
- iv. Lack of local inspection facilities.
- v. The quantity required for certain items are uneconomical for manufacture due to low demand.
- vi. Higher cost of production.
- vii. Power cut and voltage fluctuations, leading to delayed delivery schedule.
- viii. Power cut and voltage fluctuations, leading to delayed delivery schedule.
- ix. Foreign collaborator discouraging indigenous items.

Vendor Development and Rating

Any organization should realize that the development of vendors is a planned effort and does not happen by itself. Vendors are considered an

important link of a factory and their quality control activities are an extension of the factory quality assurance effort. Purchase and Quality control are jointly responsible in implementing the vendor development system. They make full use of expertise of production engineering and research & development departments in vendor development.

A good supplier (vendor) is an invaluable resource to the organization requiring the vendor's product services. Such suppliers make a direct contribution to a firm's success. They can assist their customers with product development, value analysis, and timely delivery of components with precise specifications at the desired level of quality. Good buyer - seller relationships facilitate the buyer's efforts to gain superior performance, extra service, cooperation on cost reduction programmes and a willingness to share in new process and procedure. A right supplier is one who is ethical in his behavior, stands by his promise and has a high regard for a cordial buyer - seller relationship.

Check the progress:

Fill ups

1. _____ is a function of procuring goods and services from sources external to the organization.
2. _____ is sometimes the duty of purchase department and it implies purchasing of goods, not from reasons of immediate need but because of favourable market conditions.
3. Right quantity is yet another important parameter in buying. Quality decisions are influenced by _____
4. The right procedure to be adopted has to be formally developed for the _____
5. _____ is the process of procuring an item in staggered deliveries according to the delivery schedule furnished to the supplier by the buyer
6. _____ buying refers to the procurement of the requirements of the entire department of the firm or of all the plant by a central purchase organization

Points to remember

1. Purchasing is procuring of materials supplies machines, tools and services required for the equipment maintenance and operation of a manufacturing plant.
2. Quotations received should be examined for such items as delivery charges, discount structure (e.g., discount for prompt payment), supplementary charges and any restrictions.

3. Quality of design for purchased items refers to the quality specified by the company's design departments in the form of specifications while quality of conformance refers to the extent to which the goods and service purchased complies with the specification laid down.

4. Speculative purchasing refers to the buying of an item in large quantities when its price is low with an intention to sell a bulk of it at a higher price for speculative profits

5. Decentralised buying refers to the system of procurement of requirements of the different divisions or different plants by themselves, vested with all the power of the purchase department, each attached to the division or situated at the plant concerned.

Model questions

1. Define Purchase Management and its functions of manufacturing department?

Purchase management:

Purchasing is a function of procuring goods and services from sources external to the organization. In the words of ALFORD and BERRY purchasing is procuring of materials supplies machines, tools and services require for the equipment maintenance and operation of a manufacturing plant.

Functions of manufacturing department:

- Locating, selecting and developing qualified sources of supply.
- Scrutinizing purchase indents and deciding the method of purchase.
- Plotting enquires, processing quotation conducting negotiations and releasing purchase order.
- Pre-delivery follow-up and storage chasing.
- Co-coordinating with invert inspection including timely return of defective materials back to suppliers.
- Endorsing suppliers' invoices for payment.
- Processing suppliers request for price increase including renegotiation of price.
- Attending on to suppliers' representatives and traveling sales men.
- Arranging for a meeting between suppliers' representatives and company's officials.
- Disposal of surplus, absolute and scrap materials.
- Advising the management with regard to new material, new products forward buying etc.,

- Acting as a link between company's finance department and supplier for timely settlement for suppliers' bills.
- Attending to periodical activities like applying for important license quota, etc.,
- Study the market conditions and enter into rate contact with the large suppliers to ensure availability of materials all the time.

2. What are the duties of purchasing department?

Duties of a purchasing department

The usual duties that are assigned to a purchasing department are;

1. Finding and approving suppliers:

In this context, the term suppliers refer to include both those who supply goods and those who supply services. This should be done not only by discussions with representatives and perusal of catalogues and sample, but also by visiting the suppliers' premises the approval in technical aspects of the vendor's product or services may be the responsibility of the quality or the design department, but the purchaser should be convinced that the source of the supply is stable, reliable, and will be able to fulfill the demands made upon it.

2. Purchase at least total cost:

While the quality and quantity of goods or services may be specified, elsewhere, the purchaser must purchase the materials at the most advantageous terms. He must be prepared to assist in or lead all discussions on order qualities, and give advice on imponderables - such as anticipated services from the supplier - which can effect the decision on the choice of vendor.

3. Receipt of Quotations:

A purchaser should obtain a list of satisfactory suppliers and should send out as many enquires as convenient, requesting information on quality, price, delivery, etc. These enquires must be marked clearly FOR QUATATION ONLY. Quotations received should be examined for such item as delivery charges, discount structure (e.g., discount for prompt payment), supplementary charges and any restrictions. The use of the learning curve as a negotiating into a value analysis team is a well established and a useful practice.

4. Ensuring delivery of goods and services at right time:

This involves contacting suppliers before the due date of dispatch of items and ensuring timely dispatch. It must be revised that deliveries which are too early may form a source may form a source of embarrassment, not only because payment may be demanded early, but also because excessive space might be occupied in stores.

In practice, in some organizations, the delivery date and indeed even the time of delivery may have to specify to avoid congestion.

➤ **Warning all concerned against delay in delivery:**

If, it is clear that a delivery date is could not be met, the appropriate departments must be informed so that work can be rescheduled, if necessary.

