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ANNAMALAI UNIVERSITY
DIRECTORATE OF DISTANCE EDUCATION

B.B.A., B.B.A. Computer Applications
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PRODUCTION AND MATERIALS MANAGEMENT

LESSONS: 1 - 20

(For Private Circulation Only)

PAPER – XI

Production and Materials Management

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SUGGESTED READINGS

E.S. Buffa	Modern Production Management
J.L. Lundy	Effective Industrial Management
Bunga and Sharma	Production Management
Samuel Eilon	Production Management

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LESSON - 1

PRODUCTION FUNCTION

1.1. INTRODUCTION

Production function is one among the major functions of management. Factories produce the products we require. Hospitals create and offer services to keep us hale and healthy. Film industries engage themselves in the creation of films to entertain us. Textile mills produce the dress materials to make us handsome.

From the above paragraph you can very well infer that production is the function which creates goods and services which are of immense use to us.

Production function makes use of different mechanism to convert some sort of raw materials to something useful. The production function can be viewed as a system consisting of inputs, processing unit and outputs. The inputs are processed by a series of operations. The operations may be mechanical, chemical, assembly, inspection and control, despatching to the next operation, receiving, shipping etc.

You would have visited Supermarket. In a supermarket, different products are received and stored on display shelves. The customer picks the required items from shelves, put them in the trolley, transports them and waits in the queue for the check out. As seen from the above example one can say that the supermarket is engaged in the creation and offering of the services to the customers.

Now let us see another example which deals with the creation of goods. We use bathing soaps to keep our body clean. Soaps are manufactured by the continuous process. The raw materials are received and stored. Then they are despatched from storage to the processing units. Then they get dissolved and pumped through a series of chemical operations. The material is processed while it moves and emerges as soap. It is then packaged in attractive boxes and shipped.

Now let us discuss the nature of production function. Production is essentially a decision making function. Production Manager has to select the best alternative form the available alternative and then decide the production activities. The decisions related to production processes are made to accomplish the following objectives of production function.

1.2. OBJECTTVES

1. To produce the goods and/or services in accordance with the specifications.
2. To produce the goods and/or services in the desired amount.
3. To produce within the schedule demanded and
4. To produce at minimum cost the aforesaid objectives could be achieved by the production manager through the two broad areas of production activity, i.e. the decision and the control of production systems.

Design of production systems: Production Manager designs and controls the production systems by making two major types of decisions. Long-run decisions relate to

the design of the production system and short-run decisions relate to the operation and control of the system.

1.3. CONTENTS

1.3.1. RUN DECISIONS

1. *Selection and Desist of Products:* The features of the product influence the other major decisions to be made for the manufacturing of the product.

2. *Selection of Equipment and Process:* The same product could be manufactured by alternative equipment and processes that are available. Production manager has to select the equipment and process by keeping in mind the product design objectives of his department and the policy guide lines of his firm.

3. *Production, Design of Items Processed:* Production cost interacts strongly with the design of parts, products, paper work forms etc. Design decisions often set the limiting characteristics of cost and processing for the system.

4. *Job Design:* It involves the basic organisation of work to be performed by the operator. It takes into account the work study techniques and human engineering data to increase the productivity of the worker. It is an integral part of the total system design.

5. *Plant Location (or) Facility Location:* Various tangible and intangible factors have to be considered for locating the factory. Production manager has to evaluate the critical factors in terms of cost and select the location which minimises the total production cost.

6. *Facility Layout:* The nature of the product, the volume of production quality standards greatly influence the designing of facility layout. It deals with the location of machineries and equipments in relation to each other in a pattern that minimises the overall production cost.

1.3.2. SHORT-RUN DECISIONS

1. *Production Control;* Standards are set for comparison. Different control techniques are to be thought of in advance to measure the actual performance. Rectification measure are to be taken to correct the deviations from the standards. Feasible schedules for men and machines are to be worked out to balance the load on men and machines to have a smooth flow of production.

2. *Inventory Control:* Decisions regarding Plant capacity, order completion date, delivery date effect the level of inventory to be maintained. Wastages could be minimised by the proper selection of equipment and process.

3. *Maintenance of the System:* Machine downtime greatly affects the manufacturing cycle time and production cost. Decisions regarding type of maintenance, frequency of maintenance and cost of maintenance are to be made to keep the machines running.

4. *Quality Control:* Decisions have to be made about the acceptable levels of quality. Tighter quality control measures increases the inspection cost. The production manager is confronted with the problem of producing only quality products. He has to design such quality control techniques which pass only the good parts and reject the bad parts.

5. *Labour Control:* Labour is the major cost element in most products and services. The quality of the labour directly affects the productivity. Production manager has to derive plans to appraise, improve and maintain the efficiency of labour. Work measurement techniques and wage payment system would help him a lot.

6. *Cost control and improvement:* Production personnel are expected to review their production activities frequently. Effective decisions regarding frequency of review and corrective measures will keep the production cost with in the level desired.

The relative importance to be attached lo these decisions varies considerably. It depends on the nature of individual production systems. For example, in automated industries like petroleum industry, equipment policy may occupy a dominant position. Whereas the industries engaged in the assembly line manufacturing may attach greater importance to the decisions regarding work place arrangement.

1.3.3. TYPES OF PROCESSES

As you have seen in the previous pages, production is the process through which the goods and services are created. Usually the goods are created from raw materials or from semi-finished goods.

Now let us see how do we get the finished products from the raw materials. This change is effected through a process called transformation. Basically all the production processes involve this transformation. Generally, the transformation of raw materials into finished products, is divided into two types. They are:

1. *Physical transformation:* It effects only a physical change to convert the raw materials into finished products. Physical change involves a change in shape, size, form and physical properties. In day to day life we use stainless steel vessels. Steel sheets undergo a change in shape to produce steel vessels.

2. *Chemical Transformation:* It involves mainly a change in chemical properties We swallow tablets to get cured from fever. We consume tonics to maintain our health. How do we get tablets and tonics. Simply by reacting materials. The materials undergo a chemical change to produce medicinal products.

Now let us discuss the different processes which involve physical transformation they could be grouped as under:

1. Metal forming processes.
2. Metal joining processes and
3. Metal machining processes.

1.3.4. METAL FORMING PROCESSES

The commonly used processes to form a metal of desired shape and size are casting and forging. The physical change in shape or size is effected through a change in the state of the metal.

1.3.5. FORGING

It involves the control plastic deformation of metal at temperatures through the application of force exerted through hand operated or power operated hammers. You might have seen a blacksmith beating a piece of metal. This is nothing but forging. The blacksmith heats the metal in a furnace until it turns into a red-hot piece. He handles the metallic piece by means of tongs and delivers repeated blows on the heated piece. Thus out of his skill the piece acquires the desired shape. For example crow bars, chisels and axles are made by forging processes.

1.3.6. CASTING

It is the process of pouring molten metal into dies and then allowing the molten metal to solidify. After solidification the casting formed will be removed from the dies.

Casting process involves three steps. (1) At first the pattern of the part is to be made (pattern making) Secondly a mould cavity will be formed by the use of the pattern and the moulding flask. (Moulding) Thirdly the metal will be melted in a furnace to attain liquid state and then it will be poured into the mould cavity already, formed (founding) For example the Iron bars, Sheets, billets, and beams are made by, casting processes.

1.3.7. METAL JOINING PROCESSES

It is the process of joining two pieces similiar metal or disimiliar metal by the application of heat alone or by the combination heal and pressure. There are different metal joining processes like welding, soldering, Brazing.

You might have visited "Grill Works" and seen different designs of grills. They are made by joining mild steel bars of varies sizes and shapes. The heat-required to fuse the joints is come out in the form of a flame. The process is known as oxy-acetylene welding:

Now let us see how the joint is obtained. The welding unit consists of two steel cylinders, one containing oxygen and the other containing acetylene. The cylinder are equipped with regulators, valves and pressure gauges. Two hose pipes from the cylinders enter into the welding torch. The gases delivered from the cylinders reach the mixing chamber of welding torch. When the tip of the torch is ignited, the mixed gas burns out in the form of flame and produces necessary heat to fuse the joints. Welding rod melts out of the heat and flows into the gap between the joints and forms a slag covering the joints.

1.3.8. SOLDERING

It is a metal joining process in which non-ferrous alloys are used to join the similar or dissimilar metal. The alloys that are employed should melt at a temperature below the melting temperature of the base metal.

Before joining the surfaces the surface of the metal is to be thoroughly cleaned to remove the oily and dust particles. Tin and led based alloys are used to join the surfaces. They melt at a temperature 300 to 700 F. The temperature required is obtained by the heat produced from iron furnaces, induction heaters and hot plates.

You would have seen Radio and T.V. circuits. Circuit joints are obtained by soldering process.

1.3.9. METAL MACHINING PROCESSES

You would have visited a lathe shop. Different machines are engaged in generating the surfaces required. Metal machining processes involved generation of cylindrical surfaces, flat surfaces, complex curves and holes.

Machining is the process of removing unwanted portion of the metal from the parent metal in the form of chips. Machine tools are used to create the dimensions required.

The processes is carried out by either moving the tool and keeping the work stable or moving the work and keeping the tool fixed.

Two basic motions are used. One is reciprocatory motion. It is a to and fro motion. And the other is rotatory motion. The machining processes which make use of reciprocating movement are shaping planning and broaching. The machinery processes which make use of rotating movement are threading, reaming, drilling and grinding.

Drilling (figure-l): Drilling is the operation of producing a hole in an object. It makes use of a drill. The work piece will be kept firmly on work table. The drilling tool will be feel on the work piece. It revolves around a vertical axis and creates a hole of desired diameter.

Milling (Figure~2): Milling machines consists of a milling cutter having a number of teeth along the outer edge of the cutter. The work piece is fed along of the direction in which the milling cutter rotates. Each tooth of milling cutter removes a portion of the metal from the parent body.

Grinding (Figure-3) it refers to the abrading or wearing operation by means of friction. It makes use of a grind mg wheel. It is generally made up of abrasive materials with ingredients such as shellac, rubber, silicates, and synthetic resins.

Grinding machines are used to create cylindrical surfaces (External and internal).

The work piece if forced against the grinding wheel which is rotated about an axis. The action of the wheel is similar to that of a milling cutter. But the particles are removed in minute form. It is the only method that could be applied to cut extremely hard surfaces.

Broaching: It is the operation of removing the metal with an elongated tool. It has successive teeth of increasing size. The teeth cut a fixed path. The last tooth perform finishing operation. The broaches may be fused in or pulled out. They can be operated either in the horizontal direction or in the vertical direction.

The processes consist of forcing an elongated tool through a hole or over the surface already formed. The broach has varying cross section and multiple cutting edges. It is useful in the finishing of square, hexagonal, or odd shape holes.

Production processes can also be classified into two broad types on the basis of the length of period for which the production facility is set up.

When the process is designed in such a way to utilize the production facility for a longer period of time it is termed as continuous process.

For example sugar we are using, is produced from sugarcane by continuous process. Cement is another product.

Continuous process is suitable when a only few types of products are to be manufactured,

b. When the products are standardized

c. When the products are to be produced in larger numbers.

When the process is designed in such a way to utilize the production facility for a shorter period of time it is named as intermittent process.

For example the electrical goods and medicinal products are generally manufactured by intermittent process. It is suitable when (a) A wide variety of products are to be manufactured, (b) When the products are not standardized, (c) When the products are to be produced in fewer numbers.

1.4. REVISION POINTS

Production management deals with the products the goods and services that are purchased and used everyday.

Production management decisions deals with longer-term which includes the design of production facilities.

1.5. INTEXT QUESTIONS

1.5.1. Explain Production function.

1.5.2. Explain the objectives of production function.

1.5.3. Explain the production function.

1.6. SUMMARY

Producing goods and services are ancient process function. How people can produce efficiently and effectively the goods deals with production function. The process involves designing organizations mission, achievement and adjusting to changes in the organisation distinctive competencies.

1.7. TERMINAL EXERCISES

1.7.1. A study of Design of production system .

Production manager designs and controls the production by making two major types of decisions.

1.7.2. Two major types of system.

Long run decisions relates to the decision of the production system.

Short run decisions relates to the operation and control of the system.

1.8. SUPPLEMENTARY MATERIALS

1.8.1. Refer Various Newspaper editions of science and technology section. For example The Hindu and The New Indian express in weekly magazine.

1.9. ASSIGNMENTS

1.9.1. Visit to a nearest organisation of any type of activities connected with manufacturing process and design repeat actual production function.

1.10. SUGGESTED READING

1.10.1. E. S. Buffa – Modern Production Management

1.11. LEARNING ACTIVITIES

Reading needs first interest

1.12. KEY WORDS

1.12.1. Continuous production

To utilize the production facility for a longer period of time.

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LESSON -2

PRODUCTIVITY

2.1. INTRODUCTION

The successful, performance of any Business Enterprise is measured by system indicators which reflect the change in its performance. There are many types of system indicators like productivity, profitability, rate of growth etc. These indicators guide and lead the management to plan, and control the future operations of the enterprise.

2.2. OBJECTIVES

2.2.1. To study the concept of productivity

2.2.2. To know importance of productivity

2.2.3. To measures of the productivity

2.2.4. The production and productivity.

2.3. CONTENT

2.3.1. Concept and productivity

2.3.2. Importance of productivity

2.3.3. Measures of productivity

2.3.4. Production and productivity

2.3.5. Factors affecting productivity

2.3.6. Ergonomics.

2.3.7. Motion economy

Concept of Productivity: Productivity is nothing more than the arithmetical ratio between the amount produced and the amount of any resources used in the course of production. It is the ratio between output and input.

According to Peter Druber, "Productivity means that balance between all factors of production that will give the greatest output for the smallest effort". The resources or factors of production are Land, Material, Plant, Machines and Tools and the Service of the man.

Importance of Productivity: In the modern business world the business firms engage in cut throat competition _ often the consumer gets entangled in the promotional war.

Many commodities try to attract the limited consumer's purchasing power. The firms have to design techniques to increase productivity.

In economically backward countries productivity movement is a must because it is the basic aspect of progress. Productivity aims at maximum utilization of resources to the satisfaction of consumers at the lowest cost.

Increased productivity leads to higher standard of living. If more is produced at the same cost, there is a gain to the community as a whole, which may take various forms.

Measures of Productivity: Different forms of measures are available to measure the productivity. As far as our production function is concerned we can have the following measures expressed in the form of ratios.

$$\text{Man power productivity} = \frac{\text{Output of goods or service}}{\text{Man} - \text{hours used.}}$$

$$\text{Material productivity} = \frac{\text{Output of goods or service}}{\text{Unit(or cost) of materials used.}}$$

$$\text{Machine productivity} = \frac{\text{Output of goods or service}}{\text{Machine} - \text{hours used.}}$$

$$\text{Productivity (Combined measure)} = \frac{\text{Out of goods or service}}{\text{Labour} + \text{Capital} + \text{Raw materials} + \text{Miscellaneous .}}$$

Production and Productivity: Increase in production does not imply an increase in productivity. Production Is an absolute measure where as productivity is a relative measure. Production means the total amount of output produced by a firm within a given period. Productivity indicates the performance level of input and how efficiently the output is achieved.

For example-if a drilling machine is able to drill 100 pieces per working day and by using the improved drilling tool if the same machine is able to drill 120 pieces per working day. You can very well Infer that the productivity of the machine has been increased by 20 per cent.

Factors Affecting Productivity: Before discussing the factor affecting productivity let us know what is work content. Generally the total time of a job is made up of man-hour and machine- hour. The work content of a job means the amount of work "Contained in" a given product or process and it is measured in man- hours or machine-hours. If the productivity is mainly affected when the work content is excess of the basic work content. The basic work is the irreducible minimum time theoretically required to produce one unit of output.

The work content is increased due to (which reduces the Productivity) the following reasons:

1. Work content added by the defects in the design or specification of the product. There are several ways in which this can happen, (a) The product and it is components may be designed that it is impossible to use the most economical processes or methods of manufacture, (b) Excessive variety of product or lack of standardization of components, (c) Incorrect quality standards, (d) The Components of a product may be so designed that an excessive amount of material has to be removed to bring them to the final shape. (Example Shafts with very large and very small diameters designed in one piece).

2. Work content added due to the process or method (a) If a machine with lower output than the correct one is used (b) If the process is not operating at the correct feed, speed, rate of flow etc. (c) If the plant or machine *k* in bad condition, (d) If the wrong, hand

tools are used, (e) If the lay-out of the factory, shop or work place causes wasted movement time or effort, (f) If the working method of the operative cause wasted movement, time or effort.

3. In effective time also decreases the productivity of man-machine systems. The nature of management of the firm also play a role for the ineffective time, (a) If the firm has a marketing policy demanding an unnecessarily large number of different types of products. Shorter production runs are required to manufacture a large number of different types of products. The workers do not have the opportunity to specialise and acquire skill in that situation. Quick change covers, frequent and, repeated set-up of the facilities amount to ineffective time, (b) Failure to standardize component parts. (c) When the firm has not designed an effective production planning and control system. It causes bottle-necks in the flow of work and orders. The plant and labour could not be continuously employed, (d) Failure to ensure a supply of raw materials, tools and other equipments necessary to do the work; If this condition prevails it keeps the machineries and labour waiting for materials, (e) Absence of perfect maintenance programmes leads to stopayes due to machine breakdowns, (f) When the machines are allowed to run in a bad condition, the amount of scrap and rejections are increased. Reworking on rejection are causes ineffective time, (g) Improper working conditions affect the mental make-up of the workers, (h) Failure to take proper precautionary safety measures for the workers, causes loss of time due to. accident, (i) Failure to provide equitable wage structure and adequate incentives.

4. In effective time may also be caused by the way in which the worker operates, (a) When the workers fail to start the work immediately after clocking in and deliberately work slowly, (b) By careless workmanship causing scrap or making it necessary for work to be done again, (c) Failure to observe safety regulations and causing accidents through carelessness.

So, what shall we do if minimum productivity is achieved. This is the question, perhaps, You want to be answered now. It is very easy to provide the answer therotically but it poses lot of problems to the executive handling the concerned area.

Techniques used to reduce work content and ineffective time to increase productivity:

1. Product development and value analysis reduce excess work content due to design defects.
2. Process planning ensures selection of correct machines and correct processes.
3. Method study reduces work content due to bad layout and ensure correct selection of tools.
4. Production control based on work measurement reduces idle time due to bad planning.
5. Materials control reduces idle time due to lack of raw materials.
6. Maintenance reduces idle time of man and machine due to breakdowns.
7. Improved working conditions enable workers to work steadily.
8. Sound personnel policy and incentives reduce ineffective time due to absence.

9. Operator training reduce ineffective time due to carelessness.
10. Safety training reduces ineffective time due to accidents.