➤ **Verifying invoices presented by suppliers:**

The purchase department verifies and ensures that all conditions like price, quantity, quality (grade), etc., that were earlier agreed upon are in order. A further need for verification of invoices arises from the problem of defective material being supplied. To help resolve this problem, a note of every 'rejection' should be passed to purchasing. The recording of these rejected materials will also help in building up a case against the supplier, and this may as well affect the placing of future orders.

➤ **Speculative buying:**

Speculative buying is sometimes the duty of purchase department and it implies purchasing of goods, not from reasons of immediate need but become of favorable market conditions. Thus, it may seem to the purchaser, from his intimate knowledge of the market, that a particular commodity is likely to become difficult to obtain or that its price is likely to rise sharply. Buying in the permit material bought cheaply to be resold at a profit. Speculative buying is both difficult and potentially dangerous and can result in a company carrying huge stocks which are difficult to clear.

➤ **Assisting in pricing:**

Advising on prices for materials or services to be used in new markets or in modified design of a product. This aspect can be of substantial value since it may help in deciding major policy matters - For example, the feasibility of meeting a marketing requirement on price, or the likely cost of re-equipping a unit.

➤ **Acting as a 'window-to-the-world':**

Purchasing brings continual contact with outside organisation's, and this can prove a valuable channel of communication whereby news of novel processes, materials, services and equipment are brought to the notice of the department.

3. Explain purchase parameters?

Purchase Parameters - Eight Rights (8R's) of Purchasing:

Scientific purchasing is not a mere procurement of needed materials at the lower price but procuring them in a way that minimizes the overall cost of the product. To ensure this scientific, purchasing is governed by eight well

known parameters called basis elements of scientific purchasing or also called principles of purchasing or simply "8R's go buying"- Right quality, right quantity, right price right time right source right place of delivery transportation, right procedure and right contract.

1. Right quality

Quality of a product is measured in terms of its design chemical; composition heat treatment surface, manufacturing processes mechanical and electrical properties, workmanships, etc., Two distinct but closely inter related as elects of quality are quality of design and quality of conformance.

Quality of design for purchased items refers to the quality specified by the company's ensign departments in the form of specifications while quality of conformance refers to the extent to which the goods and service purchased complies with the specification laid down.

To determine the quality of conformance or purchased items, samples plans are used. Different methods of providing quality specification are brand or trade name commercial standard, performance standard blue print, samples etc.

9. Right quantity

Right quantity is yet other important parameters in buying. Quality decisions are influenced by "REPLENISHMENT METHODS" AND "BUYING METHODS". Replenishment methods such as reorder two bin system review system -optional replenishment and review system-compulsory replenishment help to provide broad guidelines. For examples order quantity under first three replenishment systems is fixed and is generally the economic order quantity yet the same might have been modified in the light of constraints. However, the re-order quantity under the forth system (i.e., review period- compulsory replenishment) varies and it equals the different between the maximum level less the sum of stock on hand and stock on pipeline".

Buying methods followed by the buyer too has an influence pm order quantity, For example reorder quantity under:-

- Hand to mouth buying quantity is too small.
- Forward buying is generally very large covering long period of consumption.

Besides the above mentioned factors consumption markets condition lead time source of supply etc., too influence the decisions of right quantity.

10. Right price

Right price does not mean lowest price but the price which minimize the overall cost. Right price is not very easy to determine to arrive at the right price, the following techniques are employed.

Negotiation is used-

- (i) When there are limited vendors
- (ii) When time available to make purchase is short, and
- (iii) when items belong to a fixed price category.

Tender system is followed in public sector undertakings to identify the lowest potential bidder.

Learning curve is employed to determine the price of items with high lab our content.

11. Right time.

Right time and lead time are closely related. Right time implies that time at which the goods requested should be received while lead time refers to the time between the communication of the need for an item to be purchased by the indenter till the item is actually received and it is made available for consumption. The buying department has the sole responsibility of developing lead time information for all items and make it available to those concerned - mainly planning and stores - so that they indent their requirements well in advance and avoid the need for rush purchases. Basic elements of lead time are:

- Time required by the indicator to communicate requirement to purchase.
- Time required by purchase to locate, select and develop qualified source of supply including finalization of agreement, etc.
- Transmit time for the purchase order to reach supplier.
- Time required by the supplier to route buyer's order through his administrative channels.
- Time required by supplier to fill buyer's order through his administrative channels.
- Time required by supplier to fill buyer's order (i.e., time required by the suppliers to manufacture goods).
- Transportation time for the goods to reach buyer's destination.
- Time required by buyer's receiving department to collect materials from transporter's godowns, verify the quality received and prepared necessary documents.

- Time required by the buyer's inward inspection section to verify the quality of goods.
- Time required by the main stores to take possession of the goods, deposit them into appropriate bins and update inventory.
- Issuing materials and carrying them to the place of work.

12. Right Source:

Only the right source can give quality of materials in the right quantities at the right price and at the right time. Right source aspect involves decisions as to

- (d) The kind of items to be purchased directly from the manufacturers,
- (e) From which dealers and:
- (f) From which open market, etc.

Right source also requires the analysis of transportation costs along with the basic source also requires the analysis of transportation costs along with the basic price to make selection between a distance supplier and a local one.

13. Right Place of Delivery/Transportation:

In most of the cases, items have to be supplied directly to the consuming units, which may be located at far distance places from the headquarters. The place of delivery should be clearly mentioned in the supply order.