ERGONOMICS

From the previous- pages dealing with productivity, you ought to have developed an idea, that productivity could be increased by giving due consideration to the operator and the environment in which he is working. The system in which the operator and machine are working, can be renamed as MAN - MACHINE SYSTEM.

Ergonomics is a field of scientific study dealing with all such matters concerned with man-machine systems with the objective of increasing productivity. This study aims at arranging machines and work places so that they are convenient for the people who have to do the work.

Given the information the human operator of a man-machine system responds to the instructions by performing the work. He may be assembling objects or manipulating controls. He has to use his body to accomplish the required task. In addition to his hand and body motions the design of the work place layout, also affects his productivity. Ergonomics can not be treated as a separate field by itself. It makes use of the techniques of work study, principles and of motion economy. Ergonomics takes into account the knowledge of anthopometry, anatomy, physiology and psychology and solvest the problems arising therefrom. Ergonomics conduct many experiments to design the best layout for machine controls, the best design for seats and workshops, the most convenient pedal pressure and so.

For example work place layout can be effectively designed, by making use of the principles of motion economy and a knowledge of anthropometry, so that manual motions can take place with in a prescribed area and chair and table heights can be set at levels appropriate to human body sizes.

MOTION ECONOMY

There are a number of "Principles" concerning the economy of movements. They were first used by Frank Gilbreth the founder of motion study. Later, the principles have been amplified by other works, notably Professor Barnes. These principles do form a very good basis for improving the efficiency and reducing the fatigue of manual work. They may be grouped under three headings. Only few principles are listed under each heading.

A. Use of the Human Body: When possible

1. The two hands should begin and complete their movements at the same time.
2. Motions of the arms should be symmetrical and in opposite directions and should be made simultaneously.
3. Momentum should be employed to help the worker, but should be reduced to a minimum whenever it has to be overcome by muscular effort.
4. Continuous curved movements are to be preferred to straight line motions involving sudden and sharp changes in direction.

B. Arrangement of the Workplace:

1. Tools and materials should be pre-positioned to reduce searching.
2. Gravity feed, bins and containers should be used to deliver the materials as close to the point of use as possible.
3. "Drop deliveries" or ejectors should be used whenever possible so that the operator does not have to use his hands to dispose of the finished work.
4. The colour of the workplace should contract with that of the work and thus reduce fatigue.

C *Design of Tools and Equipments*

1. Two or more tools should be combined wherever possible.
2. The hands should be relieved of all work of "holding" the work piece where this can be done by a jig, fixture or foot- operated device.

2.4. REVISION POINTS

The ratio between the amount produced (output) and the amount of resources (input) used in the guse of protection.

2.5. INTEXT QUESTIONS

2.5.1. Define productivity.

2.5.2. Explain factor productivity index.

2.5.3. Define Ergonomics

2.5.4. Explain the importance of productivity.

2.5.5. Explain motion economy.

2.5.6. Explain the measures of productivity.

2.5.7. Explain the factors affecting productivity.

2.6. SUMMARY

Productivity may be measured in terms of manpower, material, medicine and the combination of all these three.

2.7. TERMINAL EXERCISES

2.7.1. What is factor of productivity index?

$$\text{A1: Man power productivity} = \frac{\text{output for goods or service}}{\text{Man} - \text{hours used.}}$$

$$\text{A2: Material productivity} = \frac{\text{output of goods or service}}{\text{output (or) of material used..}}$$

$$\text{A3: Material productivity} = \frac{\text{output of goods or service}}{\text{Material hours used.}}$$

$$\text{A4: Productivity} = \frac{\text{output for goods or service}}{\text{Labour} + \text{capital} + \text{Raw materials} + \text{Miscellaneous.}}$$

2.8. SUPPLEMENTARY MATERIALS

Refer production management magazines available in markets.

2.9. ASSIGNMENTS

2.9.1. Explain how productivity measured – make a circuit exercise.

2.10. SUGGESTED READING

2.10.1. J. L. Landy – Effective Industrial Managerial.

2.11. LEARNING ACTIVITIES

Reading needs first interest-Fix the time for reading.

2.12. KEY WORDS

2.12.1. Productivity of the curker: is also dependent on the physical environment in which he required to curla.

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LESSON - 3

PLANT LOCATION

3.1. INTRODUCTION

Plant location refers to a general area where the plant will operate to produce salable goods or services. Plant location involves a larger general area such as district, state or country.

Plant location also means the establishment of a particular unit at any particular place.

3.2. OBJECTIVES

3.2.1. The study the importance of plant location.

3.2.2. The factors influencing plant location.

3.2.3. To study about site selection.

3.2.4. The object of relocation.

3.3. CONTENT

3.3.1. Importance of plant location.

3.3.2. Factors influencing plant location.

3.3.3. Site location.

3.3.4. Advantages and disadvantages of city site.

3.3.5. Advantages and disadvantages of Reval site.

3.3.6. Relocation.

Importance: The success or failure of an enterprise is largely affected by its location. The design of production system is dependent on its location. It paves way to scientific' and planned industrialisation. Location decisions influence the layout decisions also. Location determines operating and capital costs.

Factors influencing plant location: As we have seen before the production cost is greatly influenced by the location decisions. Location analysis takes into consideration various factors to select an optimum location.

The business man may be having different alternative locations before him. He has to select the optimum location which minimises the sum of all costs affected by location. The following factors are to be considered for plant location.

1. *Land and Buildings:* Land to be purchased should be sufficient not only for the present purpose but also to meet the requirement of possible expansion in future. The quality of the soil and topography of the land should receive consideration to estimate the cost of development of the site and construction of the building.

When a building is purchased for the proposed plant, The aspects like the strength of the building, available flour space, accommodation for lay out, inward and outward

transport facilities, life of the building and vacant space available should receive consideration.

2. *Transportation:* Transportation cost includes the freight cost for raw materials and finished products. It also includes the travelling expenses of management and sales personnel.

2a. The following factors influence plant location decisions with respect to sources of raw materials:

Bulk raw materials incur high transportation cost per unit of the finished product. For this reason iron and steel plants are located close to iron ore, limestone and coal mines.

When large proposition by weight of the raw materials is removed in processing the transportation cost per unit of the finished product is high. Under this circumstances it is better to locate the plant nearer to the sources of supply.

When the raw materials is perishable and the time for transportation of the raw material from its source to the plant is long, there is a likelihood of loss on account of perishable nature of the product. Nearness to the source of raw material is an advantage.

2b. The following aspects of transportation cost are to be considered with respect to market: When transportation cost for the finished is higher than the raw material it is better to locate the plant adjacent to the market.

When the bulk and weight of the finished product is increased cost of transporting the finished product to the market also increase. Locating the plant nearer to the market is an advantage.

When the processing changes the raw material to a finished product with a fragile nature, the plant can be located nearer to the market in order to avoid or reduce the damages during transit.

3.*Labour:* Availability of a suitable labour force and favourable labour rate are the two important factors to be considered in plant location. Unskilled workers are available everywhere but skilled workers are available in sufficient numbers only in industrial areas. The intangable factors to be considered are potential labour force, productivity of the available labour and labour relations.

4.*Operating Expenses:* The operating expenses include utilities, services, disposal of waste, taxes and Insurances.

The utilities include power, fuel and water. The costs of utilities are also influenced vary from region to region. The costs of utilities are also influenced by the position of demand and supply in the particular locality. Seasonal variations also influenced the availability of the utilities. For example Hydro electric power may fluctuate with the rainfall and the level of water.

Power: The power supply should be adequate and regular. When coal is used as a source of power it is better to locate the factory nearer to coal mines. When the factory is located at a distant place from the source of supply of power it will increase the cost of

transport. The factories using electricity as a source of power may not face greater problem in locating the plant.

Water: Some industries require water to processes the product. Water may be obtained from the local authority supplies, from canal, river or lake or by sinking a well. In any case supply of water should be considered with respect to regularity, cost, degree of purity and the cost of special treatment required for purification.

5. *Waste Disposal:* Proper disposal of waste matter is essential for regular plant operation, well-being of the workers and healthy community life. Waste matters may be utilised in manufacturing useful product as by-products or joint-product. They may be used as raw materials in other industries. In such a case locating the plant close to those industries is advantageous.

When they are not used, the solid waste of ashes may require extraland for their disposal. Liquid waste may be disposed of by sewer connection or river outlet. Gaseous waste matters should be specially treated to render them, harmless before final disposal.

6. *Taxes and Insurance:* Varies local taxes on a facility should be determined. Any tax concession granted by a particular state or authority should be considered, file insurance premiums depend on the quality of production and prevention service available.

7. *Climatic Conditions:* The climatic conditions such as temperature, rainfall and humidity are the factors to be considered

while locating the plant. Textiles industries require a high humidity. If a textile mill is located in a region where the climate is not sufficiently humid, moisture content in the air should be artificially maintained. This increases the cost of production. Agro-industries depend on agricultural output for raw-materials. Regular and sufficient rainfall will exert a considerable influence in locating Agro-industries.

8. *Community Attitude:* The attitude of the people in a particular area may impose restrictions on plant location. For example the location of atomic power station may be opposed by the people living in and around the area because of the fear of radiation.

SITE SELECTION

It is the specific selection of the site for plant building after locating the general are for the plant. The firm may choose a city site, a sub-urban site or rural site. A city site is favourable in the following circumstances:

1. When a large proportion of skilled labour is required, as in the manufacture of precision instruments.
2. When contact with suppliers and customers and rapid transportation is necessary, as in printing industry and bakery.
3. When multifloor operation on a small plant site is necessary.
4. When city facilities and utilities are important factors.

A rural site is suitable in the following circumstances:

1. When a large plant site is required. The cost of plant site should not usually exceed the existing market price of farm land in the area by more than 50 per cent. The cost of site development, if any, shall also receive consideration.
2. When production processes emit dangerous fumes or by-products harmful to men and animals, as in chemical industry.
3. When large volume of pure water is necessary, as in synthetic rubber and aluminium industry.
4. When property taxes should be low.
5. When protection against sabotage or secret processes is necessary.

A suburban site is suitable in the following circumstances:

1. When plant site should be large and nearness to transportation or population centre is important.
2. When the city is already congested and there is restriction on construction of plant building.
3. When the suburban site offers advantages of cheap labour force.
4. When there is advantage of low taxes.

Site development costs should be considered for each site to be selected. Site development consideration includes suitability of the soil for foundation of plant and buildings, drainage facilities, sewage disposal and facilities or railway siding.

Advantages and Disadvantages of City Site

The following are the advantages of a city site:

1. Skilled labour is readily available.
2. There is closer contact with suppliers.
3. Delivery periods of raw materials, spare parts, etc. may be usually shortened. A shorter delivery period enables the minimum stock levels to be lowered lower working capital invested in stores materials and economy in use of stores spaces.
4. There are better repairing and maintenance facilities.
5. There are better marketing advantages.
6. Rapid transportation is easily available.
7. Multifloor operation can be carried on in a smaller plant site.
8. City facilities and utilities are available.

The following are the disadvantages of a city site:

1. Cost of land is high.
2. Expansion of plant site is difficult. Growth of business may thus hampered on account of limited space.
3. Property taxes are high.
4. Production processes may emit dangerous fumes or by-products harmful to men and animals, thereby violating municipal laws.
5. Supply of water required for processes may not be sufficient.
6. There is difficulty in disposal of waste.
7. There is less protection against sabotage or secret processes.
8. There is more possibility of labour unrest owing to closer influence of organised labour unions.

Advantages and Disadvantages of a Rural Site:

The following are the advantages of a rural site:

1. The cost of plant site is lower.
2. There is better scope for expansion.
3. Staff quarters may be cheaply built.
4. Property taxes are low.
5. Dangerous fumes and by-products may be quickly disposed of without causing harmful effects on men and animals.
6. Waste matters can be conveniently disposed of.
7. There is better drainage facility.
8. There is abundant supply of pure water required for production and also for processes.
9. The climate is healthier.
10. Unskilled labour force is available in abundance.
11. Comparatively free from disruptive influence of labour agitation.

The following are the disadvantages of a rural site:

1. Skilled labour is not readily available.
2. Contact with suppliers is not close.
3. Materials may have to be stocked in larger volumes causing more capital to be locked up in inventories.
4. Repairing and maintenance facilities may not be quick and adequate.
5. Factory may be at a longer distance from the market causing higher cost of distribution.
6. Means of transportation may not be easy.

7. Advantages of schools, colleges and other city facilities may not be available.
8. Electricity may not be easily available.

RELOCATION

Locating the plant could not be thought of a problem occurring only once in a while. The plant has to expanded to meet with the demand. A plant would have to be started. But certain changes in the plant location factors, as you have read, may compel the management of the firm to junk the old plant and relocate everything in a new one.

The causes for relocation decision are:

1. If the regular supply of the raw material from the source is affected by the location of the competitive firm belonging to the same industry.
2. When the raw material being used, is proved insignificant due to technical changes that are taking place.
3. When the means of transportation are changeable,
4. When the centre of gravity of the market area for the products changes drastically,
5. The changes in industrial pricing policies,
6. And when the companies consider the existing labour situation as undesirable and decide to get away from the place.

3.4. REVISION POINTS

The factors that affect the location of a plant 1. Market. 2. Labour. 3. Transport Faculita. 4. Availability of power and fuel. 5. Climate and atmospheric condition. 6. Availability of water. 7. Laws and taxation. 8. Waste disposed. 9. Technology ksunhen.

3.5. INTEXT QUESTIONS

3.5.1. Explain how raw materials influence plant location.

3.5.2. What are the advantages and disadvantages of rare site

3.5.3. Explain the merits and demerits of a plant location.

3.5.4. Explain the factors affecting plant location.

3.6. SUMMARY

Location of plant periodically determines the operating and capacity costs. It determines the nature of investment costs to be incurred and also the level of many operating costs.

3.7. TERMINAL EXERCISES

3.7.1. What is market area?

Each porspective location implies a raw allocation of capacity to respective market area.

3.7.2. What way location helps?

Location helps to deliver the product at a cheaper price and thus helps to combat competition.

3.8. SUPPLEMENTARY MATERIALS

Go to a library and refer venus listed magazines.

3.9. ASSIGNMENTS

How the plant location is ably designed-make a object view.

3.10. SUGGESTED READING

Mayer. R. Raynold, Production Management.

3.11. LEARNING ACTIVITIES

Select the area to study and make new outline selection for reading.

3.12. KEYWORDS

Geographic dispersion: Widens the range of acceptace location is the manuring of regional wage differentials.

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LESSON - 4

PLANT LAYOUT

4.1. INTRODUCTION

After selecting the location for the plant the management of the firm has to decide the type of layout to be designed to carry out the manufacturing activity.

Plant layout may be defined as a technique of locating machines, processes and plant services within the factory so as to achieve the greatest possible output of high quality at the lowest possible total cost of production.

According to James Lundy, "It identically involves the allocation of space and the arrangement of equipment in such a manner that overall operating costs are minimised."

Plant layout is a flour plan, whether established or contemplated, for determining the exact location of machineries and equipments in relation to one another and planning and co-ordinating the paths of raw material and products.

4.2. OBJECTIVES

The basic objective of layout is to develop a production system that meets the requirements of capacity and quality in the most economical way.

1. To provide economics in materials, work in progress and finished goods handling.
2. To effect improvements in processes and methods.
3. To utilise the area and flour space available economically.
4. To avoid bottlenecks.
5. To minimise the production delays.
6. To effect supervision and production control.
7. To avoid frequently and costly changes so that cost of production is not unduely increased.
8. To ensure safety to the workers with a view to minimise accidents.
9. To provide the layout that permits meeting of competitive costs.

4.3. CONTENT

4.3.1. Steps to be followed in designing a plant layout.
4.3.2. Product layout
4.3.3. Characteristics
4.3.4. Advantages of product layout
4.3.5. Disadvantages of product layout
4.3.6. Process layout
4.3.7. Advantages of process layout
4.3.8. Disadvantages of process layout
4.3.9. Combined layout
4.3.10. Stationery layout
4.3.11. Work place layout

STEPS TO BE FOLLOWED IN DESIGNING A PLANT LAYOUT

1. Deciding the products to be produced and the processes to be carried out in the transformation. Production planning and control techniques provide the necessary details to carry out this first step. You will be exposed to these techniques in the concerned section.

2. Determining the exact location of receiving and shipping departments.

The receiving department is the door way to the increasing materials required for manufacturing. The materials received are checked for quantity and quality by the inspection and testing departments. They may be temporarily stored by the stores department or directly sent to the production department. The finished products leave the plant through the shipping department after the usual inspection for quality and quantity.

The receiving and shipping departments are the beginning and ending points of the flow of materials. The flow pattern of materials as established by the plant layout and the location of these two departments depend on each other.

The relative positions of receiving and shipping departments vary from one plant to another. They may be combined into a single department or may be adjacent to one another. Adjacent or combined receiving and shipping departments may be convenient and economical to operate. When production follows a straight line it is worthwhile to locate the receiving department at one and of the plant and the shipping department at the other end. Sometimes the [1] location of these two departments will be decided by the location of loading and unloading points.

When both the beginning and end points of the flow are fixed by locating the receiving and the shipping departments the general flow of the materials can be decided.

3. *Location of Aisles:* The aisles are the passager ways through which all the movements of materials and workers takes place. There are two types of aisles namely main aisles and department aisles.

The main aisles have to be straight to save space and distance. The main aisles are located first and then the departments are located by the side of main aisle. The main aisles once fixed are seldom changed.

4. *Column Spacing:* After planning the aisles, column spacing should be determined. Columns are usually placed at intervals varying from 20 ft to 60 ft. The ways may be square shaped.

5. *General Materials Handling Plan:* General material handling plan is decision which decides the methods and means through which the material will be handled.' From the time of receipt of materials till the shipment of products materials have to be moved between different points. Material handling devices such as conveyors, trucks etc are used for this purpose. In an average industrial plant cost of material handling varies from 25 percent to 35 percent of total manufacturing cost.

Selection of material handling plan is influenced by the following factors:

a. The nature of the materials to be moved,

b. The nature of the contains in which materials will be moved,

c. Origin and destination of movement,

d. Distance between the different points,

e. Frequency and speed of movement,

f. The personnel performing material handling operations,

g. Width of the aisles for allowing passage of loaded trucks etc and,

h. Column spacing.

5. *Planning General Flow of Materials:* A general flow pattern determines the location of production centres constituting the plant. Each production centre consists of a machine or a group of machines worked by an operator or a number of operators working in a group;

The judicious arrangement of equipment and suitable location of stockrooms is taken care of by the technique namely plant layout. The general flow pattern can be decided by taking into consideration the following factors.

a. Locations of receiving and shipping departments

b. Volume of production of different parts.

c. Number and nature of operations to be performed on each part.

d. Number of sub-assemblies for each assembly line.

e. Area and shape of flour space available.

f. Frequency of flow between different production centres.

6. *Location of Service Departments* (other than receiving and shipping department): A good layout should provide for locations of both manufacturing and service departments. The layout of production and service departments should be considered simultaneously as an integrated plan. You will be expired to this particular section when we deal with the topic. "Layout of service facilities".

We have already seen that plant layout is floor plan dealing with the arrangement of machineries and equipments in relation to one another, to achieve the objectives of a plant layout.

Classification of Plant Layout: During the development of a hew plant design production executives are faced with fundamental problem of selecting the type of layout suitable for the.manufacturing of the product, all its aspects. There are three basic layout, merits, demerits and suitability of each type of layout. So let us view each type of layout from those angles.

PRODUCT LAYOUT

It is product oriented. It is otherwise called as line layout and the procedure takes into account the sequental grouping of machines. The basic organisation of work is dictated by the product or part. The machines or the operating facilities arranged in accordance with the sequence and nature operations to be performed on a particular

product. Each product will have a separate production line consisting of the required facilities arranged in the sequence* a$ provided by the route sheets.

CHARACTERISTICS

1. Product standardization favour the selection of product layout. Only standardised products could be manufactured.
2. Requires the production of products in mass resulting in the volume of production adequate for reasonable equipment utilization.
3. The products having reasonably stable demand could be produced. The production facility should operate for a longer period of time without interruption.
4. There should be a continuous supply of material to keep the production going. Raw material is fed at one end and is received as the finished product at the other hand.
5. Machines are arranged as per the sequence of operations.
6. The materials or work-in-process are handled by fixed path material handling equipments.

Suitability: Product layout is suitable for continuous process industries where production proceeds in uninterrupted flow and one operation follows another in a fixed sequence. Petroleum refining, cement and sugar industries make use of product layout.

The machines which are arranged sequentially in an individual flow pattern are of four basic types as given below:

a. *Straight Line Type:* In this type of product layout the machines are arranged in a straight line in such a way that the output of one machine is processed in the next machine in the sequence.

b. *Circular Type:* The machines are arranged in a circle with operations suitably placed inside or outside the circle. Inlets and outlets are to be provided for incoming and outgoing materials. It is compact and a saves floor space.

c. *Odd Angle Type:* It has no fixed geometrical pattern. It is designed to conform to the available space with successive operations as near to each other as possible. It has the advantage of flexibility and adaptability to changed conditions.

d. *'U'-Type:* It economises floor space and allows closer supervision than the straight line type. This is a more compact layout than the straight line type. The same aisle can be used for the incoming and outgoing materials.

ADVANTAGES OF PRODUCT LAYOUT

1. *Reduction in Material Handling Cost:* Materials flow from the preceding machine centre to the subsequent machine centre directly without any stoppage. Since the flow is continuous fixed path equipments are used to handle the materials. The continuous flow and the use of fixed path equipments reduce material handling cost.

2. *Minimisation of Manufacturing Time per Unit:* The production time per unit is reduced because the materials continuously pass from one operation to another without delay. There is no delay on account of non-availability of machine, machine operator and

Bad routing. The uninterrupted continuous flow quickens the flow of materials at a faster rate and thus results in the minimisation of production time.

3. *No Accumulation of Work-in-progress:* As soon as the proceeding operation is completed the material is passed on to the subsequent machine centre. Thus there is no much accumulation of work in progress.

4. *Less Floor Space is Required:* Since there is no accumulation of work-in-progress, there is no need to have additional, storage facility. When there is a possibility of line storage is used to do the operation. So less floor space is required.

5. *Production Control and Record Keeping Simplified:* As the work-in-process automatically flows from machine to machine continuously the production control and record keeping function are very much simplified.

6. Inspection and Efficiency of inspection is greatly increased due to the repetitive nature of the work.

7. Unskilled workers can be employed and utilized to a higher degree. Little amount of training will shape the worker to carry out the job.

DISADVANTAGES

1. Each product has a separate line of production. If one machine of the line fails the entire system will be out of production. The breakdown of one machine causes the other machines in the same line to be idle. The cost due to breakdown will be higher in product layout.

2. Only in continuous process carried out for 24 hours a day the machines can be fully utilised. In other cases there is bound to be less machine utilizations. The machine in a particular line cannot be employed to manufacture some other product.

3. Product layout is highly inflexible. It is not possible to add new facilities or remove old facilities as and when required. Once the line is formed it will operate in a definite pattern as intended at the time of inception. If one machine in the line fails it is not possible to arrange for a substitute immediately. When a machine is lying it could not be used for some other activity. These factors account for the inflexible nature.

4. Supervision cannot be carried out effectively because a number of operations are carried out in the same line.

5. The flow of materials will be interrupted when there occurs a breakdown. It is not possible to divert the route to some other line.

6. The facilities with similar nature will be found in different lines of production. The equipments thus arranged will make the line self-sufficient with respect to that equipment. When two identical machines are required to carry out identical operations at different times, two machines should be provided to maintain the sequence. It results in the duplications of facilities which calls for huge investment.

7. Specialisation is very narrow. One operator cannot operate more than one machine at the same time because the operations are different. There is usually lower level of individual operator performance..

8. It is not possible to exercise fullest control over manufacturing cost.

9. Preventive maintenance is usually followed for the up-keeping of machineries. It is costlier affair.

PROCESS LAYOUT

Process layout is based on type of process through which the raw material is transformed to its final stage. A single process or operation is performed by one machine or a group of machines forming a production centre. Each machine in the group performs a particular operation for different parts or production orders.

All grinding machines may be located in a particular area forming a grinding centre. Thus there will be a number of group of machines. The products requiring different operations will be routed to the suitable production centre for the required operations in proper sequences. Process layout is also called as type grouping of machines or functional or job-lot layout.

CHARACTERISTICS

1. Same facility is used to fabricate and assemble a wide variety of parts.
2. Suitable for product designs which are not stable.
3. Volume of individual parts is low.
4. Suitable for intermittent process industries. For example automobile industries and factories producing electrical goods make use of process layout.

ADVANTAGES

1. The machine utilization is to the maximum extent possible. Single machine is not meant for single operation. When a particular product is not manufactured, the other products will keep the machine engaged.

2. In the event of break down of a machine at a particular centre, the rest of the machines could be engaged by making slight adjustments. Thus there is a greater flexibility of the production process.

3. Similar machines are employed in the same production centre, the supervisor incharge of that centre can develop specialized knowledge about that centre. Hence in process layout there is a higher degree of supervisory efficiency.

4. When a machine fails another machine in that centre can be employed to perform the same operation. So there is less interruption due to break down.

5. In process layout machineries are fully utilized and there is; less duplication of machines. On account of these reasons there is less capital investment.

6. Since the machines are fully utilised the performance level of individual operator is high.

7. A single operator can operate and control a number of machines, because the operations are similar,

8. Process lay out is suitable for non-standarized products and when a larger number of non-repititive products are to be manufactured.

9. Each batch or job of production requires a separate production planning and control system, there is a better control costs.

DISADVANTAGES

1. Different materials require different operations. Materials have to be loaded into a particular centre and unloaded from a particular centre. Thus loading and unloading occur frequently in process layout. Varied path material handling equipments (Fork lift trucks, skids, pallets etc) are used for this purpose. Thus the materials are often handled by varied path equipments consequently the material handling costs are increased.

2. The production in a particular centre for a particular batch could be started only when men, machines, and materials are made available. When a semi-finished product requiring further operation reaches a particular centre it cannot be processed immediately. It is un-loaded into that centre, waits for further processing and gets despatched after processing. Sometimes the facility requires adjustments in the machines. Thus the loading, unloading waiting and set-up times increase the unit production time.

3. There is higher accumulation of work in process in different departments, because the recently arrived batch of materials can be processed only when the batch being processed is completed.

4. More storage space is to be provided at each production centre to accommodate loading and unloading operations and the accumulation of work in progress.

5. Production planning control is a complicated because each batch of production requires separate production plans and control measures. Clerical costs will be higher.

6. A single production centre handles a number of different products. The products are to be checked before they leave the particular production centre. The inspection under, this layout is more frequent and costlier.

7. It damages the machines and equipments because of their frequent resetting and readjustments.

COMBINED LAYOUT

The basic characteristics of product and process layout are combined to form a layout deriving maximum advantages out of the combination and incurring minimum disadvantages. In this kind of layout a process or department performing a specialized operation is taken as a unit and the various units are suitably combined into product layouts.

STATIONARY LAYOUT

In this type of layout, the men and equipments are moved to the material. The material remains in one place and all the necessary operations are performed at the place. For example in ship building and job welding shops stationary layout is utilized.

WORK PLACE LAYOUT

A machine operator, the machine or machines operated by him and the floor-space allotted to him for the work constitute a work place or work station. It is the smallest indivisible space unit of a product or process layout. Ergonomics is of immense use in designing the work place layout.

4.4. REVISION POINTS

Plant layout indentically involves the allocation of space and the operating costs are minimized.

4.5. INTEXT QUESTIONS

4.5.1. Explain the objectives of plant layout.

4.5.2. Define product layout

4.5.3. Explain the process layout.

4.5.4. What are the steps to be followed in designing a plant layout.

4.5.5. What is combined layout?

4.5.6. What is stationery layout.

4.5.7. What is curk place layout?

4.6. SUMMARY

Good layout requires

i. Smooth flow of production
ii. Maximum utilization of available space.
iii. Facilities the movement of nero
iv. Involves minimum handling.
v. Provides better working condition.
vi. Flexibility
vii. Location of stores.
viii. Facilities suspension of control
ix. Provision of safety
x. Coordination and integration.

4.7. TERMINAL EXERCISES

4.7.1. Explain smooth flow of production

There must be smooth flow of production. Raw materials and workers must have access of each machine without any difficulty and delay.

4.7.2. What is Maximum utilization of available space?

An efficient plant layout must be such that they utilize the maximum of the space available.

4.7.3. What is Location of stores

The stores in a plant must be located in such a place from where raw materials, tools, equipment, and other materials may be supplied to the departments concerned easily without any delay.

4.8. SUPPLEMENTARY MATERIALS

Collect production magazines related with production department of a manufacturing concern and understand their plant layout in order to visit respective places.

4.9. ASSIGNMENTS

Make a plant layout design with the help of the industrial visit made by you with what are all the objectualisation methods present a rearside view.

4.10. SUGGESTED READING

4.10.1. Burge and Sharma – Production management.

4.11. LEARNING ACTIVITIES

4.11.1. Reading of the type part learning and whole learning. Select the concept of learning with respect to applicability.

4.12. KEY WORDS

Factors layout consisting of an analysis of the buildings, in terms of additions and modificiations required and their adequacy for housing needed equipment and machinery.

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LESSON - 5

LAYOUT OF SERVICE FACILITIES

5.1. INTRODUCTION

An efficient layout should provide for location of both manufacturing and service departments. The layouts of production and service departments should be considered simultaneously as an integrated plan. Plant services must fit into the over all layout. Some of the service activities such as receiving, shipping and warehousing are in the direct material flow and they process the product. Other activities such as maintenance facilities and tool cribs, do not work on the product but interact with production costs. Hence their physical location and capacity deserve careful thought. Layout considerations for some of the important service departments are discussed below. First comes the plant services.

5.2. OBJECTIVES

5.2.1. To study about storage space, subject to some of the important service departments.

5.3. CONTENT

5.3.1. Storage space.

5.3.2. Office layout.

1. *Storage Space:* Storage space should be provided for raw materials, work-in-process and finished goods. The layout for store keeping depends upon the following steps to be taken sequentially.

(a) Determination of the area of storage space.

(b) Determination of the location of the stores items.

(c) Allocation of storage space to different stores items.

Generally the raw materials stores is located near the receiving departments but adjacent to the production departments where the. first operation are carried out. The factory may have a centralized stores or decentralized stores. It depends upon the stores location factors such as classification of materials according to nature, similarity of physical characteristics, point of usage and material handling considerations valuable materials used exclusively by a production department may be kept under the control of the production department concerned in a departmental store-room.

2. *Tool Cribs and Tool Rooms:* Usually a centralized tool room is designed for making tools, for keeping tools which are costly but less frequently used, for carrying out major tool repairs, for maintaining tool records and for issuing tools to workers. The central tool room keeps tools, jigs, fixtures and dies in tool cribs and supplies them to the production departments. It is conveniently located nearer to the manufacturing areas. The layout of the tool room is to be designed in such a way to make the tools available quickly and conveniently. A number of smaller tool-cribs may be located near the different production departments where minor tool repairs may also be undertaken.

3. *Power House:* When a plant has its own power house, it should be located where delivery of coal or oil may be conveniently made and ashes from coal fired boilers may be easily removed and disposed off. When the power house requires large quantities of coal, adequate storage space and handling system are to be provided. Equipment and distribution system for power, compressed air, steam, hot water etc., have to be designed.

4. *Factory Office* It is the office which controls and co ordinates the production activities. So it should be located very nearer to the production departments. Al the same time, it should be protected from dost, fumes and noise from and the production department to provide a pleasant office atmosphere. It should be located in such away that the personal observation of processes is made easier.

Next let us look into the layout considerations for Employee services.

Personnel services cover a broad spectrum including parking, cafeterias, medical services, locker rooms, toilets, lavatories and recreational facilities.

These services are generally used during working hours. The size of facility and its location in relation to the users become important. The travel distances to and from the service facility should be made in order to determine reasonable location. Weighting line models are useful in deciding the location and capacity of the facility.

Locker rooms, wash rooms, toilets, etc., should be located as close to the respective departments as possible. They should not be located in another building or another floor in the same building.

Locker rooms can be situated adjacent to the respective departments. They should also be inproximity to the building entrances where the time clocks are also located. The passage ways in these areas should not to be narrow, otherwise it will resulting congestion. These facilities can also be located in wings or service towers provided with elevators or stairways.

The restaurants and cafeterias should be located at the centre of the plant. So that the employees can reach them with minimum travel. The medical facility should be located in such a way that the injured and sick can reach the facility be located near an outside driveway for ambulance. Recreation rooms should be placed where suitable areas are available for the purpose. Large companies have their own football fields, Tennis courts and open air theatres.

OFFICE LAYOUT

The general offices and offices for manufacturing executives, engineers and other special groups are usually placed together. This atmosphere provides a healthy co-operation and understanding.

In small and medium sized plant the general office may be situated at the main entrance to the plant. This makes the visitors to contact the executives without inferring with the production activity. In large plants the general office is located in separate buildings.

Generally the employees in the office are involved with mental work. The disturbing factors should be avoided to carry out their work productively. Street noises are very disattracting. To guard against noises offices are located in the higher parts of the building, the office should be protected from chemical fumes, and unpleasant odours, smoke and dirt. An office should be well ventilated. Low ceilings few windows result in poor ventilation and deficient light. Buildings with small windows should be avoided. If 75 per cent of the surface of the outside is occupied by windows, it can be considered as an ideal arrangement.

In constructing a new building for office provision should be made in advance for fioorconduits for telephone, buzzer, power and light, the shape and size of office space should given consideration. One large rectangular area is much better for general office purposes then a number of smaller rectangular ones.

PLANT LOCATION

1. Enumerate the major factors to be considered for plant location.
2. Discuss the advantages and disadvantages of locating a factory in the city.
3. Some factories start their new units or extend their units in rural areas. Discuss the reasons for selecting rural areas.
4. When a company has to consider the relocation of the factory?

LAYOUT

1. What are objectives of a good layout
2. Discuss the characteristics of different types of lay outs.
3. Compare the merits and demerits of product and process layout.
4. Discuss the factors to be considered for laying out service facilities.

5.4. REVISION POINTS

5.4.1. The objective of good layout

5.4.2. The characteristics of different types of layout.

5.4.3. The effects to be concerned for laying at service facilities.

5.5. INTEXT QUESTIONS

5.5.1. Explain the principes involved in an ideal office layout.

5.6. SUMMARY

A good plant layout have

i. Minimization of material handling.
ii. Elimination of bottle needs through holding of plant capacities.
iii. High metal tumer through slurter operating cycle.
iv. Effective utilization of cuture space of the faculty area.
v. Effective utilization of manpower resources through elimination

5.7. TERMINAL EXERCISES

5.7.1. What is a storage space?

Space provided for raw materials, work-in-process of finished goods.

5.8. Supplementary materials

Try to list out the layout of service faculties required in an organisation by block diagram.

5.9. ASSIGNMENTS

From the Block diagram make a craft work art of making specific designing of arrangements in an organisation.

5.10. SUGGESTED READING:

5.10.1. Samuel Eilen – Production management.

5.11. LEARNING ACTIVITIES

Reading not only helps in accquiring knowledge so kindly aware some protected knowledge or working knowledge may help and able designs in the learning attributes.

5.12. KEY WORDS

EQUIPMENT LAYOUT AND ARRANGEMENT

Class of work arrangement where all the machines performing the save type of work are grouped together, like drilling machines in one department and milling machines in another.

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LESSON - 6

PRODUCTION, PLANNING AND CONTROL

6.1. INTRODUCTION

Production, planning and control is the organisation and planning of the manufacturing process by means of routing, scheduling, despatching, inspection and follow-up.

Production planning co-ordinates the activities of the production departments with other departments of the business such as sales, purchasing, materials control, personnel, engineering and administrative groups. The activities proceed as follows.

Sales department forecasts the probable sales for a specified future period and prepares sales schedule. It can be handed over to the Production Department and it prepares the production schedule detailing the major and volume of work to be undertaken by the department. From the production schedule, purchasing department prepares the purchasing schedule with regard to the quality and quantity of materials, parts to be procured. Personnel department works out the labour requirements to achieve the production target already set. Production control function involves the controlling of activities within the production department itself for promoting most effective shop operations.

6.2. OBJECTIVES

Manufacturing function transforms the raw materials into finished product through machines, equipments, labour force and technology. The transformation requires an integrated efforts. Various functions are to be co-ordinated to achieve greater productivity.

The products are to be produced in stated amounts with specified quality and within the stipulated time. Production, planning and control achieves these, objective by maintaining timely supply and movement of materials, required labour force and maximum machine utilization. Efficient production, planning and control system makes the concern to meet the delivery dates.

6.3. CONTENT

6.3.1. Functions of production planning.
6.3.2. Functions of production control
6.3.3. Types of production plans
6.3.4. Production plans relating to sales qualities.
6.3.5. Production plans relating to methods.
6.3.6. Plans relating to timing.
6.3.7. Factors determining the correctly or simplicity of production planning.
6.3.8. Organisation
6.3.9. Centralised plan.
6.3.10. Decentralised plan.
6.3.11. Control through progress man

FUNCTIONS OF PRODUCTION PLANNING

The following are important function of production planning:

1. Coordination of production activities with the related activities performed by other departments. Co-ordination of activities is essential to accomplish the common goal.