14. Right Procedure:

The right procedure to be adopted has to be formally developed for the pre-purchase, ordering, and post-purchase systems. Pre-purchased means initiating the purchase through requirement of indents, planning, and selection of suppliers, obtaining quotations and evaluating them. Along with the purchase order, an acknowledgement copy is also sent to the supplier, who returns the same duly signed as a token of acceptance of the purchase order and to abide by the terms and conditions mentioned in the order.

15. Right Contract:

Purchase order is a legal document that binds the selling company with the buying company. Various terms and conditions about insurance, sales tax, octroi, excise, customs, breach of contract, settlement of dispute, etc.,

Factors in source selection:

The selection of particular availability of source(s) must be such factors as reliability, technical abilities, after sale service, buying convenience, past experience, location, financial position, labour relations, reciprocal relations etc.

4. Explain Centralised versus decentralized buying?

Centralised versus Decentralised Buying

Centralised buying refers to the procurement of the requirements of the entire department of the firm or of all the plant by a central purchase organization.

Advantages of the centralized buying:

- Consistency in buying policies since all purchase contracts and related decisions are taken by one department.
- Economy in buying due to better bargaining on price and better terms and conditions with vendors, reduced in transport costs, etc., on account of large scale purchasing.
- Uniformity in purchase records since only one department handles all purchases.
- Economy in maintenance of records in the purchase (few purchase indents), receiving and inspection (fewer receipts) and accounts (fewer payments) departments.
- Low inventory investment.
- Reduction in handling and storage costs due to centralization of receiving, inspection and storage.
- Performance of specialist functions by non-specialists.

Decentralized buying refers to the system of procurement of requirements of the different divisions or different plants by themselves, vested with all the power of the purchase department, each attached to the division or situated at the plant concerned.

Advantages of Decentralized Buying

- Greater flexibility: Decentralization enables individual buyers to reach rapidly to change in requirements of the divisions/plans to which they are attached.
- Close Liaison: Since local buyers are in close contact with their respective divisions, they can render greater assistance to them by providing information on probable price, delivery schedule, and performance of items to the departments concerned.
- Accountability: A local buyer under the decentralized system is under the control of a senior executive of the division/plant and the executive concerned can be held responsible for the production lost due to failure attributable to the buyer.

Answer for fill ups

1. Purchasing
2. Speculative buying
3. Replenishment Methods"and "Buying Methods
4. pre-purchase, ordering, and post-purchase systems
5. Scheduled purchasing
6. Centralised

SCOPE OF VENDOR DEVELOPMENT

One of the basic objectives of materials management is vendor development and rating. The scope of vendor development includes-

1. Identifying new sources of supplier base from time to time.
2. Dropping out existing sources which prove to be inefficient.
3. Advertising in the newspapers inviting tenders from, suppliers.
4. Developing ancillary units and sub-contractors,
5. Maintaining a regular list of approved suppliers called registered of suppliers
6. addressing the appropriate efficient and tactical issues,
7. Ensuring that those potential suppliers are carefully evaluated and that they have the potential to be satisfactory supply partners.
8. Deciding whether to use competitive bidding or negotiation as the basis of source selection.
9. Selecting the appropriate source of is the team leader responsible for this task through evolving a proper method of vendor rating.
10. Cultivating and maintaining good vendor vendee relationship.

Thus vendor development is a continuous process and may start from the collection of names and addresses from different but authentic sources. After collecting the necessary details a list of prospective vendors may be drawn up for evaluation.

Sources of Information on Potential Vendors:

Every purchase department must maintain a classified list of potential vendors i.e., vendors who deal in the materials regularly purchased by the company. There are various sources from which information on suppliers of different types of materials is available. The most important of these are discussed below;-

Trade registers and directories:

There are several trade registers and directories available both Indian and foreign. Some of these deal with, a manufacturers and suppliers o all kinds o materials while some are specialized e.g., those devoted to chemicals or engineering goods and so on. These directories give information on the addresses, regional offices names types and ranges of product of addresses of dealers or agents.

There is also another type of sources faster becoming popular. It is through Electronics Digits interchange. All sales information is stored by foreign manufacturer in his computer. With a personal computer and a modem attached to it one access his/her computer via satellite through the Videsh Sanchar nigam Ltd. (VSNL).

There are international agencies which have world wide suppliers listed in their computer storage system for which once can have access to from any part of the world. In India also such computer- based for directories are being developed quite rapidly.

1. Trade Journals:

Many leading companies advertise in trade journals and these constitute an important source of information about suppliers. These journals also some times carry articles on specific industries and such articles often contain valuable information on the latest developments in the industry including product and technological improvements. There are many trade journals devoted two specifies industries such a chemical steel etc. These usually contain valuable information necessary for sourcing. The information available is mostly through advertisements or though articles.

2. Telephone Directories:

Most telephone directories having Yellow pages, especially in the big cities in India, containing a number of pages of classified advertisements, alphabetically arranged, item-wise or group wise - abrasive, air - conditioners, castings, computer accessories, duplicators, jewellery paper - boards, PVC footwear, welding, electrodes, etc.

3. Suppliers' Catalogues:

Many manufacturers bring out catalogues or pamphlets periodically giving details of the products they manufacture. These catalogues can be easily obtained on request from suppliers. Catalogues contain technical information, specifications, performance characteristics, price, etc.

4. Trade Exhibition and Fairs:

Exhibition and trade fairs are useful places for obtaining information on new suppliers, new products or modifications of old products. Exhibits of specialist products are often held, e.g., textile machinery, motors, office equipment, electronic equipment, etc.

5. Salesmen:

Salesmen are very good source of information for possible source of supply. They are always on the move and are trained to keep their eyes and ears open with regard to the developments that take place around them. They are, therefore, not only fully conversant with the potentialities of their own products but are usually well acquainted with similar products in the market. An alert buyers can tap are usually well acquired with similar products in the market.

6. Company Personnel:

Specialist personnel in other departments, e.g., engineering, sales, designed. Within the company, is another good source of potential information. Through their own professional association or social groups, these personnel learn about new or good suppliers. People involved in Research and Development usually have valuable information of this nature. The buyer should be able to tap this source properly and this is best done by the relationship he/she maintains with his/her colleagues in other departments requesting them from time to time for lending useful information.

7. Supplier information File:

Purchase department of a company should keep supplier information files of past and present containing the name of each supplier, the supplier's delivery history, the supplier's quality record, etc. Supplier information files are important because many purchasing operations are repetitive.

8. Purchase department of other companies:

Exchange of information on a mutual basis with the purchase departments of other companies can be extremely beneficial not only with regard to new sourcing but with regard to supplier evaluation and also prevailing market prices.

9. Filing of Mail-advertisements:

Many mail-advertisement booklets received from suppliers are worth saving. They should be given a file number, and indexed suitably. When buyers seek a new source, they can refer to the index and review the appropriate brochures and booklets immediately.

10. Local Purchasing Management Associations:

Local purchasing management associations, such as the local affiliates of the National Association of Purchasing Management association is that its members help one another, in every possible way, to locate and evaluate new sources of supply.

11. Public Tenders:

One of the most common or popular methods of sourcing is by advertisements in the press. The buyer states the product he/she wishes to have gives necessary information, e.g., specifications or terms of purchase. Potential suppliers respond and sent their quotations. Usually, there are special tender forms in which they have to furnish the information purchases also.

Vender Rating

The hallmark of an effective purchase department is the quality of suppliers selected. The purchaser's prime interest lies in getting the best value from his suppliers. This implies that he should be in a position to assess and rate their performance. An objective accurate vendor rating, can become an asset and a valuable tool in the hands of a buyer in making his/her purchase decisions and also for providing feedback to suppliers with low rating in order to impure their performance. In the absence of such an improvement even after a reasonable period of time, black listing or grey listing the vendor may follow.

The responsibility of vender rating is normally entrusted with a committee comprising Chief commercial manager, Quality control manager, Accounts Manager and Chief Production Engineer. The committee meets every quarter to review each vender's performance.

It classifies the vendors as class 'A' 'B' or 'C' based on their performance. Alternatively, they are also graded as First, Second or Third class vendors. Future enquires shall not be sent to class 'C' (Third grade) vendors. Future enquires shall not be sent to class 'C' (Third grade) vendors. A price preference of 5% to 'A' class (First grade) and 2% to class 'B' (Second grade) vendors shall be accorded over the prices of class 'C' (Third grade) vendors.

Rating Criteria/Factors

There is several rating technique now being used. Whatever be the technique, the vendors are assessed on the basis of a wide variety of factors or criteria which might include, but are not limited to the following:

Price

- | | |
|-----------------------------------|-------------------------------|
| (a) Price | (i) Disposition of rejections |
| (a) Maintenance of specifications | (j) Adjustment policies |
| (b) Promptness of delivery | (k) Inventory plans |

- | | |
|--|---------------------------------|
| (c) Discounts received | (l) Services |
| (d) Compliance with other specifications | (m) Co-operation |
| (e) Freight and delivery charges | (n) Credit terms |
| (f) Installation Cost | (o) Employee training |
| (g) Market information | (p) Cost reduction suggestions. |
| (h) Management competence | (q) Financial position. |

Methods of Evaluation of Suppliers:

In a large store and material organization, where a large number of parts and components are supplied by different vendors, it becomes difficult to keep track on their performance. Therefore, in order to compare the performances of various vendors, it is essential to rate them individually. The rating may be done different parameters such as quality performance, service performance, price performance, etc.

There are various ways in which a supplier can be evaluated. Five of these, viz., the categorical method, the weighted method, the cost-ratio method, the critical incidents method and the check list system are the most popular.

These are described below:

1. Categorical Method:

The buyer makes out a list of all the factors which he/she considers necessary for evaluation, and at periodic intervals, say, once a quarter, he/she makes out a performance report. The buyer may also seek the help of others concerned such as stores, production, or quality control departments, in order to determine the grading to be given. A performance standard may be decided upon a six-point scale category. For example, a vendor who gets

- ❖ 80 points and above out of 100 is considered excellent
- ❖ Between 70-79 points is considered very good
- ❖ Between 60-69 points is considered good
- ❖ Between 50-59 points is considered satisfactory
- ❖ Between 40-49 points is considered average
- ❖ Between 40points is considered poor

2. The Weighted Point Method:

In this method, the evaluation criteria are quantified on a point rating basis for the quality of goods received, the promptness of deliveries made and the quality of the service rendered by the vender points.

The rating would be,

$$\text{Quality performance} = \frac{\text{Number of lots accepted}}{\text{Number of lots received}} * 50$$

Similarly, for delivery rating can be as follows:

$$\text{(a) Timely Performance} = \frac{\text{Number of lots delivered on time}}{\text{Number of lots delivered}} * \text{Quality}$$

$$\text{(b) Quantity performance} = \frac{\text{Quantity supplied}}{\text{Scheduled delivery}} * \text{Delivery}$$

$$\text{(c) Price Performance} = \frac{\text{Least offer received}}{\text{Supplier Offer}} * 20$$

3) Cost Ratio Method:

This method involves an intricate system of determining the actual costs incurred on purchasing, follow-up, transportation, packing, etc., and determining the unit cost incurred by the buyer on the material when actually received.