2. Careful timing of inter-related activities. The production function can be started only after materials and tools are made available, this must be ensured before starting the production otherwise, it will leave to the stoppage of production.

3. Achieving the most economical combinations of resources for reducing the cost of production.

FUNCTIONS OF PRODUCTION CONTROL

1. Production control co-ordinates production information ant production aids including materials, tools, methods and times
2. It directs and checks the course and progress of work.
3. When a production order is completed it closes the records.
4. It relieves the foreman of the burden of preliminary planning and recording and allows him to devote his full time to; normal duties.

TYPES OF PRODUCTION PLANS

There are three main types of production plans.

1. Production plans relating to quantities of sales.
2. Plans relating to methods.
3. Plans relating to timing of individual production operation and processes.

PRODUCTION PLANS RELATING TO SALES QUANTITIES

At first the estimated sales of the products is determined. The production is reconciled with the estimated sales. The manufacturing programme is extended to future period correlating with sales, production and inventory capacities. These plans achieve a balanced relationship among sales rate, production rates and inventory levels. Recording to changes in anticipated sales production rates are varied by utilizing more or less of the production capacity. Provision for inventories is similarly varied in order to strike the most economical balance between production rates and inventory levels. Sales forecast figures determined the quantity requirements for raw material and parts, necessary lead time for procurement or manufacturing and plant's capacity and available capacity to meet this load. Production plans are reviewed and changed at frequent intervals to meet changing needs.

PRODUCTION PLANS RELATING TO METHODS

Depending upon the methods of production the production plans will vary.

In custom manufacturing the products are made only after receiving the orders from the customers. A more extensive organisation is required for operations study and sequence planning relating to each order. Operation planning prescribes time allowances for each operation. Operation times and sequences provide the basic information for establishing production rates and operating plans.

PLANS RELATING TO TIMING

By this plan a working tables of shop operation is established by machine analysis and operation study. Physical materials are distributed to various processes to achieve the following results.

1. Every order is completed according to the time schedules.
2. Promised delivery dates are based on definite information.
3. A study of supply of work is maintained ahead of each process or machine.

FACTORS DETERMINING THE COMPLEXITY OR SIMPLICITY OF PRODUCTION PLANNING AND CONTROL SYSTEM

Factors which make the system complex are as follows

1. Number of parts in the final product influences the system. As the number of parts increases, the system becomes more complex.

2. As the number of operations to be performed on each part increases, the system becomes more complex.

3. Mutual dependence of processes makes a system more complex. A process can not performed unless the previous process has been completed.

4. The variances in capacity of machine for different classes of work affect the system, when different metals are to be worked, the capacity changes according to the hardness of different metals.

5. Number of sub-assemblies required to make the final product affects the system. Increasing number of sub assemblies increases complexity of the system.

6. When fixed delivery dates are to be maintained the system becomes more complex.

7. When the firm receives larger number of orders in small lots, the system becomes more complex.

FACTORS MAKING THE SYSTEM SIMPLE

1. When the work is repetitive in nature.
2. When a fixed date of completion need not be observed
3. When machines and processes have the same capacity for different, classes of work.
4. When the methods of operations of machines are processes are invariable.
5. When parts and assemblies require no special skill.
6. When there is balanced production.

ORGANISATION

There are three basic forms of organisation for production, planning and control. These are

1. Centralised production, planning and control department.
2. Decentralised production, planning and control.
3. Production control through progress-men.

CENTRALISED PLAN

The production, planning and control department is headed by a production, planning and control manager responsible to the works

ADVANTAGES

1. Possibility of accurate determination of production control load for ascertaining man power requirement for production planning and control.
2. Provides data for making accurate delivery commitments.
3. All delays may be correctly determined and summarised.
4. It provides a better basis for taking corrective action because of centralised information.
5. There is centralised co-ordination of production and services activities.
6. The departmental foreman is relieved of the responsibility of production control.

DISADVANTAGES

1. The centralised office can not have direct knowledge of actual conditions in the production departments
2. The cost of installation and operation of production control function may be high.
3. Centralised planning, planning and control may not quickly adopt itself to changing local conditions.
4. There may be clash with areas of line authority.

DECENTRALISED PLAN

Under Decentralised Plan each foreman has his own Production Planning and Control group functioning under his authority.

ADVANTAGES

1. The Foreman has the first hand knowledge of current capabilities of man and machines in his own departments. This enables him to plan work according as a whole.
2. He is in a position to plan the best sequence of jobs for most effective operation of the department as a whole.
3. He has complete control of work assignment for smooth production activity.
4. There is no additional fixed overhead of having an independent Production, Planning and Control department.

DISADVANTAGES

1. The best sequence of work in one department may not fit into the sequence of work in the following department. This may give rise to obstruction in the flow of work.
2. Follow up of works orders through the departments presents considerable difficulty.
3. Difficult to have overall control with effective co- ordination.
4. Production Control work is an additional burden on the Foreman.

CONTROL THROUGH PROGRESS MAN

It consists of placing a number of Work Orders under the responsibility of a progress man who chases each order under him through the various Production departments till it is completed and ready for delivery. He can assign priority to an order and expedite urgent orders.

ADVANTAGES

1. The plan can be made flexible to adopt itself to local conditions.
2. Urgent orders can be expedited on emergency basis.

DISADVANTAGES

1. Machine set-ups may be frequently broken when attention is confined to particular production order only. Frequent change covers increase departmental costs.
2. There is limited scope for overall planning and co-ordination.

PROCEDURE (FUNCTIONS OF A PRODUCTION CONTROL SYSTEM):

Control of manufacturing is exercised through the function of

1. Routing
2. Scheduling
3. Despatching and
4. Progressing.

ROUTING

Routing is a production planning functions and may-be entrusted to a methods engineering section. The methods engineering function is concerned with time studies, works simplification, analysis of operation, routing, tool planning and design. Routing includes the following functions.

1. Study in the product, determining the alternative methods of processing and selecting the best method for manufacturing.
2. Determining the equipment and the place where the processing will be done.
3. Determining the capacity of the machine available for processing.
4. Determining the sequence of operations to be carried out for completing the product.
5. Determining the speed at which operations will be performed.
6. Determining the time required for each operation.

7. Preparing route sheets.
8. Grouping of route sheets and preparing master route sheet.
9. Preparing works orders for authorising production regarding to details contained in the route sheets.
10. Adopting procedures to the despatching system in use in the plant.

Route sheets contain the following informations.

1. The name of the part.
2. Manufacturing Order number
3. Materials to be used.
4. Operations to be performed in sequence.
5. Machines on which the operation will be done.
6. Tools to be used.
7. Time taken and Inspection report about number of good -units and bad units.

6.4. REVISION POINTS

Manufacturing function transforms the raw materials into finished, seatable products with the help of machines, equipment labour force and technology.

6.5. INTEXT QUESTIONS

6.4.1.1. Discuss the importance of production planing and control in an industry.

6.4.1.2. Outline the objectives of production control.

6.4.1.3. Explain the concept of system and intermittent systems of production.

6.4.1.4. Define Routing.

6.4.1.5. Explain the function of production and control department.

6.4.1.6. Explain continuous production.

6.4.1.7. Explain mass production.

6.6. SUMMARY

The seles forecasts are converted into master production schedules through production planning which uses the information developed in both the manufacturing and factory planning to prepare production forecasts, master schedules, procurement schedules, department schedules, personnel schedules and establish stock room procedures finished goods inventory control etc.

6.7. TERMINAL EXERCISES

6.7.1. What are the three types of production plans.

A. Production plans relating to qualities of sales.
B. Plans relating to methods.
C. Plans relating to timing of individual production operation and processes.

6.8. SUPPLEMENTARY MATERIALS

Make a flow chart – prepared for the analysis of the movements involved to determine which could be removed, combined and so ask for the demonstration to a near by industry.

6.9. ASSIGNMENTS

Make a block diagram in a chart or make a model of flow chart

i. Man – machines chart
ii. Right – hand left hand chart.

6.10. SUGGESTED READING

Make an entry into world wide website for latest updates in your subject.

611. LEARNING OBJECTIVES

Study makes feasible only when noise pollution and in control measures whether belonged to individual or group may be the case of text or man or nature.

6.12. TECHNICAL WORDS

PROJECT PLANNING :

Manufacturing articles such as special purpose, machines, which in all likelihood will not be manufactured again in the same form.

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LESSON - 7

SCHEDULING

7.1. INTRODUCTION

Scheduling is the determination of time for starting and finishing of operations. It deals With the amount of work to be done. It lays down the table of manufacturing activities in which all processes and operations are timed in detail.

7.2. OBJECTIVES

7.2.1. To view machine load chart

7.2.2. To objectualise project chart

7.2.3. To view order control chart

7.2.4. To focuss Gantl chart

7.2.5. To study schedule control power

7.3. CONTENT

7.3.1. Scheduling procedure

7.3.2. Machine level chart

7.3.3. Project chart

7.3.4. Order control chart

7.3.5. Gantl chart

7.3.6. Schedule control power.

7.3.7. Despatching

7.3.8. Progressing

SCHEDULING PROCEDURE.

After having prepared the operation and master route sheets the manufacturing methods should produce desired items in a efficient manner. The route sheets deals with the "how" aspect of production whereas scheduling determines "when" aspect of production.

The group working with scheduling will start with the desired delivery date of the customer order in mind. The machine availability is determined from a machine load chart.

MACHINE LOAD CHART

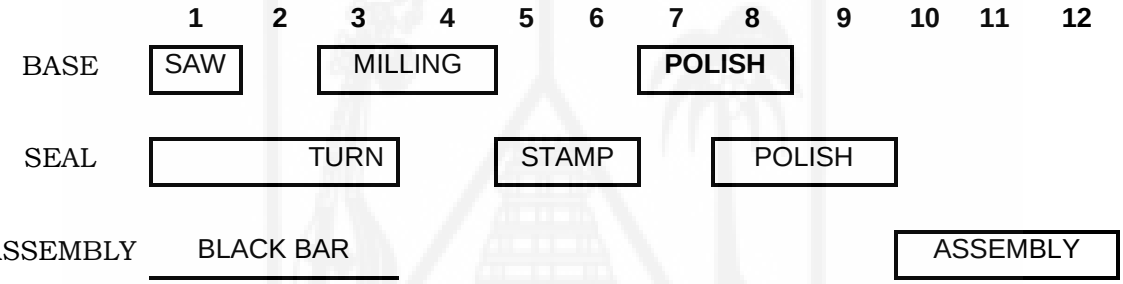
MACHINE	MACHINE CAPACIT HOURS	ASSIGNED ORDER HOURS				
		1	2	3	4	5
TURRET LATHE	160	160	152	136	160	92
SHAPER	24	24	24	24	0	0
PLANER	8	8	6	6	6	6

Machine load chart lists all the machines required for the operation and indicates the amount of work scheduled for each machine or group of machines. It shows the dates for which the machines are to be employed for different work orders. It also shows the dates on which the work has orders. It also shows the dates on which the work has not been assigned to the machines.

A machine load record shows at a glance to what extent the capacity of the machine is utilised and the nature of work.

From the above illustration you can understand how the machine load chart is used to toad the machines for completing the work orders. There are three machines viz. Turret, Shaper and planer. Assuming that there is one shift per day consisting of 8 hours of work, there are 20 Turret lathes, 3 shapers and t planer. The aim is to find out the dates on which the machines would not fully engaged. The available the machines hour give an idea to fix the delivery date.

PROJECT CHART WORKING DAYS



It is used to schedule individual order through the plant. It is designed to show the progress with overall picture of work that is to be done on a particular order including parts, sub assemblies completed items and time required for manufacturing each.

Project chart shows the expected completion date for each operation. As seen in the illustrations three types of operations are to be done on the base. They are sawing, milling and polishing. *Their* operations namely Turning, stamping and polishing are to be done on seal and working day, milling operation will take three days wit! one day left between for transportation and two days for operation with one and half day left for transportation. The operations on sea-are similarly shown. The assembly of parts will take place on the 10tl working day will be completed on 12th. The Black bar indicates the progress that has been made.. When the progress is not as great as expected the cause is investigated. The tick mark indicated the present date.

MASTER SCHEDULE

DAY	UNITS TO BE PRODUCED			
	SEALS	NAME PLATES	BASES	ASSEMBLIES
SEPTEMBER 9	348	267	300	250
SEPTEMBER 10	205	300	280	250
SEPTEMBER 11	162	266	100	300

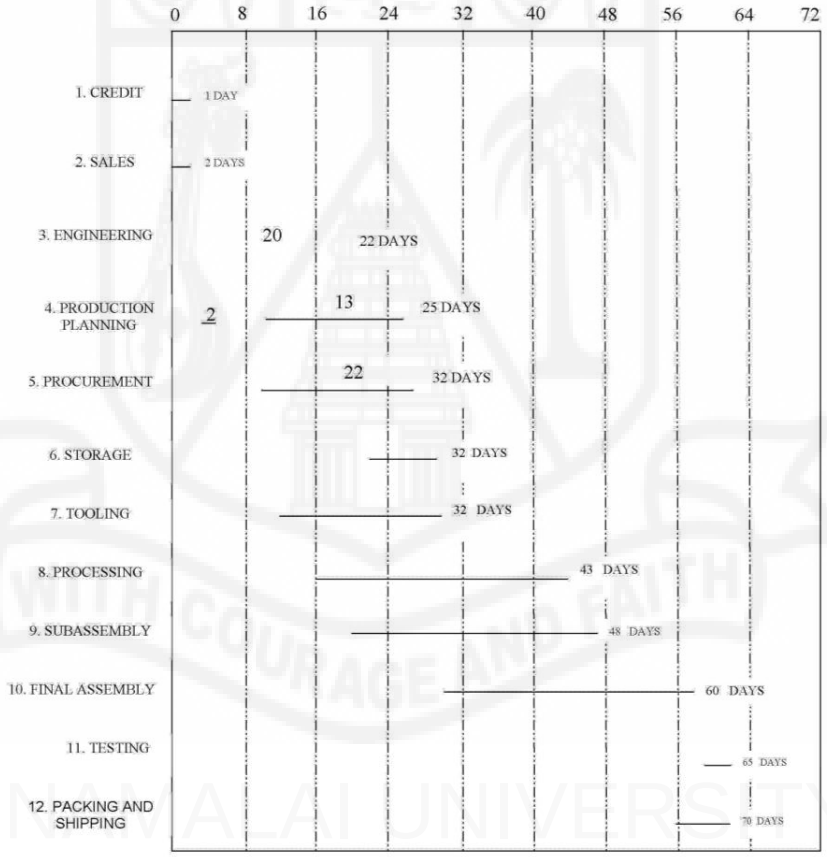
It shows the overall production plan and the amount of each product scheduled to be completed daily, weekly or monthly basis. Job order companies will have their master

schedule on daily basis. Continuous process industry can have a weekly or monthly master schedule. From the master schedule sales department can obtain information about the possible delivery date.

ORDER CONTROL CHART

ORDER	JANUARY	FEBRUARY	MARCH
X-472	1	2	3
F-360		2	
J-490	3	1	3

It is the planning and control device used to check up the progress of individual orders. As seen in the illustration there are three job orders (X - 472, F - 360, J - 490) to be processed on three machines (1,2, 3). In the control chart the dotted line shows the work in progress according to the schedule which is indicated by a solid line.



As seen from the chart order F 360,was started about two week prior to the scheduled stating date. J - 490 was processed on machine No. 3 according to the schedule but there has been some delay in getting it started on machine number one. Just looking at the chart the executive can explore the reason for the delay.

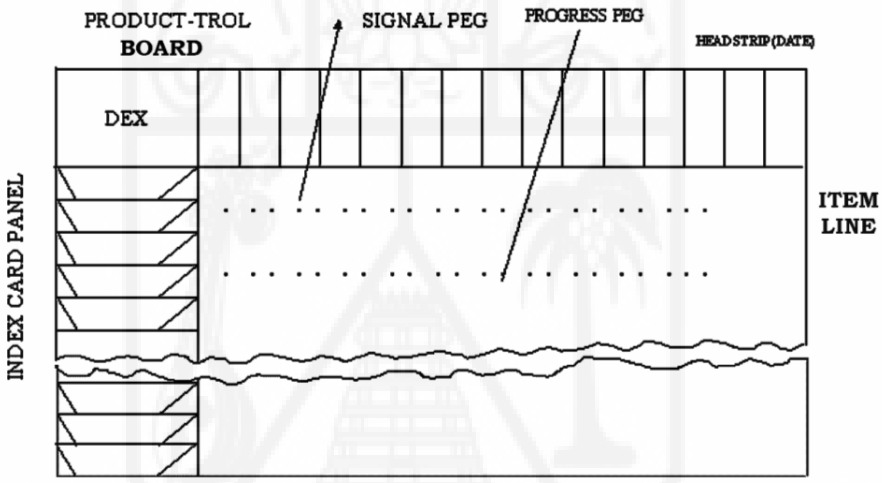
It was devised by Henry Laweranace Gantt. It give consideration to the fundamental factors in scheduling despatching and control. The item will be represented in the left

hand column and the remaining portion of the chart is used for time aspect. It shows clearly the relationship among different variables.

The components of the schedule given above are chronologically represented. It explains how the customer's order is! converted into the required product. It provides basis for the] determination of overall time cycle beginning, receipt of a customer's! order and ending with shipping the ordered goods to the customers.

SCHEDULE CONTROL BOARDS

The boards of varying sizes are used instead of lines as shown in the Gantt Ghart. Coloured Pegs are place in the hole to show the starting, completion date arid progress. One among them is product -Trol board,



It employs movable tapes or strings which run horizontally across the board to record the progress of work. On the left side of the board is a pocket panel in which cards are inserted in such a way that the bottom margin carries the identification required. The right side of the board is divided into a series of peg holes for visible charting. A heading strip is used to notify the division of time or quantity across the top of the peg board section. The heading strip can also be used to divide the holes into departmental sections.

Each card in the visible index panel is aligned with an item line on the peg board section. The item line consist of two lines of peg holes. The upper one after two line is used to indicate the scheduled operations by means of signal pegs the lower line is used to record the progress against the schedule by inserting the tap peg under the respective column. Tap peg consist of a peg to which tap or chord is attached. The chord is not visible on the face of the board. It is always kept in tension.

DESPATCHING

It deals with the issuances of necessary order and taking all other steps to ensure that the time target set in the schedule will be i achieved. It is the routine of setting manufacturing operation in motion through release of production orders and instructions in accordance with established loading schedule and sequences as embodied in the route sheets.

FOLLOWING ARE THE DESPATCHING ACTIVITIES

1. Issue of Stores requisition to move materials from Stores to Processes. The Stores requisition authorised the stores keepers to issue material to departments for performing operations.

2. Issue of tool orders to the tool department. It makes the tools, Jigs, fixture etc. ready for the use of the production departments.