4) Critical Incidents Methods:

Evaluating vendors under this method requires that a record of events and occurrences related to the buyer-vendor relationship is maintained in each vendor's file. The data and comments recorded should be important and not trivial in nature. They should reflect the positive and negative aspects of an actual performance. This kind of documentation can be used as a basis for discussing ways and means for overcoming difficulties, improving performance, determining the competence of a vendor and if necessary considering his determination.

5) Check list system:

Some companies use a simple check list to evaluate their vendors. Designed to facilitate vendor rating from the stand point of financial strength,

size, product service, price, quality, etc., the check list system is quite useful in evaluating suppliers.

STORE KEEPING:

Store keeping is a service function which deals with physical storage of goods under the custodianship of a person called store keeper or store controller. Goods stored may be stores or stocks. Un worked materials or raw materials are usually referred to as 'stores' and the place where they are kept is known as stores room. Finished products ready for shipment are usually called stocks and are housed in a place called stock room. Store keeping, therefore is that aspect of materials which is concerned with physical storage of goods.

Types of stores:

Functionally, stores are of five types: receiving stores, main stores, finished product stores (ware house), special store and scrap yard.

1. Receiving stores:

Receiving stores performs activities necessary to exercise control on quality and quantity of purchased materials before they are accepted and taken into stock. Receiving store may be sub-divided into;

- Inward stores: To keep incoming material until they are accepted and taken into stock.
- Quarantine store: To temporally stock materials which are under dispute and requires supplier's (or transporter's) certification (e.g: Quantity discrepancy in the consignment, transits damaged to goods, etc.,)
- Rejection store: To stock defective (non-conforming) goods until they are send back to the suppliers.

2. Main store:

Main store performs activities concerning storage and issue of accepted materials is maintenance of records. Main store may either centralize and housed in a large godown or decentralized and located near its point of views. Main store may be divided in to:

- Crid stores: To stock cutting tools, hand tools, measuring instrument and gauges, etc., to be issued to the work men in the beginning of the shift and to be collected at the end of the shift (or job).
- Finished part sore: To stock spares of plant and machinery
- Plant (or maintenance) store: To stock spares of plant and machinery
- Sub-store (Raw material store): To stock bar stocks, castings and forgings, etc., which require lot of space and can be stocked in areas open to sky.

3. Ware house (finished product store):

Ware house performs activities concerning receipt, packaging and packing, despatch of finished goods to different destinations and handling of connected papers and documents.

4. Special store:

Special store performs activities of receipts, storage and issue of special materials. Typical example of special stores is:

- Bonded store: To stock materials that are hypothecated to banks to stock excisable goods, etc.
- Statutory store: to stock material such as kerosene, diesel, and other petroleum products requiring strict conformance to safety precautions as per statutory regulations.
- Temperature controlled store: To stock perishable items such as meat, fish, milk, vegetables and fruits or goods like rubber and rubber part active ingredient like anti-biotic and vitamins, etc, which require temperature controlled store rooms.

5. Scrap yard:

Scrap yard performs activities of receipt, segregation and storage of different types of scrap

Function of a store keeper:

1. Identification:

Identification is the process of systematically defining and describing all items of materials in stock.

2. Inspection:

Inspection involves the examination of the incoming consignment for quality.

3. Receipt:

Receipt is the process of checking and accepting, from all sources (vendors, production units, repair units, etc), all materials and parts which are used in the organization)

4. Storage and Preservation:

Items are required to be binned and kept in storage bins and impounds, on racks and shelves and some times in the yard. The general rule "A place for every thing and everything in its place".

5. Material handling:

Material handling involves movement and handling of materials. It can be manual or mechanical (e.g., by use of fork lift).

6. Packing:

Materials despatched to customers from the finished goods store (or from one store to another at a different location) need to be packed.

7. Issue and dispatch:

This is the process of receiving indents; picking the items required and handling them over to users are despatching them to customers.

8. Stock records:

These are the documents which records, daily, full particulars of individual receipts, issues and balances of materials in stocks.

9. Stores accounting:

Stores accounting is the process of recording details of stock movements and balances in terms of financial value.

10. Inventory Control:

Inventory control is the operation of continuously arranging receipts and issues in such a way so as to measure that stock balances in quantity or value or adequate to support the current rate of consumption at all times with due regard to economy.

11. Stock taking:

Stock taking is the process of physical verification of the quantity and conditions of goods in store.

12. Salvaging:

Materials which are unusable, scrap or obsolete or foreign excess of requirements have to be profitably disposed of.

STORE LOCATION:

Store location is the process of selecting the appropriate site for the store building - in the organization and deciding how material has to be placed inside store so as to provide efficient and prompt service to the user department.

Centralised Stores:

A large company, marketing a variety of goods, may have central warehouse of finished goods at its factory location, decides a large number of stock points in various cities. Centralisation is a matter of convenience.

Advantages of the Centralised stores

- i. A wider range of goods is provided for all users than is possible in smaller stores.
- ii. Inventory can be minimum. This especially so in the case of tools, fixtures, equipment and spares.
- iii. Better control is possible.
- iv. As centralized stores are normally big in size, even bulky items could be stored easily.
- v. A bigger storehouse ensures better and more modern handling methods.
- vi. Delivery at a single point decreases cost of delivery.
- vii. Receipt and inspection of goods can be more efficiently organized.
- viii. Opportunities of standardization are improved.
- ix. Stock turn over is increased and the probability of deterioration during storage is correspondingly decreased.
- x. Unnecessary duplication of records takes place in decentralised stores.