3. Issue of job orders. It authorises the operator to carry out the operations in accordance with the plants date and times as entered on machine load charts, route sheets and control devices. The time taken to perform an operation is recorded on the job order.

4. Issue of time tickets, drawing, instruction cards to the workers. The time of commencement and completion of job are recorded on the time tickets. The time ticket serve as a basis of Payment to workers.

5. Issue of inspection orders. It instructs the inspector to examine and report the number of good and bad units relating to each operation and causes of scraps.

6. Collection of time tickets, drawings and instruction cards at the end of each operation and return them lo the production control, department.

7. Issue of move orders. A move order instructs move man to move work from one operation to another or to the inspection centres or to the Stores room.

8. Forwarding time tickets to the pay-roll departments and records on jobs to the production control departments.

9. Recording ideal time of machines and operator and reporting them to appropriate authorities for necessary action on delays.

Despatching boards are used to check up the work. Visually controlling work load on each machine, a certain space is allotted to the machine on a wall or rack.

The space is divided into three compartments. One compartment is meant for the job which is already on the machine. The second compartment is reserved for the job which will be taken up on the machine when the job already in the process will be over. The third compartment contains the job orders one behind the other. This compartments shows whether there is a fair supply of work in reserve, so that the machine may be kept engaged without break. Various types of Gantt charts can also be used to assist despatching section.

PROGRESSING

Progressing is checking production activities systematically so that the production is carried out according to plan. It regulates flow of materials and parts through production. Process production is planned in detail through the functions of routing, scheduling and despatching. The shortage of materials, defective parts and materials, shortage of operators, machine and tool break down, excessive scrap etc., may upset the production programme. Progressing function reveals these aspects.

The Progress section prefers each day a list of jobs schedule and a list of machines which are idle. Appropriate remedial measures should be taken in co-operation with the planning section despatching section and the departmental foreman. Progress section remedies the defects within its competency and it should be capable of reporting to the Management on any required remedies action.

Production Planning and Control functions - in continuous process industries and intermittent industries.

It continuous manufacturing industries the functions are simple in character whereas in intermittent manufacturing the functions are very much complicated.

In continuous manufacturing the products are produced through repetitive operations. The facility once said could be utilised for a longer period of time. It deals with only a fewer variety of related products once a particular product is decided it could be followed for a length period. But in intermittent manufacturing different orders for different product *pie* to be manufactured. Each order will have its own delivery date, quality and quantity. Different route sheets are to be prepared for different components of single product for different products and for different orders. Thus routing function is very much complicated.

In continuous manufacturing the finished product of one piece of equipments becomes the raw material for the next and it automatically flows without detailed orders, when the operation is started on the first machine, the flow of production is automatic and goes without intermediate scheduling, till the desired volume of production is obtained. Once the length of time required for the production cycle and the rate at which the finished product flows out of the equipment are known, then it is considerably simple to determine the date of commencement of operation and the Completion of operation.

In intermittent manufacturing, scheduling is primarily concerned with completing an order or lot according lo the delivery date. The orders can be expedited by considering the availability of material, equipment, tools and personnel. Scheduling as a complicated function is intermittent manufacturing because the orders received differ in a number of aspects.

In continuous manufacturing despatching procedure is much simple. The same material is worked through different operation to form the final product. Thus the subsequent operation after the first one need not be controlled and they do not require separate job orders. Despatching is confined to materials and tools timely to be furnished at the first machine only. Inspection order may be issued at -the end of the each operation. Bui more orders are not necessary.

Despatching is a complicated function in intermittent manufacturing. Different orders are to be processed in intermittent type each part are product or order is considered as a separate entity requiring a set of despatch orders. Separate ticket, inspection order and more order are to be prepared for each job orders.

Follow up is simple in repetitive manufacturing (continuous manufacturing). But it is very much complicated in intermittent manufacturing because a number of follow up procedures are to be devised.

7.4. REVISION POINTS

Study of the various charts indicates preparation and the operation and master route sheets the manufacturing methods should produce items in a effective manner. The route sheets deals with the how "aspect of production whereas scheduling" when "aspect of production."

7.5. INTEXT QUESTIONS

7.5.1. Explain Gantl chart and describe its uses.
7.5.2. Explain despatching in production control.
7.5.3. Explain scheduling, what are the various steps in scheduling production.

7.6. SUMMARY

These charts can be drawn for the existing method as well as for the proposed method to highlight the savings possible. This is sometimes referred to as process analysis and motion analysis.

7.7. TERMINAL EXERCISES

7.7.1. Explain Despatching.

It deals with the issues of necessary order and taking all other steps to ensure that the time target set in the schedule will be achieved.

7.8. SUPPLEMENTARY MATERIALS

Go for Google search related to any topic, area, subject, and collect relevant information.

7.9. ASSIGNMENTS

Workout a model with chart analysis findings and suggestions on your own ideas or with any industrial reference.

7.10. SUGGESTED READINGS

7.10.1. Es. Buffa. – Modem production management.

7.11. LEARNING ACTIVITIES

Reading is capable of understanding capability with subject to refer dictionary of specialisation make keywords of minimum ten numbers to understand the subject concept.

7.12. KEY WORDS

SCHEDULING: The assignment of stating and the finishing.

LOADING: Time for which the various work station are booked in advance for definite products.

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MAKE OR BUY DECISION

8.1. INTRODUCTION

Materials Manager has to make many Policy decisions, pertaining to his area. One among them is the make or buy decision, whether to make an item within user plants (producer) or to buy it from outside sources is a major policy decision. Normally decision in this aspect are taken at top level. When the Materials Manager is a member of the top Management team, he places a key role and is best equipped to deal with the problem. Otherwise, he has to play a supporting role by providing relevant data so that the top Management can make a scientific decision,

A great deal of coordintion is required between Materials Management and Production departments. Production department has to convey the information such as quality requirements, quantity requirements, existing production facilities, balance equipment, requirements to the Materials Manager.

Few organisation have formed committees to analysis and recommend proposals make or buy decisions arise due to variety of reasons. When the suppliers consistently fail to supply the items or when there exists a strong competition from many end users for the same item, the firms has to make the item in its own plant.

The following factors are to be analysed in arriving at make or buy decisions.

8.2. OBJECTIVES

8.2.1. The study on Quality requirements.
8.2.2. The study on Quantity requirements.
8.3.3. The focus about cost aspects.

8.3. CONTENT

8.3.1. Quality requirements
8.3.2. Quantity requirements
8.3.3. Cost aspects.

QUALITY REQUIREMENTS

When the buyer is able to make the item with required quality standard and when the vendors consistently fail to meet the quality requirements it is better to make the item but when the suppliers enjoys the benefit of specialised knowledge and skill, in making the item, it would be better to buy the item from supplier.

QUANTITY REQUIREMENTS

When the quantum .of items to be purchased is small the supplier may not accept small orders. In such circumstances it may be worthwhile to make them if the existing facility allow for making the items in question. When the demand for items are not certain it would be advantages to make it using a flexible production schedule. When the requirements are very large buying would be desirable.

COST ASPECTS

The advantages and disadvantages of making or buying an item will have to be quantified and a cost analysis has to be done: If the existing capacity is sufficient to make the item, fixed costs do-not normally enter the analysis. However when fresh capacity is to be added to make the item, additional fixed costs have to be taken into account while utilising existing capacity for making the projected sales requirements are not affected for want of capacity.

In addition to the above three factors discuss above, factors such as flexibility, technical know-how, labour content, usage level etc. also influence the top management's policy in make or buy decisions.

8.4. REVISION POINTS

Make or buy decision in several, aspects listed here to discuss about the advantages and disadvantages of every system.

8.5. INTEXT QUESTIONS

8.5.1. Explain Make or Buy decision.

8.5.2. Explain Quality and Quality requirements

8.5.3. Explain cost aspects and other aspects in Make or By decision.

8.6. SUMMARY

The lesson deals with Make or Buy decision with respect to quality, quantity, cost aspects, flexibility, technical laws, labour content, usage level requirements and top management subjecting.

8.7. TERMINAL EXERCISE

Why the aspects of Make or Buy decision can be discussed here?

8.8. SUPPLEMENTARY MATERIALS

Meet the materials manager of an organisation to understand the technical law how and respects about Make or Buy decision.

8.9. ASSIGNMENTS

With the information gathered from the materials manager / purchase manager enumerate the points to be added with the topic of the context.

8.10. SUGGESTED READING

J. L. Landy – Effective Industrial Management.

8.11. LEARNING ACTIVITIES

Go to an industry and ask your questions about the process of progressing how to Make or By decisions taken by the materials manager.

8.12. KEY WORDS

Top managements in Make or By decisions the involvement may be dried or product or through channels of representation with the sample models have been noted.

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MAINTENANCE

9.1. INTRODUCTION

Maintenance department is a service department. Maintenance costs are appropriated to production department. The object of maintenance is to keep building and grounds, production and service equipment in satisfactory condition according to the standards set by management.

9.2. OBJECTIVES

9.2.1. To analyse types of maintenance work

9.2.2. To use maintenance in an organisation

9.2.3. To look maintenance system through maintenance organisation chart and through maintenance work under chart.

TYPES OF MAINTENANCE WORK

The following are the Various kinds of Maintenance Work.

1.*Building Maintenance:* This includes maintenance relating to floors, service mains, heating, lighting, ventilating, air- conditioning, painting, plumbing, general building up-keep, general plant house keeping and clean up.

2.*Ground Maintenance:* It includes maintenance of roadways walk ways, paving tunnels, outdoor crane structures, fences, land scaping, gardening, parking facilities, yard drainage, collection and disposal of refuse.

3.*Mechanical Equipment Maintenance:* This includes maintenance of power transmission equipment, compressed air equipment, furnace boiler, Heat treating equipment, production machinery and equipment including lubrication, material handling equipment, store room equipment etc.

4.*Electrical Equipment Maintenance:* This includes maintenance of generators, transformers, wiring and switch boxes, communication systems including calling, signaling, alarm, private telephone system; electrical measuring instruments and recording devises.

5.*Plant Safety Services:* This includes maintenance of safely installation, warning signs, fire fighting equipment.

MAINTENANCE ORGANISATION

The maintenance organisation varies widely from plant to plant according to the nature and volume of maintenance work. Although there are great variation in detail from one plant to another, certain general principle may be laid down in respect of matters common to all of them. They are as follows:

1. Control of maintenance personnel.
2. Planning of maintenance work on long term basis.
3. Issuance of maintenance work orders.

4. Storing of maintenance materials such as tools, spare parts, lubricants, cleaning materials etc.

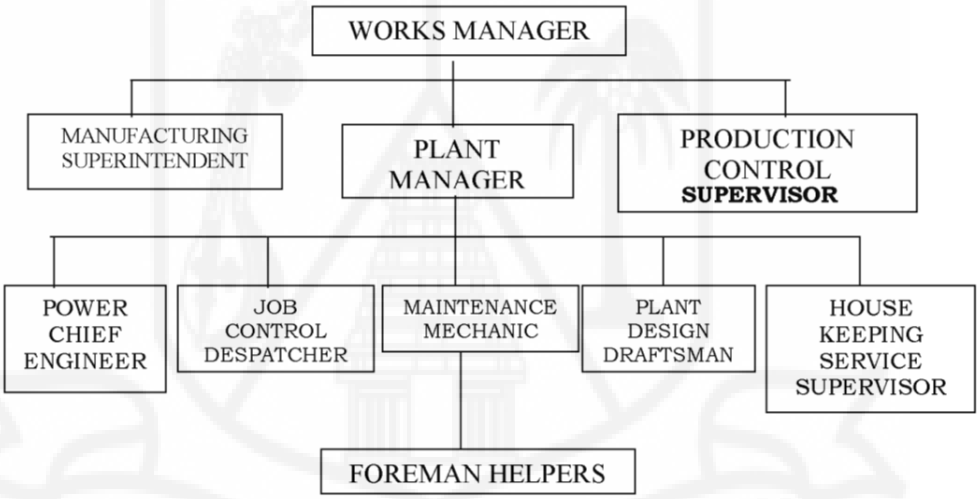
5. Maintaining records. ,

6. Standard practice instructions and their issuances.

7. Inspection methods and inspection routine.

In small plants a separate maintenance department does not exist. The other departments such as the production engineering department, the plant engineering department or the production department perform maintenance work according to needs in addition to their normal duties. In large plants the volume of maintenance work justifies the existence of separate maintenance department looking after maintenance activities on a whole time basis.

MAINTENANCE ORGANISATION CHART



MAINTENANCE SYSTEM

Maintenance work should be undertaken on the basis of *i* written maintenance work order. It authorises the maintenance department to carry out their work when there is no time to issue formal maintenance work order, maintenance men may be sent to the job on verbal instruction. Latter a covering order should be issued to regularise the work.

The maintenance work orders may originate from

1. Inspection carried out as a matter of regular and active.

2. Requests by Operating departments for maintenance or repair work.

The work orders should be executed by a single authority whom may be the plant engineer or his delicate. Maintenance should be properly planned and scheduled by the Plant Engineer so that there may orderly disposition of maintenance man power. Before starting the maintenance work materials requirements should be checked and it should be ascertained whether the materials are actually on hand in the stores. If the required materials are not in the stores, the Plant Engineer should initiate a material purchase

requisition. The master mechanic or his assistant should check up the progress of work. At the end of the day next day's assignment should be lined up to avoid delay in starting the next day's work.

The maintenance work order contains columns for regarding estimated quantities and cost of materials man-hours and labour costs.

MAINTENANCE WORK ORDER CHART

MAINTENANCE WORK ORDER								
DATE		DEPT.		ASSET NO.				LOCATION
LABOUR				MATERIAL				ESTIMATED COST
ESTIMATE		ACTUAL		ESTIMATE		ACTUAL		MATERIAL
MEN	HRS.	MEN	HRS.	UNIT	MAT.	UNIT	MAT.	LABOUR
								OVERHEAD
								TOTAL
								ACTUAL COST
								MATERIAL
								LABOUR
								OVERHEAD
								TOTAL
REQUESTED BY ESTIMATED BY ISSUED BY APPROVED BY								

The estimated figures are entered by the Plant Engineer or his deligate. The actual figures are collected by the Cost department from the materials requisitions and labour time tickets.

Thus maintenance cost could be controlled by comparing the estimated and the actual figures and taking corrective measures in respect of significant variation.

9.4. REVISION POINTS

To streamlkne maintenance in an organisation by analysing the chart of reference.

9.5. INTEXT QUESTIONS

9.5.1. Explain the various kinds of maintenance work?

9.5.2. Explain the objectives and significance of maintenance in industry and how it will heping to there productivity.

9.5.3. Explain the function of plant maintenance?

9.6. SUMMARY

There are several types of maintenance work

i. Building maintenance

ii. Ground maintenance

iii. Mechanical equipment maintenance.

9.7. TERMINAL EXERCISES

9.7.1. What is Building maintenance?

9.7.2. What is ground maintenance?

9.7.3. What is mechanical equipment maintenance.

9.8. SUPPLEMENTARY MATERIALS

Refer articles, journals issued by the particular organisation to meet at the maintenance criteria.

9.9. ASSIGNMENTS

visit to the industry of high calore and how they are maintaning machinery, men, building and various section or defect and give a respect.

9.10. SUGGESTED READING

9.10.1. Delta – Integrated materials management.

9.11. LEARNING ACTIVITIES

Learning is a process not only a threated views undertaken. But also gain some protected knowledge to prospect your carreer.

9.12. KEY WORDS

Maintenance costs can be classified into direct and indirect costs.

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LESSON - 10

TYPES OF MAINTENANCE

10.1. INTRODUCTION

There are two main types of maintenance work according to the times of maintenance namely.

1.Break down maintenance.

2.Preventive maintenance.

10.2. OBJECTIVES

10.2.1. To assess product down maintenance.

10.2.2. To analyze preventive maintenance.

10.3. CONTENT

10.3.1. Production materials.

10.3.2. Preventive maintenance.

10.3.3. Functions of preventive maintenance.

10.3.4. Advantagesof preventive maintenance.

BREAK DOWN MAINTENANCE

When the maintenance work is undertaken after the break down of the machinery it is called as the break down maintenance. The machineries will not be attended to until they go out of order and fail to work. Break down maintenance is not always advisable because of the following disadvantages.

1. The sudden failure of the machine may result in wide spread dislocation of production. In continuous processes industries failure of one machine will paralyse the entire facility. Break down will result in huge loss in normal working condition the machine is not quickly restored.

2. Break down of machinery has to be communicated to respective authorities. After receiving this information, they have to arrange for repair materials, technical assistance and appropriate tools. This causes considerable delay.

3. When a machine breaks down it results in loss of production hours and wages are to be paid for ideal time.

4. When a machine is allowed to run continuously till its breakdown, it causes accidents.

In order to reduce the incidents of sudden break down preventive maintenance system is followed.

PREVENTIVE MAINTENANCE

It is undertaken according to a preplanned programme before the occurrence of break down of a machinery. It is designed to bring down breakdown to a minimum. It is a definite programme of periodic cleaning, servicing, inspection and replacement of work parts for important plant facilities. It remedies minor defects, which would otherwise lead to major repairs.

FUNCTIONS OF PREVENTIVE MAINTENANCE

1. Classification of equipment into three categories.

a. Machine failure of which is costly in causing wide spread interception to production, emergency expenses and high mechanical cost.

b. Machines failure of which leads to high mechanical expenses.

c. Machines of low cost, failure of which does not interfere with General production schedule.

The above classification is useful in deciding the frequency and type of preventive maintenance required.

2. Provision of stand-by machines and spare parts:

Certain types of machineries switched off and made to undergo preventive maintenance schedules. In such cases they should be installed in duplicate. (Example: Pumps, compressors, transformers) when one machine is under repair the stand-by machine can carry out the work without interrupting production. Where duplication of equipment is not practicable, spare units, spare parts, assemblies, controls and the like may be provided for rapid substitution as an item fails or shows signs approaching failure.

3. Setting up preventive maintenance programme based on the nature of machineries, equipments and processes the maintenance schedule is to be established. The service time required by maintenance people should not interfere with manufacturing schedule. Maintenance schedule is to so design in advance as to minimise interference with production schedule.

4. Setting up organisation for preventive maintenance. Larger plants may have maintenance inspection foreman reporting directly to the Plant Engineer. In smaller plants inspection work may be entrusted to the various crafts.

5. Carrying out maintenance inspection and repairing. Detailed instructions about the elements to be inspected, measurements to be taken and tolerance allowed should be specified. Regular inspection reports reveal the time of renewals and repairs. Sufficient schedule shutdown is to be provided for carrying out inspection, renewals and major and minor repairs.

6. *Maintenance of Records:* Inspection records are to be maintained when a failure occurs. Investigation is made and statistical records are kept to indicate whether or not the preventive programme is really cost effective.