Disadvantages of a centralized store

- i. Extra handling of material is involved and more staff will be required for transportation from stores to various production units.
- ii. If the system is not well organized, there can be severe shortages at work places causing unnecessary interruptions in production. Inefficiency can also result in production maintaining some buffer inside the unit which can lead to the shrinking of work space and pilferage because of the absence of security.
- iii. More internal documentation may become necessary.
- iv. In case of fire, the risk is greater as the entire stock can be lost, bringing production to a total halt.

Safety and security of stores:

The term safety envisages the safety of the materials in stores, facilities used, including material handling equipment, and safety of the personnel working in stores.

Security in all stores should be reasonably adequate. If materials in the stores are considered as money, the reason will be obvious. The internal layout is arranged in such a way that there is a spacious issue counter where employees can obtain materials without entering the stores. The issue counter should be segregated from the main storage area and preferably it should be enclosed.

Main causes for Accidents in store and suggestions:

- Materials falling from racks - rack itself may be designed properly
- Removal of Obstacles - unwanted scrap should be removed
- Injury arising from lifting heavy loads, or normal loads unscientifically - The operator has to be trained to handle the equipment correctly
- Collusion with bins - space should be adequate and rack should be bolted.
- Falling of while climbing to reach the upper shelves - Improper ladder should be inspected often and trained person should be placed.
- Injury to hands arising from lifting or handling of materials with out wearing protective gloves
- Slipping on oil, grease or even water spillages - whenever the spillages occur it should be wiped clean
- Injury caused by nails left on empty cases

Safety of material handling Equipment

Some general rules regarding safety in handling specific equipment are,
Cranes - Truck cranes must be properly blocked and be on firm footing before lifting a heavy load with a low boom.

Forklift trucks

Security Measures

Security of stores includes measure against

- i. Closure of stores daily and custody of keys
- ii. Theft by outsiders
- iii. Pilferage by employees
- iv. Malpractices of stores staff
- v. Prevention of fire protection
- vi. Pest control measures to contain rodents and termites menace

Closure of stores daily and custody of keys

Closure of stores every day should be properly supervised. Store keys must be numbered and registered. Written instruction should be issued nominating the persons responsible for them. Key movement register should be maintained.

Theft by outsiders:

To eliminate theft by outsiders, the entire factory should have a compound wall or high barbed wire fencing. The number of windows, glass

shouters and open vendors should be as minimum as possible. Expensive items and scarce items should be kept in locked steel almirahs. Stores should be insured against buglers.

Pilferage of employees:

Pilferages refer to the gradual removal of material in small quantities by the employees of the companies. The following steps should be taken to check pilferage by the employees.

- Only authorized personnel should be allowed to enter the store.
- Surprise checks of a section of store items should be done every now and then.
- Immediate enquiry should be conducted if any mal practice is brought to light.
- The punishment of pilferage should be given adequate publicity.

Mal practice by the store staff:

Mal practice is the manipulation of the store personnel with active help of outsiders. The following steps help in checking mal practice by stores staff.

- Out going trucks, trolleys, parcels, etc., should be thoroughly checked.
- Gate pass should be issued to take material out of the company.
- Indemnity bonds are bank security must be taken from store employees.

Prevention of Fire protection:

Fire is an accident caused by chemical reaction between combustible materials and oxygen. Possible causes of fire are careless handling, improper storage and disposal of inflammable materials, open electrical circuits causing short circuits, smoking from staffs and clients in the store, etc.,

The following Precaution should be taken;

- Doors and stair cases should be made of fire resistant materials
- Smoking should be prohibited in and around the stores
- Materials should be properly stored. Leakage of inflammable oil, grease and fluids should be prevented
- Fire alarm should be provided at appropriate places
- Fire extinguisher should be provided as near as possible to exist or stair landing.
- Store buildings, stocks, machinery and other assets should be covered by fire insurance.

Menace of rodents and termites:

If Menace of rodents is observed, the stores should be fumigated and rat poison traps should be kept. For termites, white ants and fungi, suitable pesticides and fungicides should be sprayed.

Stock Records:

Physical verification of the stock after each month, quarter or year should be under taken to verify the balance quantity of the items in the stores. Physical verifications should be carefully under taken by an officer not related to stores. The balanced should be tallied with those on the accounts, discrepancies (excess or shortage) should be noted and reasons ascertained for further action.

Check the progress:

Fill ups

1. _____ is continuous process and may start from the collection of names and addresses form different but authentic source. After collecting the necessary details a list of prospective vendors may be drawn up for evaluation
2. _____ are very good source of information for possible source of supply. They are always on the move and are trained to keep their eyes and ears open with regard to the developments that take place around them.
3. _____, can become _____ and a _____ in the hands of a buyer in making his/her purchase decisions and also for providing feedback to suppliers with low rating in order to impure their performance.
4. _____ is a service function which deals with _____ under the _____ of a person called store keeper or store controller
5. _____ refer to the gradual removal of material in small quantities by the employees of the companies

Points to remember

1. There are several trade registers and directories available both Indian and foreign. Some of these deal with, a manufacturers and suppliers o all kinds o materials while some are specialized e.g., those devoted to chemicals or engineering goods and so on. These directories give information on the addresses, regional offices names types and ranges of product of addresses of dealers or agents.
2. There are various ways in which a supplier can be evaluated. Five of these, viz., the categorical method, the weighted method, the cost-ratio method, the critical incidents method and the check list system are the most popular.