7. *Providing a Follow up System:* The follow up system is essential to check-up and get the effectiveness of preventive maintenance programme.

ADVANTAGE OF PREVENTIVE MAINTENANCE

1. Preventive maintenance minimises the chances of sudden break down in equipment and emergency shut-down for repairs.

2. The Plant maintenance of equipment increases plant life and reduces costs due to depreciation.

3. It provides for plant repair work so that repair labour, materials, tools etc. are readily available and machine shutdown is reduced to minimum.

4. Through inspection schedule all the item of equipment are systematically checked up and unnecessary inspection is avoided.

5. The provision of stand-by machines and spare parts helps in quick replacement without affecting the production schedule.

6. Servicing time plant in advance minimise the interference of maintenance schedule with manufacturing schedule.

7. The maintenance records kept by the maintenance department reveal the effectiveness of preventive maintenance system.

8. It is an economic necessity for enterprises which must operate continuously.

9. Break down maintenance results in high rates of labour to be paid for down time of machineries.

10.4. REVISION POINTS

To study the various types of maintenance of a key feature here.

10.5. INTEXT QUESTIONS

10.5.1. Explain production maintenance.

10.5.2. Explain preventive maintenance and its advantages.

10.6. SUMMARY

The maintenance work undertaken before and after breakdown is clearly featured here.

10.7. TERMINAL EXERCISES

10.7.1. What is provision of a stand by machines and spare parts.

10.8. SUPPLEMENTARY MATERIALS

Collect periodic maintenance requirement for the type of machinery from the production of materials department for any kind of organisation.

10.9. ASSIGNMENTS

From the collected information prepare a report with particular machinery type required maintenance factor with subject to teached excellance.

10.10. SUGGESTED READINGS

Gopalakrishnan. P. And Sanram – Materials management – In Integrated Approach.

10.11. LEARNING ACTIVITIES

The knowledge gained theoretical and the factors obtained practically may be compared at one stage and gives issues for the decision making.

10.12. KEY WORDS

Duplicate: Stand by machine can carry out the work culture interuption.

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Syllabus

1. *Introduction*

   Function - Objective of Materials Management

2. *Purchasing Department* - Objectives - Functions - Advantages - Methods of purchasing.

3. *Purchasing - Organisation* of Purchasing Department - Advantages - Methods of Purchasing.

4. *Stores 'Department* - Functions - Location - Layout - Storage - Physical Stock Verification.

5. *Inventory Management* - Classification - Functions – Inventory Analysis Kardex system.

6. *Quality - Control* - Inspection standard - Function of Q.C. - S.Q.C. - Control Charts.

7. *Standardisation* - Simplification - Specialisation.

8. *Material Handling* – Importance - Objective Function Principle - Factory Affecting Material Handling – Materials Handling Devices - Selection of Materials Handling Equipments.

9. *Work Study* - Method Study - Work Measurement - Advantages.

10. *Case Studies*

LESSONS - 11 & 12

MATERIALS MANAGEMENT

11.1. INTRODUCTION

Materials Management is the name applied to the management function which co-ordinates and controls those activities in an organisation, responsible for the purchasing of materials, their scheduling from supplier and from internal sources, their handling, storage and movement through the organization and their delivery to the customers. To assist in this the function must also be responsible for the control of inventory, material handling, engineering, and associated work study layout, planning etc.

Most of the manufacturing concerns spend more than 60% of the money they take in for materials, (i.e) materials soak up a substantial portion of the capital insisted in an industrial concern.

This emphasizes the need for adequate materials management and control because even a small saving in materials can reduce the production cost to a great extent and thus add to the profits.

Materials management involves controlling the type, amount location, movement, timings of purchase of various materials etc., used in an individual concern.

11.2. OBJECTIVES OF MATERIALS MANAGEMENT

1. To reduce the cost of material
2. Bring the inventory in line with demand and thereby reduce the investment.
3. Increase productivity to a maximum
4. Make certain that finished products were ready to satisfy customer's orders at the time they were promised for delivery.
5. Reduce wastages and reduce obsolescence to a minimum

11.3. CONTENT

11.3.1. Function of materials management

11.3.2. Penetrating or procurrent – function.

11.3.3. Stages of source selection.

11.3.4. Steps in source selection.

11.3.5. Enquiry form

11.3.6. Factors influencing final selection of source.

FUNCTIONS OF MATERIALS MANAGEMENT

1. Materials planning
2. Procurement (or) purchasing of materials
3. Receiving and warehousing
4. Storage and store administration

5. Inventory control
6. Standardisation, simplification and value analysis
7. External transportation [(ie) Traffic, shipping etc)] and Materials handling (ie Internal transportation) and
8. Disposal of scrap, surplus and obsolete materials.

PURCHASING (OR) PROCUREMENT

The purchasing department occupies a vital and unique position in the organization of an industrial concern because purchasing is one of the main functions in the success of a modern manufacturing concern.

Mass production industries, since they rely upon a continuous flow of right materials, demand for an efficient purchasing division.

The purchasing function is a liaison agency which operate between the factory organization and the outside vendors an all matters of procurement.

Purchasing implies - procuring materials, supplies, machinery and service needed for products and maintenance of the concern.

OBJECTIVES OF PURCHASING DEPARTMENT

1. To procure right material
2. To procure material in right quantities
3. To procure material of right quality
4. To procure from right and reliable source of vendor
5. To procure material economically
   (i) at right (ii) reasonable price
6. To receive and deliver materials at
   - right places and at
   - right time

Purchasing Department has to perform certain activities, duties and functions in order to achieve the above mentioned objectives.

ACTIVITIES, DUTIES AND FUNCTIONS OF PURCHASING DEPARTMENT

1. Keep records - indicating possible materials and their substitutes.
2. Maintain records of reliable sources of supply and prices of materials
3. Review material specification with an idea of simplifying and standardising them.
4. Making contact with right sources of supply.
5. Procure and analyse quotations.
6. Place and following purchase orders.
7. Maintain records of all purchases.

8. To make sure through inspection (hat right kind (ic) (quality, quantity etc.) of material has been purchased.
9. To act as liaison between the vendors and different departments of the concern such as production, quality control, finance, maintenance etc.
10. To check if the material has-been purchased at right lime and at economical rates.
11. To keep an uninterrupted supply of materials so that production countries with last capital tied in inventories.
12. To prepare purchasing budget
13. To prepare and up date the list of materials required by different departments of the organisation within a specified span of time.
14. To handle sub contracts at the time of high business activity.
15. To ensure that prompt payments are made to vendors in the interest of good public relations.

SELECTION OF MATERIALS

CHARACTERISTICS OF ITEMS TO BE PLKCIIASKD

Before source selection, there are elements which in themselves either qualify or disqualify certain types of companies as possible suppliers and hence narrow the field of selection.

i. Industry Classification

The industry which produces the items to be purchased should be ascertained. The type of industry producing a product frequently determines the number of potential sources available from which to select. We should see the commercial availability the product also, whether they are produced only on order etc

ii. Quantity to be Purchased

The purchase manager should know whether the quantity required is small, moderate or large. As these are relative terms, they must be considered in relation to be physical size of the product, its unit value and the production facilities that the potential sources are available for making it. (Make or Buy decision)

iii. Time Element of the Purchase Requirement

Time required for delivery. When the time available for procurement is less than the minimum time required for manufacture, the potential source must be cither distributors or manufacturers who ordinarily carry the product in stock. When the time available for procurement is equal to or greater than the minimum time required for manufacture, the logical potential sources will be the manufacturers, provided that the manufacturers backlogs of unfilled orders permit actual deliveries in the minimum processing time.

iv. Purpose of the Purchase

Will the product be repeatedly required? Will the product be purchased only once or occasionally?

v. *Physical size of the required Plan*

The size of the product in terms of the weight and/or dimensions should also be considered. Tolerances etc. should be examined.

STAGES OF SOURCE SELECTION

1. The survey stage, in which all possible sources for a product are explored.

2. The Enquiry stage, in which the relative qualification and advantages of potential sources are analyzed.

3. The stage of negotiation and selection leading to the issue of an initial order

4. The Experience stage, in which a continuing vendor-supplier relationship is established or the earlier steps are reviewed in the search for a more satisfactory source.

STEPS IN SOURCE SELECTION

1. Preliminary Selection of Sources is necessary to narrow the field to those most likely to best fulfill the requirements is to supply most satisfactorily and most economically.

2. SOURCES OF INFORMATION

a. Printed forms available in the purchasing office, i.e, buying registers, telephone directories, catelogues, trade directions, trade journals, and trade shows etc.

b. Interviews with salesman and manufacturers representatives.

c. Internal specialist sources: Research or Engineering Departments, Planning and Production, quality and inspection are the concentration of specialised knowledge whose judgement should be solicited.

d. Vendor index file.

e. Professional Organisation such as the local chapters of purchasing organisations (National Association of Purchasing Agents etc.) Personnel involvement in the activity of such organisations however is the key to enjoyment of most of the benefits.

3. SELECTION FOR QUOTATION

The list must be wide-ranging enough to represent all the types of competition desired including price competition, technological competition and service competition.

4.THE ENQUIRY OR INVITATION TO BID: IT SHOULD INCLUDE

a. Quantity required

b. Description and/or specification of items to purchased.

c. Required point of delivery

d. The time required for delivery, from the time the order is issued until goods are required

e. Transportation method

f. All special conditions which will affect price or the bidders' ability to perform.

g. The date by which quotation must be received.

h. It should require bidders to identify, the basis of the prices in relation to the quantity range to which it applied, the basis in relation to the number and spent in time of deliveries, the period of time, after the date of the bid, for bid prices are "firm" and any exceptions or events which can invalidate the prices quoted such as strikes, union renegotiations etc.

ENQUIRY FORM

The A.B.C.Mills Company Limited,

(Mill No .Y) Telephone (34291(5 lines)

(32170,38139)

Telegram: ABC Ltd.Civil Lines, Rampur

(Regd Office: 21/F.Smt., Parbati Bagla Road, Rampur)

Enquiry No. ISM/7 dated .....

Dear Sirs,

If you are in a position to supply the material detailed in the schedule below, please let us have your lowest quotation(s) together with the following particulars:

(a) Rate should be on F.O.R despatching station basis.

(b) Rate on free Mill delivery basis

(c) make and /or any further description considered necessary

(d) Delivery time and any other conditions or remarks.

We do not pledge ourselves to accept the lowest or any quotations and reserve the right of accepting the whole or any part of the quotations or a portion- of the quantities offered and you shall supply the same at the rates quoted, unless specifically indicated to the contrary in your quotations.

Please arrange to send your quotations immediately so as to reach us latest by..... The Envelope should be clearly marked:

Quotation

Enquiry No..... Dated .....

Due on .....

Schedule of materials for which quotations are invited

Item No.	Name of articles and specification	Quantity required	Remarks

Yours faithfully

Store Purchase Officer

5. EVALUATION OF QUOTATIONS

Quotations are sometimes so simple that they can sometimes be compared by curiously glancing through them or by writing down the essentials as they are received over the telephone. This is often the case with standardized products where the differences or uniformity in specifications and quality between the acceptable bidders are known and understood by the buyer beforehand. A check list or tabulation will minimize the changes of embarrassing oversight. Tabulation in fact is the only safe method of comparing complicated tabulation should, however, provide for easy comparison of the following: cost factors i.e. price, transportation costs, sales or excise taxes to be added, terms of payment, cash discount, price basis if multiple deliveries are involved, price protection, delivery, design or specification factors viz., specification compliance, specification deviation, specification advantages, important dimensions, weight, and legal factors e.g. warranty, cancellation provisions, patent protection, public liability and workmen's compensation protection, compliance of various laws and regulations.

In evaluating complex or highly competitive procurements, it is sometimes useful to assign relative "weight" to the factors being compared and then to grade each potential vendor as to his competitive position for that factor. Thus quality must be considered as worth 20 percent; price 20 percent; and business confidence factor, 10 percent, rounding out the 100%

FACTORS INFLUENCING FINAL SELECTION OF SOURCE

The following factors exert considerable influence on the supplier selection:

i. Financial Consideration

a. price
b. Transportation cost
c. Installation cost
d. Preparation cost
e. Sales Taxes
f. Terms of Payment
g. price Protections

ii. Product Quality

The quality of a product as viewed by the purchasing agent is that degree of quality which will result in the products most economically useful life for the purpose intended. It is the measure of the desired characteristics of the product, rather than its perfection; hence it must be judged in the light of its suitability for the purchaser's needs.

It calls for

a. Specification and or design
b. Demonstration or samples
c. Experience of other users
d. Reputation

iii. Prospective supplier service:

The service factor in individual transactions commences with the sales representative's first call of solicitation, his demonstration of competence; prompt, complete and imaginative response to an enquiry.

iv. Labour Relations

The relationship that exists between management and labour in a supplier's plant is of great concern to a buyer. A good labour relations history is no guarantee against disrupting strikes or slowdowns in the future, but it is a sufficiently good sign to merit important consideration by the prudent buyer.

v. Financial Responsibility

The financial standing of a supplier, or prospective supplier, is a factor warranting thoughtful consideration by the buyer; it is the key to evaluation of ability to stand behind a product in case of failure and dependability of supply. The financial position of company is evidence of the extent of its past success, and is the best possible guide to the character of its future performance.

vi. Reciprocal Relations

Reciprocal can be neither wholly served nor wholly ignored. The larger and more diversified company affiliation, the more this is true. To practise flagrant reciprocal favouritism is to espouse a policy which tends to limit the growth of one's own enterprise and to deny it business from its larger growth market.

11.4. REVISION POINTS

Under the revision points the production and objectives of purchasing, the deletion, purchasing department were discussed first.

Secondly stages of sources selection, steps in seven selection and selection materials parted out and the enquiry form.

11.5. INTEXT QUESTIONS

11.5.1. What is materials mgt.

11.5.2. What are the advantages of materials mgt.

11.5.3. Explain the various technique of material control.

11.5.4. Explain the objectives and supplementary mgt.

11.6. SUMMARY

The main objectives of purchasing department the activities , duties and functions also elaborately discussed here.

11.7. TERMINAL EXERCISES

11.7.1. What are the factors presented with enquiry form.

11.8. SUPPLEMENTARY MATERIALS

Please make out red tone exercise on the factors of purchase, order, quotation, supply prices etc.

11.9. ASSIGNMENTS

Future exercise list out and expend all the above things on your own way.

11.10. SUGGESTED READING

Ratta. A. K. Integrated materials mgt.

11.11. LEARNING ACTIVITIES

Prepare the model enquiry form with any industrial reference of your experience.

11.12. KEY WORDS

ACTIVITY ASPECT

Avened with maintaining documentary evidence of more event of relevants at every stage.

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LESSON - 13

PURCHASE DEPARTMENT

ORGANIZATION OF PURCHASE DEPARTMENT

13.1. INTRODUCTION

The composition of purchase department varies according to he size of the enterprise, its comparative significant towards procurement and the capability of the purchase personnel.

In an organization engaging in procurement of smaller number of items but from limited no. of suppliers the purchase officer is attached to controller of accounts.

In organization with job (or) batch system of production, purchasing becomes a complicated exercise and needs regular and thorough co-ordination with production department. In such cases the purchase manager is directly attached to the production manager.

The size of the purchasing departments depends on the nature of products manufactured by the organisation, sizes of the production runs and type of the manufacturing system.

In general, the purchasing department can have the composition given in fig. (1).

13.2. OBJECTIVES

13.2.1. To focus the organisation of a purchase department.

13.2.2. To analyse the advantages of catalinal purchasing.

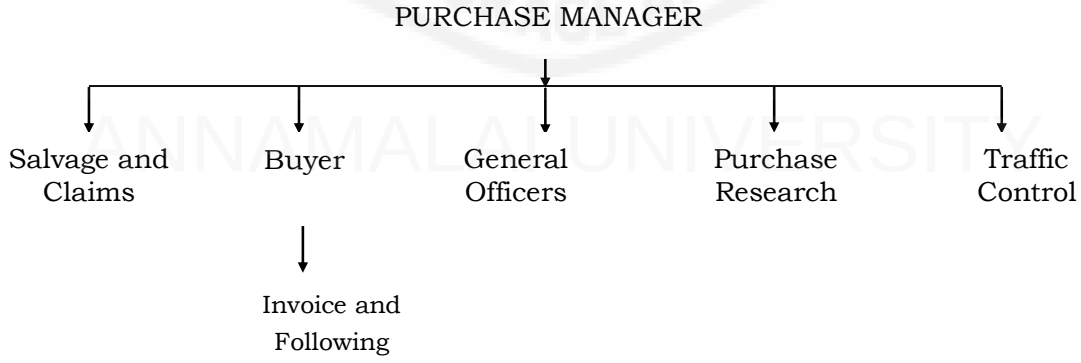
13.3. CONTENTS

13.3.1. Central rod and local purchasing

13.3.2. Advantages of central and purchasing

13.3.3. Functions of purchasing department

13.3.4. Purchasing according to the requirements.



In the organization, purchase manger occupies an importance position. He should be a man of quick decision making power pleasing personality, quality of good leadership and farsighted approach should be inherent in him.

CENTRALIZED AND LOCAL PURCHASING

Centralised and local purchasing policy depends upon the nature-of the manufacturing organization. In companies with only one plan there is mostly centralized purchasing system. In multiplane organization. Sometimes centralized purchase system can be adopted on the basis of homogeneity in terms of product produced, location of plants and suppliers of the material required etc.

Generally in the case of multiplant organization decentralized (Localised) purchasing unit are preferred in each plant. This system is more appropriate in cases where users plants are distantly situated and are producing different kinds of products.

ADVANTAGES OF CENTRALISED PURCHASING

1. This ensures undevided responsibility. The officials can concentrated in their operation more efficiently.
2. Bulk buying increases the bargaining power of the department and can encourage quantity discounts.
3. Reduces inventory carrying cost as well as investment in inventors.
4. More specialised personnel in purchasing can be employed.
5. There is more economy in maintenance of records, easy adoptability to the market condition. All this leads to most efficient and effective use of resources.

DISADVANTAGES

1. Localised purchasing can have more flexibility in purchase.
2. Can not have close liaison with suppliers as well as other department of the organization.
3. Cannot properly deal the demand and supply problems to avoid misunderstanding and possibility of wrong purchases.

FUNCTIONS OF PURCHASING DEPARTMENT

The main objects of purchase department is to purchase item of specified quantity and quality at lower price. To accomplish this, the functions of the department are:

1. PROCESSING THE REQUISITION

The purchase requisition is prepared in duplicates and the original copy is sent to the purchase department. The purchase department processes and scruitnises the requisition and then proceeds to other operations for making purchase.

PURCHASE REQUISITION					
No.				Date	
S.No.	Quantity Required	Quality & Other details of the item	Dept.	Suggested supplier	Balance in Stores
Required by		Authorised by			

2. LOCATION AND CHOICE OF SUPPLIERS

The potential vendors are contacted their authorised representative their catalogues and samples of the items are inspected and examined either at the purchaser's place or at the vendors place. On the basis of findings from inspection examination of samples and analysis of the quoted prices, suppliers are approved for placing the orders. The criterion for the ultimate choice of a vendor is based as following aspects.

(1) Reliability of supply

(2) Assurance of Timely delivery

(3) Other considerations.

3. PLACING OF ORDERS

The purchase department tries to purchase the materials with desired quality and quantity at the most advantages terms. All purchase should be made through a purchase order in a specified form and duly signed by some authorised person. The purchase order must contain the details about the supplier, description of the item required, corresponding prices and amount required.

The format of Std. purchase order can be:

PURCHASE ORDER			
To		Payment thro : Delivery thro' : Date : Order No. : Your Ref. No. :	
Description of items	Quantity	Price	Other requirement
Date of supply:		Signature	
	Your TNGST/CT No....		
	Terms & condition (on the other site of the slip)		

As a rule original copy is sent to the supplier, one copy is retained by the purchase department and one copy is sent to the concerned department requiring the ordered items.

4. Follow up (or) progressing the purchase order:

5. Invoice received from Supplier are checked and verified with the order specifications. The process include the following activities:

(i) The goods supplied are of desired specification both in quality and quantity.

(ii) Comparison of quoted price and the price charged in the invoice.

(iii) If some goods supplied does not confirm with the specification or are damaged during transhipment then steps are taken for adjustment on claims.

6. SOME OTHER FUNCTIONS OF PURCHASE DEPARTMENT CAN BE

(i) Delay in availability of registered material, should be informed to concerned department in time,

(ii) To maintain records regarding surplus, their performance in past, products available with them, probable delivery period for each order etc.

(iii) To dispose off old dated and scrapped items,

(iv) Control stores operation of receiving the items from vendors and issuing it to concerned department of the organization,

(v) To evaluate the performance of the department,

(vi) To collect information about trends in market regarding availability of improved goods and services and also about the substituted products in case of emergency

(vii) To handle damages and damage claims.

7. METHODS OF PURCHASING

There are no. of methods used by different purchase departments. The methods used depends on the classification of production, the production system, policy of the organization and behaviour of the market.

Following are some of the popular method of purchasing:

1. Purchasing according to the requirement
2. Purchasing for some definite future period
3. Market purchasing
4. Speculative purchasing
5. Contract purchasing
6. Scheduled purchasing

1. Purchasing According to the Requirements

In such case an order is placed only when there is some need for the product. This method is appropriate for those, items which are not of regular and common use in the production process. These items are generally not stored in inventories. In such cases the purchasing department should keep a record of reliable and thrust worthy suppliers.

2. Purchasing for Some Definite Future Period

The method of purchasing is generally used for these items which are regularly consumed but the consumption is comparatively low and the price changes for these items are not much.

3. Market Purchasing

The policy of making the purchases at a time when the fluctuations in price of the items provide advantage to the purchased is known as market purchasing. This method provides procurement at lower price and savings in purchase expenses. This method is useful in situation where major price variation are prominent. Here the purchasing may not relate with the production needs and if the assessment of price fluctuations is wrong then the organization may suffer losses.

4. Speculative Purchasing

Here excessive purchases are made when market is low for the item with the hope of earning profile by selling the item purchased in excess at a higher price. This procedure is most suitable in the case of stable commodities, (ie) Cotton Textile tab!es.The merits of this method lies in more profits and more protection against shortages^ This method involves more financial commitments on the part of the organisation.

5. Contract Purchasing

Here the purchase department enter into agreement with various supplies, to supply the item at some futures period (or) periodically.

(ie) Car manufacturers, Coal consumers, etc. Here the purchaser is able to reduce the size of the inventory and supplies is assumed for stable demand.

b. Scheduled Purchasing

It is a scientific method of purchasing, This is according to requirements of various department of the organization.

13.5. INTEXT QUESTIONS

13.5.1. Explain the objectives of purchasing?

13.5.2. What are the different methods of purchasing?

13.5.3. Explain centralised purchasing? Define in rental demerits.

13.5.4. Explain the role of purchase manager.

13.6. SUMMARY

The lesson deals with purchase deput organisation. cultural and local purchasing is advantages and disadvantages and the function of purchasing department finaly the purchasing according to the requirements.

13.7. TERMINAL EXERCISE

13.7.1. Define the methods of purchasing?

13.8. SUPPLEMENTARY MATERIALS

Ask the purchase manager of any organisation how he is able to purchase, for the organisation and theh compension he made before purchase.

13.9. ASSIGMENTS

For the purchase manager newspirit ably mix the final how to select the host alternatives away the sources of purchase.

13.10. SUGGESTED READING

Collect some purchasing quotation.

13.11. LEARNING ACTIVITIES

Purchase is an art under purchase manager initiates this point.

13.12. KEY WORDS

Value engineering : It results in low costs, low price, high sales and more profits.

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LESSON - 14

STORES MANAGEMENT

14.1. INTRODUCTION

Materials and supplies constitute the most important assets in the majority of business enterprises. The success of the business depends to a large extent on the efficient storage and material control.

Material pilferage deterioration of materials and careless handling of stores lead to reduced profits.

14.2. OBJECTIVES

STORE MANAGEMENT

It takes care that

1. the required material is never out of stock
2. that no material is available in excess than required.
3. to purchase the materials on the principle of economic order quantity. So that the associated cost can be minimized.
4. to protect stores against damage, theft, etc.

This can be achieved thro

1. A proper purchasing practice (ie when to order materials)
2. An adequate procedure of receipt and issue of materials
3. proper methods of storing materials
4. An effective system of physical control of materials
5. A proper method of keeping store records

14.3. CONTENT

14.3.1. functions of stores department and the duties of the store keeper.
14.3.2. Location of layout of stores.
14.3.3. Advantage of catalization of store.
14.3.4. Advantage of deadvantages of stores.
14.3.5. Layout.
14.3.6. Storage space requirement (storage).
14.3.7. Physical ven function of stores or stock taking.
14.3.8. Advantages.

FUNCTIONS OF STORES DEPARTMENT AND THE DUTIES OF THE STOREKEEPER

1. To receive materials, goods and equipments, and to check them for identification
2. To receive parts and components which have been processed in the factory
3. To record the receipt of goods
4. To correct positioning of all materials and supplies in the store.

5. To maintain stock safely and in good condition taking all precautions to ensure that they do not suffer from damage, deterioration.
6. To issue items to the users only on the receipt of authorised stores requestions.
7. To record up date receipts and issues of materials.
8. To check the bin card balances with the physical quantities in the bin.
9. To make sure that stores are kept clear and in good order.
10. To prevent unauthorised persons from entering the stores.
11. To make sure that materials are issued promptly to the users.
12. To plan store for optimums utilization of the cubic space (ie length, breath and height)
13. To ensure that the required materials are located easily.
14. To initiate purchasing cycle at the appropriate time so that the materials required are never out of stock
15. To co-ordinate and co-operate to the full extent with the purchasing, manufacturing, inspection and production planning and control departments.

LOCATION AND LAYOUT OF STORES

(i) Location

1. Location of the stores should be carefully decided and planned so as to ensure maximum efficiency.

2. The best location of stores is one that minimizes total handling costs and other costs related to store operation and at the same time provides the needed protection for stored items and materials.

3. Stores location depends upon the nature and value of the \ items to be stored and the frequency with which the items are received and issued.

4. In general, stores are located to the point (ie) Raw materials are stored need to the first operation, in-process, materials close to the next operation. Finished goods near the shipping area and tools and supplies in a location control to the personnel and equipment served.

5. All departments should have easy access to the stores and especially those which require heavy and bulky materials should have stores located nearly.

6. In big industries having many departments, stores department possible cannot be situated when it is convenient to deliver materials to all departments and at the same time be near the receiving department; thus it becomes often necessary to set up sub stores conveniently situated to serve different departments.

ADVANTAGES OF CENTRALIZATION OF STORES

This leads to the concept of decentralized stores.

1. Better supervision and control
2. It requires less personnel to manage and thus involves reduced related costs.

3. Better layout of stores.
4. Inventory checks facilitated.
5. Optimum (minimizations) stores can be maintained.
6. Fewer obsolets items.
7. Better security arrangements can be made.

ADVANTAGES OF DECENTRALIZATION OF STORES

1. Reduced material handling and the associated cost.
2. Convenient for every department to draw materials etc.
3. Less risk of loss by fire (or) theft
4. Less chances of production stoppages owing to easy and prompt availability of materials etc.

LAYOUT

1. A good store layout usually brings the point of origin, store room and point of use in adjacent and proper squence for best flow of material.
2. Stores layout should be planned with the following objectives:
3. To achieve minimum wastage of space
4. To achieve maximum case of operation
5. before planning the stores layout

(A) CLASSIFY ALL STORES ITEM AS FOLLOWS

1. By measurement (ie) size
2. By Quantities (ie) No. and weight to be stored.
3. By frequency of handling
4. By (material) handling arrangement
5. By possibility of perishing the item and the susceptibility for

(B) UST THE AVAILABLE STORAGE SPACE

1. Platform
2. Floor space
3. Rack
4. Shelves
5. Bins
6. Trays
7. Drums
8. Barrels

(C) DETERMINE THE SEQUENCE OF LAYING OUT STORAGE SPACE FOR LOCATING THE MATERIALS

1. *A Unit:* It is the smallest space for storage which is given a particular identity
2. *A Tien* A tier consists of a no. of units placed vertically
3. *A Row:* A row consists of a no. of units joined together and spread hour.
4. *A section:* A section is made up of a group of rows

(D) STUDY THE SIZE AND SHAPE OF THE SPACE AVAILABLE FOR LAYING OUTTHE STORES

The following factor should be considered while planning the store layout.

a. A section adjacent to the store room should be kept reserved for the receipt of materials and for its inspection before storage.

b. Store layout should be such that it provides for easy receipt, storage and disbursement of materials preferably to the point of use.

c. Store-room layout should minimise handling and transportation of materials.

d. An ideal store room layout makes optimum utilisation of the flow space and height.

e. Shelves, racks, etc should be situated in clearly defined leaves. So that the items are quickly stored and located for physical counting (or) issuing.

f. Main lines or a should usually be between 1.5 and 3 metres wide, depending upon, the type of materials and the amount of traffic involved. Sub-aisles bet racks and bins may be a minimum of 80 cm wide.

g. Storage space should be clearly marked to ensure easy and quick identification.

h. Storage space, should be adequately protected against waste, damages determination and pilferage,

i. A place for storing a material should be decided depending upon the material characteristics.

(eg) fuels and flammable gases will require separate locations, [welding electrodes and ferrous parts a need dry place for storing etc.] portable and salable items should be stored in areas enveloped with wire mesh portioning so that all unauthorised persons can be kept outside that areas.

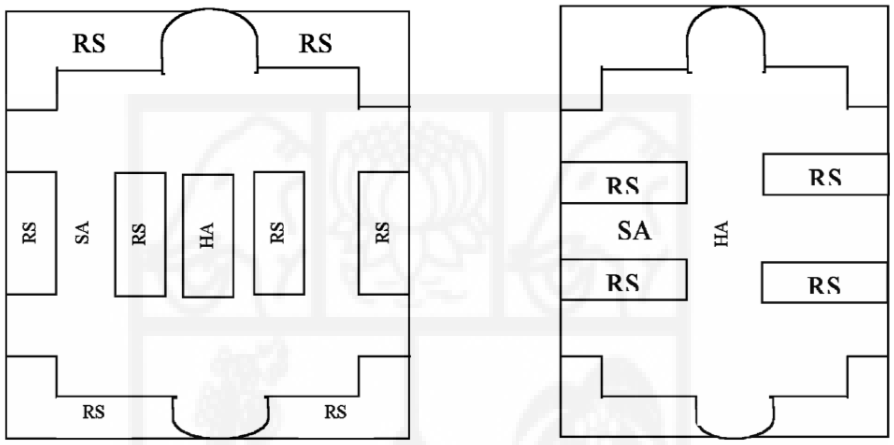
j. Stores layout should be such that for its efficient operation it can make use of modern material handling equipments such as fork-lifts trucks, conveyors etc.

k. Store layout should be such that the store keeper is not compelled to put newly arrived material on the top of the old. As a rule, all the old store should be consumed first before using the new one.

l. Due spare (20 to 25%) should be left in each portion of the store to allow for expansion.

m. The following fig (a) and (b) show a poor and a good layout of storage space.

Storage Space Layout



a) Poor b) Good

MA – Main Aisle
SA – Side Asile
RS - Racks, Shelves, Platform, etc

STORAGE SPACE REQUIREMENTS (STORAGE)

Adequate storage space allocation to different materials and supplies is of great importance because other wise, a small increase in their quantities may give rise to congestion and the whole storage system may be out of gear.

The following items and the amount of stock handling determine the storage space requirements

a. Incoming raw materials
b. Checking and sorting the raw materials
c. Inspection of raw materials
d. Temporarily storing the raw materials before it is placed at the proper location
e. In process inventory
f. Tools and other supplies and
g. Finished products

The space to be provided for above factors depend upon:

1. Size and weight of raw material in process goods and finished goods.
2. Their qualities and

3. Frequency of use.

1. Liquid materials are stored in drums, cans, barrels and bottles.

2. Gases are kept in cylinders where as solid materials can be placed in boxes, barrels,, bags, pallets, containers etc.

3. Castings (or) forging can be stored in pallet and stocked in rows.

4. Toxic materials are generally stored in well ventilated area.

The storage space should be such that the materials can be generally and easily taken out for delivery (or) stocked as soon as they received in the factory.

Suitable equipments can be used for handling the material.

Bins, drums, racks, shelves, tanks, bags, pallets etc., may be usefully mployed for storage purposes.

Storage space should be adequate considering the material requirements and the load bearing capacity of the said heavy materials to be stored.

Aisles are passages for the movements of man and materials. Depending upon the type and size of the material to be stored, the amount and frequency of men movements and the other traffic involved, and the size of material handling equipment, the aisles and sub aisles are designed.

Generally aisles can be 1.543 metres wide and sub-aisles between racks may be 75 cm wide.

The aisles should not have many bends or blind curves which may cause accidents.

PHYSICAL VERIFICATION OF STORES OR STOCK TAKING

a. Necessity of:

Physical verification of stores is essential in order to:

i. ensure the correctness of stocks held by comparing them with the balance shown in the store ledger or bin cards;

ii. avoid shortages of materials in the stock;

iii. check losses in inventory due to

- pilferage
- improper storage or misplacement;
- deterioration, etc.,

iv. correct and update store-records;

v. calculate the values of stock carried for the balance sheet and profit and loss account;

vi. calculate the rate of turn-over of an item; vii. ensure maximum economy in stock carrying; viii. effect insurance covers.

b. Disadvantages of physical stock taking

i. Loss in production; unless and until during period of physical stock taking, plant overhaul etc., is planned,

ii. labour and over-time expenses in carrying out stock taking (in order to complete it in a shorter duration of time).

Disadvantages of physical stock taking are minor as compared to the advantages achieved through it.

c. Methods of Physical Stock Taking

1. Annual Physical verification

2. Perpetual Inventory and Continuous Stock Taking System

1. Annual Physical Verification

i. Near the year end, stores are closed for a few days; no material is issued to any shop in the plant. In case this leads to plant shut down, activities such as repair and overhaul of equipment and machinery are resorted to.

ii. A team of stores inspectors or stores verifying officers physically check and count each and every item lying in the complete store. They tally it with the quantities marked on bin cards and store ledgers,

iii. Step (ii) above leads to the formation of a list of surplus and short items.

Damaged and obsolete items can also be traced and recorded

iv. Inspectors check a number of items everyday as per a

v. preplanned schedule and finish the complete work within a few days,

vi. This method of stock taking is advantages in the sense that all the items are checked at one time, so there is no confusion about any item being left unchecked.

Moreover, this method helps recording discrepant items at one time and at one place.

2. Perpetual Inventory and Continuous Stock Taking System

i. Annual physical verification method may work well for a small plant involving a limited number of store items, because it is not economical to shut down a large plant involving huge inventory quantities for a number of days.

ii. A more appropriate method for large plants is - the Perpetual Inventory and Continuous Stock Taking System which records store balances after every receipt and issue and facilities regular checking and obviates closing down of the plant for stock taking.

iii. Under this system, store-items are checked continuously throughout the year; a number of items are counted daily or at frequent intervals and checked (compared) with the bin cards . and stores ledger.

iv. Discrepancies found if any, owing to incorrect entries, breakage, pilferage, over-issue, placing of items in wrong bin, etc., are investigated and corrected accordingly.

v. Every item of the store is checked atleast once or twice a year.

vi. To reduce the work load, an item is checked generally when it reaches its minimum level.

ADVANTAGES

The perpetual inventory and continuous stock taking system claims the following advantages:

1. It is not necessary to close down the plant or stop production for stock taking.

2. Since, only a few items are to be checked every day, as compared to annual physical verification, this method is less costly less tiring, less cumbersome and hence is more accurate.

3. Discrepancies and incipient defects in the stores system are readily discovered and can be rectified before much damage through loss or irregular practices has occurred.

4. Slow moving stocks can be noted and, where necessary, action may be taken to prevent their accumulation.

5. The audit extends to comparing the actual stock with the maximum and minimum level and thus ensures that stocks are kept within the limits specified.

6. Since, stock is kept within the specified limits, the capital invested in the store-items cannot exceed the amount arranged and prescribed for the same.

14.4. REVISION POINTS

Functions, duties of the store keeper centralization of stores decentralization stores, location and layout of stores – physical ven function of stores or stock taking – advantages.

14.5. INTEXT QUESTIONS

14.5.1. Explain location of store and layout of store?

14.5.2. Explain centralized stores.

14.5.3. Explain perpetual investing.

14.5.4. Explain the function of a stores manager.

14.6. SUMMARY

The lesson deals with stores management function and duties, advantages of centralization and decentralization of stores layout and the storage space requiremnents. Finally focus about physical verfication of stores or stock taking.

14.7. TERMINAL EXERCISE

14.7.1. List the available storage space.

14.8. SUPPLEMENTARY MATERIALS

Prepare stores department layout in consulting with the stores manager.

14.9. ASSIGNMENTS

List out the available storage space and explain them in detail.

14.10. SUGGESTED READING

J. L. Lendy – Reffedine Industrial Management.

14.11. LEARNING ACTIVITIES

Event to a small company and very big organisation make a differences of stores and purchases department that will enable you to make the understanding about stores management.

14.12. KEY WORDS

a. Receipt : If receives and account industries.

b. Storage It stores and preserves the inventories protecting them from damage, preferage and deterioration.