3. The term safety envisages the safety of the materials in stores, facilities used, including material handling equipment, and safety of the personnel working in stores.
4. Security in all stores should be reasonably adequate. If materials in the stores are considered as money, the reason will be obvious. The internal layout is arranged in such a way that there is a spacious issue counter where employees can obtain materials without entering the stores. The issue counter should be segregated from the main storage area and preferably it should be enclosed.
5. Physical verification of the stock after each month, quarter or year should be under taken to verify the balance quantity of the items in the stores. Physical verifications should be carefully under taken by an officer not related to stores.

Model Questions:

1. Explain vendor rating and the scope of vender rating?

Vender Rating

The hallmark of an effective purchase department is the quality of suppliers selected. The purchaser's prime interest lies in getting the best value from his suppliers. This implies that he should be in a position to assess and rate their performance . An objective accurate vendor rating, can become an asset and a valuable tool in the hands of a buyer in making his/her purchase decisions and also for providing feedback to suppliers with low rating in order to impure their performance. In the absence of such an improvement even after a reasonable period of time, black listing or grey listing the vendor may follow.

The responsibility of vender rating is normally entrusted with a committee comprising Chief commercial manager, Quality control manager, Accounts Manager and Chief Production Engineer. The committee meets every quarter to review each vender's performance.

It classifies the vendors as class 'A' 'B' or 'C' based on their performance. Alternatively, they are also graded as First, Second or Third class vendors. Future enquires shall not be sent to class 'C' (Third grade) vendors. Future enquires shall not be sent to class 'C' (Third grade) vendors. A price preference of 5% to 'A class (First grade) and 2% to class 'B' (Second grade) vendors shall be accorded over the prices of class 'C' (Third grade) vendors.

Scope of Vendor Development

One of the basic objectives of materials management is vendor development and rating. The scope of vendor development includes-

- Identifying new sources of supplier base from time to time.

- Dropping out existing sources which prove to be inefficient.
- Advertising in the newspapers inviting tenders from, suppliers.
- Developing ancillary units and sub-contractors,
- Maintaining a regular list of approved suppliers called registered of suppliers
- addressing the appropriate efficient and tactical issues,
- Ensuring that those potential suppliers are carefully evaluated and that they have the potential to be satisfactory supply partners.
- Deciding whether to use competitive bidding or negotiation as the basis of source selection.
- Selecting the appropriate source of is the team leader responsible for this task through evolving a proper method of vendor rating.
- Cultivating and maintaining good vendor-vendee relationship.

Thus vendor development is a continuous process and may start from the collection of names and addresses from different but authentic sources. After collecting the necessary details a list of prospective vendors may be drawn up for evaluation.

2. Write a note on,

- | | |
|-----------------------|-------------------------------|
| a) Categorical Method | b) The weighted point method |
| c) Cost ratio method | d) Critical incidents method. |

Ans:

1) Categorical Method:

The buyer makes out a list of all the factors which he/she considers necessary for evaluation, and at periodic intervals, say, once a quarter, he/she makes out a performance report. The buyer may also seek the help of others concerned such as stores, production, or quality control departments, in order to determine the grading to be given. A performance standard may be decided upon a six-point scale category. For example, a vendor who gets

- 80 points and above out of 100 is considered excellent
- Between 70-79 points is considered very good
- Between 60-69 points is considered good
- Between 50-59 points is considered satisfactory
- Between 40-49 points is considered average
- Between 40 points is considered poor

2) The Weighted Point Method:

In this method, the evaluation criteria are quantified on a point rating basis for the quality of goods received, the promptness of deliveries made and the quality of the service rendered by the vendor points.

The rating would be,

$$\text{Quality performance} = \frac{\text{Number of lots accepted}}{\text{Number of lots received}} * 50$$

Similarly, for delivery rating can be as follows:

$$\text{(a) Timely Performance} = \frac{\text{Number of lots delivered on time}}{\text{Number of lots delivered}} * \text{Quality}$$

$$\text{(b) Quantity performance} = \frac{\text{Quantity supplied}}{\text{Scheduled delivery}} * \text{Delivery}$$

$$\text{(c) Price Performance} = \frac{\text{Least offer received}}{\text{Supplier Offer}} * 20$$

3) Cost Ratio Method:

This method involves an intricate system of determining the actual costs incurred on purchasing, follow-up, transportation, packing, etc., and determining the unit cost incurred by the buyer on the material when actually received.

4) Critical Incidents Methods:

Evaluating vendors under this method requires that a record of events and occurrences related to the buyer-vendor relationship is maintained in each vendor's file. The data and comments recorded should be important and not trivial in nature. They should reflect the positive and negative aspects of an actual performance. This kind of documentation can be used as a basis for discussing ways and means for overcoming difficulties, improving performance, determining the competence of a vendor and if necessary considering his determination.

3. What are the five types of stores?

Types of stores:

Functionally, stores are of five types: receiving stores, main stores, finished product stores (ware house), special store and scrap yard.

Receiving stores:

Receiving stores performs activities necessary to exercise control on quality and quantity of purchased materials before they are accepted and taken into stock. Receiving store may be sub-divided into;

- Inward stores: To keep incoming material until they are accepted and taken into stock.
- Quarantine store: To temporally stock materials which are under dispute and requires supplier's (or transporter's) certification (e.g: Quantity discrepancy in the consignment, transits damaged to goods, etc.,)
- Rejection store: To stock defective (non-conforming) goods until they are send back to the suppliers.

Main store:

Main store performs activities concerning storage and issue of accepted materials is maintenance of records. Main store may either centralize and housed in a large godown or decentralized and located near its point of views. Main store may be divided in to:

- Crid stores: To stock cutting tools, hand tools, measuring instrument and gauges, etc., to be issued to the work men in the beginning of the shift and to be collected at the end of the shift (or job).
- Finished part sore: To stock spares of plant and machinery
- Plant (or maintenance) store: To stock spares of plant and machinery
- Sub-store (Raw material store): To stock bar stocks, castings and forgings, etc., which require lot of space and can be stocked in areas open to sky.

Ware house (finished product store):

Ware house performs activities concerning receipt, packaging and packing, dispatch of finished goods to different destinations and handling of connected papers and documents.

Special store:

Special store performs activities of receipts, storage and issue of special materials. Typical example of special stores is:

- Bonded store: To stock materials that are hypothecated to banks to stock excisable goods, etc.

- Statutory store: to stock material such as kerosene, diesel, and other petroleum products requiring strict conformance to safety precautions as per statutory regulations.
- Temperature controlled store: To stock perishable items such as meat, fish, milk, vegetables and fruits or goods like rubber and rubber part active ingredient like anti-biotic and vitamins, etc, which require temperature controlled store rooms.

Scrap yard:

Scrap yard performs activities of receipt, segregation and storage of different types of scrap

4. Define Store location and the advantages and disadvantages of centralized and decentralized stores?

Store Location:

Store location is the process of selecting the appropriate site for the store building - in the organization and deciding how material has to be placed inside store so as to provide efficient and prompt service to the user department.

Centralised Stores:

A large company, marketing a variety of goods, may have central warehouse of finished goods at its factory location, decides a large number of stock points in various cities. Centralisation is a matter of convenience.

Advantages of the Centralised stores

- A wider range of goods is provided for all users than is possible in smaller stores.
- Inventory can be minimum. This especially so in the case of tools, fixtures, equipment and spares.
- Better control is possible.
- As centralized stores are normally big in size, even bulky items could be stored easily.
- A bigger storehouse ensures better and more modern handling methods.
- Delivery at a single point decreases cost of delivery.
- Receipt and inspection of goods can be more efficiently organized.
- Opportunities of standardization are improved.
- Stock turn over is increased and the probability of deterioration during storage is correspondingly decreased.
- Unnecessary duplication of records takes place in decentralised stores.

Disadvantages of a centralized store

- Extra handling of material is involved and more staff will be required for transportation from stores to various production units.
- If the system is not well organized, there can be severe shortages at work places causing unnecessary interruptions in production. Inefficiency can also result in production maintaining some buffer inside the unit which can lead to the shrinking of work space and pilferage because of the absence of security.
- More internal documentation may become necessary.
- In case of fire, the risk is greater as the entire stock can be lost, bringing production to a total halt.

5. Discuss the safety of material handling equipment?

Safety of material handling Equipment

Some general rules regarding safety in handling specific equipment are,

Cranes - Truck cranes must be properly blocked and be on firm footing before lifting a heavy load with a low boom.

Forklift trucks

Security Measures

Security of stores includes measure against

- Closure of stores daily and custody of keys
- Theft by outsiders
- Pilferage by employees
- Malpractices of stores staff
- Prevention of fire protection
- Pest control measures to contain rodents and termites menace

Closure of stores daily and custody of keys

Closure of stores every day should be properly supervised. Store keys must be numbered and registered. Written instruction should be issued nominating the persons responsible for them. Key movement register should be maintained.

Theft by outsiders:

To eliminate theft by outsiders, the entire factory should have a compound wall or high barbed wire fencing. The number of windows, glass shutters and open vendors should be as minimum as possible. Expensive items and scarce items should be kept in locked steel almirahs. Stores should be insured against burglars.

Pilferage of employees:

Pilferages refer to the gradual removal of material in small quantities by the employees of the companies. The following steps should be taken to check pilferage by the employees.

- Only authorized personnel should be allowed to enter the store.
- Surprise checks of a section of store items should be done every now and then.
- Immediate enquiry should be conducted if any mal practice is brought to light.
- The punishment of pilferage should be given adequate publicity.

Mal practice by the store staff:

Mal practice is the manipulation of the store personnel with active help of outsiders. The following steps help in checking mal practice by stores staff.

- Out going trucks, trolleys, parcels, etc., should be thoroughly checked.
- Gate pass should be issued to take material out of the company.
- Indemnity bonds are bank security must be taken from store employees.

Prevention of Fire protection:

Fire is an accident caused by chemical reaction between combustible materials and oxygen. Possible causes of fire are careless handling, improper storage and disposal of inflammable materials, open electrical circuits causing short circuits, smoking from staffs and clients in the store, etc.,

The following Precaution should be taken;

- Doors and stair cases should be made of fire resistant materials
- Smoking should be prohibited in and around the stores
- Materials should be properly stored. Leakage of inflammable oil, grease and fluids should be prevented
- Fire alarm should be provided at appropriate places
- Fire extinguisher should be provided as near as possible to exist or stair landing.
- Store buildings, stocks, machinery and other assets should be covered by fire insurance.

Menace of rodents and termites:

If Menace of rodents is observed, the stores should be fumigated and rat poison traps should be kept. For termites, white ants and fungi, suitable pesticides and fungicides should be sprayed.

Stock Records:

Physical verification of the stock after each month, quarter or year should be under taken to verify the balance quantity of the items in the stores. Physical verifications should be carefully under taken by an officer not related to stores. The balanced should be tallied with those on the accounts, discrepancies (excess or shortage) should be noted and reasons ascertained for further action.

Answer for fill ups

1. Vendor development
2. Salesmen
3. An objective accurate vendor rating, an asset, valuable tool
4. Store keeping, physical storage of goods, custodianship
5. Pilferages