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LESSON - 15

INVENTORY MANAGEMENT

15.1.INTRODUCTION

Inventory in an organisation plays an important role whicn affects or maintains the production flow as well as financial stand of the organisation. In current asset inventory occupies a major portion since it is considered as a fixed investment of the organisation to some extent to meet our production flow as well as to maintain the current ratio of the organisation. The financial implication of the working capital (current asset - current liability) is mainly on the control of inventory and accounts receivable forms the major part of current assets. The inventory planning and control are rested with middle management people who are the supporting pillars of any organization.

15.2. OBJECTIVES

1. To reduce financial investment in inventories
2. To, facilitate production operations
3. To avoid losses from inventory obsolescence
4. To improve customer services.

15.3. CONTENT

INVENTORY

It is the physical stock of the items that a business or production organisation keeps in hand for efficient running of business or its production.

Inventories consists of Raw Materials, components parts, supplies and finished assemblies which an organisation purchases from an outside source and parts, assemblies and finished products which the company manufactures itself. In simple words, "inventory* means "Stock-items" or "Item in stock".

CLASSIFICATION OF INVENTORIES

Inventories are generally classified as under:

a. Raw Materials and Supplies Inventories

b. Production Inventories

c. Maintenance, Repair and Operation (MRO) Inventories

d. Inprocess Inventories

e. Finished Product Inventories

f. Material in Transit Inventories

g. Total Inventories

INVENTORY CONTROL

Inventory control is the process of deciding what and how much of various items are to be kept in stock. It also determines the time and quantity of various items to be procured. The basic objective of inventory control is to reduce investment in inventories and ensuring that production process does not suffer at the same time.

To attain various objectives, Inventory control must:

2. determine items to be stocked
3. determine when and bow much to replenish
4. keep suitable records
5. weed out absolute items

ADVANTAGES OF INVENTORIES

It is always advantages to order some types of raw materials and purchased parts in advance and hold them in stock to be used when customer orders are received.

Reasons are:

1. Delivery of production in time

2. Bulk purchase results in lesser cost

3. Inventory of raw materials and parts will help to replace these products faster.

4. Procurement of spares and raw materials may be difficult during strike, shortage, power break down period, high demand time etc.

5. Building up a big inventory will be profitable as later on there may be a rise in process cost of various items due to various reasons.

6. More products can be manufactured very rapidly when we are having sufficient stock of raw materials.

7. Inventory reduce the risk of costing down the plant or keeping the workers and machine idle.

DISADVANTAGES

1. Working capital is tied up

2. More valuable spare occupied
3. More insurance charges
4. More cost of handling and maintaining records in stores
5. With change in design or availability of better type of material, long lying inventories may become obsolete.
6. More possibility of pilferage and misplacement of materials parts
7. Change of reduction in prices.

SCOPE OF INVENTORY CONTROL

1. Defining policies to guide inventory control programme.
2. Determine the approximate organization structure
3. Determine the E.O.Q.
4. Determine the stock out
5. Determine the safety stock
6. Determine lead time
7. Determine the inventory status
8. Minimise the handling and store cost
9. Effective running of stores.

FUNCTIONS OF INVENTORY

Eventhough inventory of materials is an idle resource, it is an invitable requirement of Industrial activity.

Materials Management is the integrated functioning of an organization dealing with supply of materials and allied activities in order to achieve the maximum co-ordination and optimum expenditures on materials.

Inventory control is the most important function of material management. The various functions of materials management are:

i. Materials planning
ii. Purchasing
iii. Recording, inspection and forwarding
iv. Stocking and distribution
v. Inventory control
vi. Other functions like cost reduction, the variety reduction, volume analysis etc. and
vii. Disposal

CLASSIFICATION AND CODIFICATION

Classification

Classification of stores is essential for exercising control. Stores are grouped (or) classified according to certain principle, which may be either according to grade (or) according to purposeful.

Here each items of stores is given a number. For numbering of items, only one numerical which have special advantages towards mechanisation of ledger posting with computers (or) purchased card systems are to be adopted.

Codification

A system of symbolizing stores and stocks for representation information and the rules associating them to express in a code for and correct identification

Then an various systems at code such as:

1. alphabetical codes according to 1st alphabet of the name.
2. Numeric codes in which each letter stands as a symbol for a word.
3. Visual codes in which colour scheme is adopted for identification.
4. Decimal code to facilitate grouping of varieties under one whole number.
5. Numerical codes which is an aid to reckon the total number in a group directly.

The code numbers should indicate kind, type, and size of the item, section sub-section and serial no. in the sub-section under the class.

Codification, if properly done puts a premium on standardisation of parts and nationalisation of items by putting a curb an proliferation of varieties.

INVENTORY ANALYSIS

It is imperative to undertake a systematic analysis of all items in stores for achieving the objectives of inventory control. The three levels of analysis for effective control over inventories are as follows:

1. Overall analysis
2. Category analysis
3. Individual analysis

1.Overall Analysis

This analysis takes a bird's eye view of total period of time to find out trends. This type of analysis is very useful for the top management for keeping the track of inventory behaviour. The inventory holding should always be expressed in "months consumption" rather than in absolute figure. This under of "months" consumption is found by dividing average stock by monthly requirements.

2.Category Analysis

This is the second level of analysis where in stock of each category (group of similar items) is analyzed. Generally it has been found that even if the over all position of stock is satisfactory, stores carry higher inventory of same categories and low of some other,

resulting in locking up of the capital in higher inventory categories and having stock out in low inventory categories.

FUNCTIONS OT INVENTORIES

Inventories

1. Separate operations different from one another make them independent, so that each operation (starting from raw material to finished product) can be performed economically. For example, ordering of raw material can be carried out independently of the finished goods distribution and both these operations can made low cost operations, say by ordering raw material and distributing finished goods in one big lot, than in small batch sizes. Besides economy, the men and machinery also can be out in various department than if coupled and tied at one place.
2. Maintain smooth and efficient production flow
3. Purchased in desired quantities nullify the effects of changes in prices or supply.
4. Keep a process continually operating
5. Create motivational effect. A person may be tempted to purchase more if inventories are displayed in bulk.

ECONOMIC ORDER QUANTITY

Concept: A problem which always remains is that how much material may be ordered at a time. An industry making bolts will definitely like to known the length of steel bars to be purchased at any one time. This length of steel bars is called as"Economic order Quantity " and an economic order quantity is one which permits lowest cost per unit and is most advantageous.

Before calculating economic order quantity it is necessary to become familiar with terms like maximum inventory, minimum inventory, standard order and recorder point, which are known as Quantity standards. Fig.l shows different quantity standards.

Starting from an instant when inventory OA is in the stores, it (inventory)consumes gradually in quantity from number of days between initiating order and receiving the required inventory. Therefore as the quantity reaches point B, purchase requisition is initiated which takes from B to C, that is time R. From C to D is the inventory procurement time P. At the point D when only reserve stock is left, the ordered material is supposed to reach and again the total quantity shoots to its maximum value, i.e., the point A' (A = A').

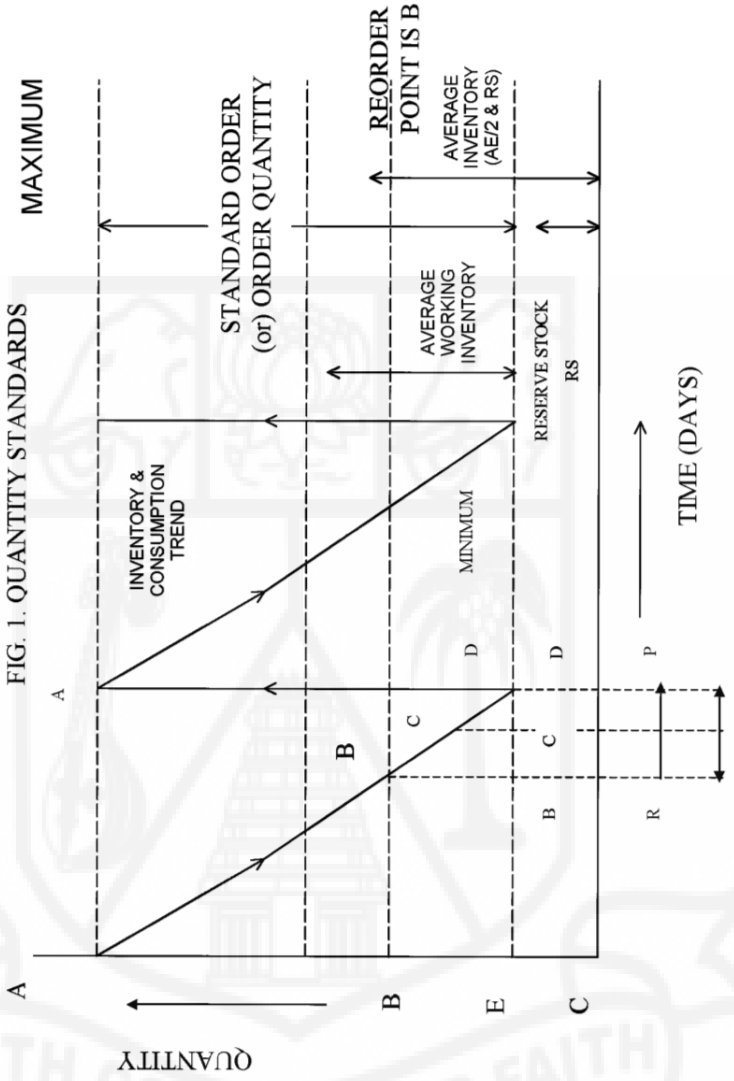


FIG. 1. QUANTITY STANDARDS

Maximum Quantity OA is the upper or maximum limit to which the inventory can be kept in the stores at any time.

Minimum Quantity OE is the lower or minimum limit of the inventory can be kept in the stores at any time.

The purpose should be to hold enough and not excessive stock of material. Stock holding.

a. Avoids running out of stock

b. Helps creating a buffer stock which may be utilized if the material falls below the minimum level

c. Makes sure the predecided delivery dates

d. provides quick availability of materials.

e. Takes care of price fluctuations and shortage of inventory in the market.

f. Advises regarding, obsolete and slow moving items.

g. Helps in standardsization and thus reducing the variety of items to be handled.

Standard order (A & D)is the difference between maximum and minimum quantity and it is known as economical purchase inventory size.

Recorder Point (B) indicates that it is high time to initiate a purchase order and if not done so the inventory may exhaust, and even reserve stock utilized before the new material arrives.

From B' to D' it is known as lead time (L) and it may be calculated on the basis of past experience. It includes:

j. time to prepare purchase requisition and placing the order;

k. time taken to deliver purchase order to the seller;

l. time for seller (vendor) to get or prepare inventory; and

m. time for the inventory to be dispatched from the vendor's end and to reach the customer.

Time, (a) above is known as requisition time (R) and (b) + (c) + (d) is the procurement time (P).

The economic lot size for an order or the economic order quantity depends upon two types of costs:

(a) Inventory procurement costs which consist of expenditures connected with

1. receiving quotation;
2. processing purchase requisition;
3. following up and expediting purchase order;
4. receiving material and then inspecting it and
5. processing sellers (vendor's) invoice.

Procurement costs decrease as the order quantity increases. (See Fig. 2)

(b) Carrying costs, which vary with quantity ordered, base on average inventory and consist of;

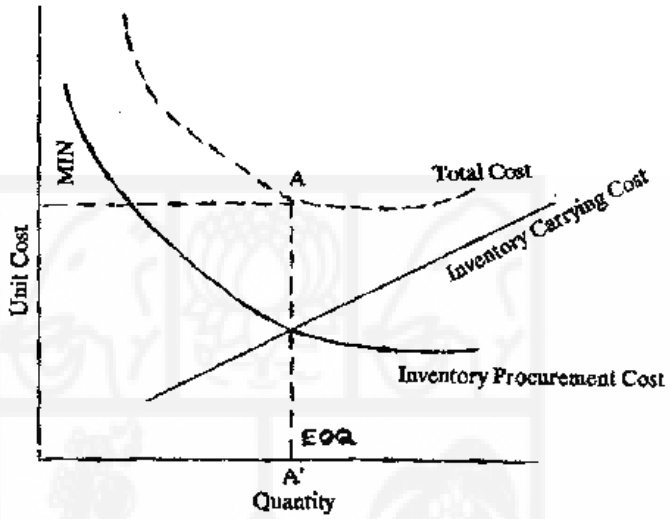
1. interest on capital investment
2. cost of storage facility, up-keep of material, record keeping, etc.
3. cost involving deterioration and obsolescence; and
4. cost of insurance, property tax,etc.

Carrying costs are almost directly proportional to the order size or lot size, or order quantity (see fig.2)

In fig.2 the procurement costs and inventory carrying costs have been plotted with respect to quantity in lot. Total cost is calculated by adding procurement cost and carrying

cost. Total cost is minimum at the point A and thus A' represents the economic order quantity or economic lot size.

Fig. 2: Relationship Between Cost and Quantity



Another method of finding E.O.Q. that is by mathematical means, is given below:

Let Q is the economic lot size or E.O.Q.

C is the annual carrying cost for one item

P is the procurement cost associated with one order and U is total quantity used annually.

Number of purchase orders to be furnished

$$= \frac{\text{Total quantity}}{\text{E.O.Q.}} = \frac{U}{Q}$$

Total procurement cost = Number of purchase orders x cost involved in one purchase or procurement

$$= \frac{U}{Q} \times P \qquad \text{(a)}$$

Average annual inventory = $\frac{Q}{2}$

Inventory carrying cost = Average inventory x carrying cost per item

$$= \frac{Q}{2} \times C \qquad \text{(b)}$$

Total cost $T = (a) + (b)$

$$T = \frac{U \times P}{Q} + \frac{Q}{2} \times C$$

$$T = U.P.Q. - 1 + \frac{Q}{2} . C$$

To minimize the total cost, differentiate T, w.r.t., Q and put it equal to zero

$$\frac{dT}{dQ} = \frac{d}{dQ}(U.P.Q - 1 + \frac{Q}{2}.C)$$

or $$0 = - U.P.Q. - 2 + \frac{C}{2} \text{ or } \frac{UP}{Q^2} = \frac{C}{2}$$

$$.Q.^2 = \frac{2U.P.}{C}, Q = \sqrt{\frac{2U.P.}{C}}. \quad \ldots\ldots\ldots(i)$$

Example: Given that

(i) annual usage, *V* = 50 units

(ii) procurement cost P = Rs. 15 per order

(iii) cost per piece, C_1 = Rs. 100 per item

(iv) C2, a percentage including expenditure on obsolescence, taxes, insurance, deterioration, etc. = 10% Calculate E.O.Q.

From (iii) and (iv) above, the carrying cost (C) per item can be calculated as C = C_1 x C_2 or the equation (i) developed above can be rewritten as

$$Q = \sqrt{\frac{2U.P.}{C_1.C_2}} ; \text{substituting the values}$$

$$Q = \sqrt{\frac{2 x 50 x 15}{100 x (10/100)}} = \sqrt{150} = 12 \text{approx.}$$

The readers may try the following examples:

Example 1: The rate of use of a particular raw material from stores is 20 units per year. The cost of placing and receiving an order is Rs. 40. The cost of each unit is Rs. 100. The cost of carrying inventory in per cent per year is 0.16 and it depends upon the average stock. Determine the economic order quantity. If the lead time is 3 months, calculate the reorder point.

Example 2: Find Economic Order quantity from the following data:

Average annual demand = 30,000 units

Inventory carrying cost = 12% of the unit value per year

Cost of placing on order = Rs. 70

Cost per unit = Rs. 2

Example 3: A factory uses two pieces per day of a rod 6 mm in diameter and 150 mm long in one of their manufacturing processes. The rod costs Rs. 3 each and the total expenses involved in pin-chasing and receiving them are Rs. 50 per order. The annual

inventory carrying cost per item is Re. *V*- The procurement period is 3 days and minimum stock kept is 8 pieces. Find out.

(i) Standard ordering quantity

(ii) Reorder point and

(iii) Maximum stock.

A B C ANALYSIS

Necessity

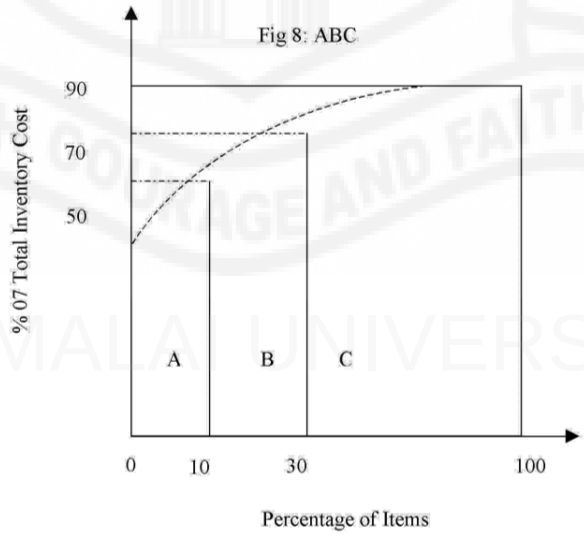
As the size of the industry increases, the number of items to be purchased and then to be taken care of also increases. Purchase and control of all items at a time and in bulk much before their use, irrespective of their usage value, price or procurement problems, blocks and involves a lot of money and man hours, and is therefore uneconomical.

ABC analysis he. segregating the items from one another and tells how much valued the item is and controlling it to what extent is in the interest of the organization.

PROCEDURAL STEPS

1. Identify all the items used in an industry
2. List all the items as per their value
3. Count the number of high valued, medium valued and low valued items.
4. Find the percentage of high\ medium and low valued items. High valued items normally contribute for 70% or so of the total inventory cost and medium and low valued items, 20 and 10% respectively.
5. A graph can be -plotted between percent of items (on X-axis) and per cent of total inventory cost (on Y-axis) fig. 3 shows such a graph.

Fig 8: ABC



It can be seen that 70% of the total inventory cost is against 10% of the total items (called A-items), 20% against 20% of the items (B-items) and 10% against a'big bulk, i.e., 70% of the items (called C-items).

The ABC analysis furnishes the following information:

1. A-items are high valued but are limited or few in number. They need careful and close inventory control. Minimum and maximum limits, and recorder point is set for A-items. Such items should be thought of in advance and purchased well in time. A detailed record of their receipt and issues should be kept, and proper handling and storage facilities should be provided for them.

Such items being costly are purchased in small quantities only and just before their use. This of course increases the procurement costs and involves a little risk of non-availability. However, the locked up inventory cost decreases and the problems of storage and care taking are minimized.

A-items generally account for 70-80% of the total inventory cost and they constitute about 10% of the total items.

2. B-items are medium valued and their number lies in between A and C-items. Such items need moderate control. They are more important than C-items. They are purchased on the basis of past requirements, a record of receipts and issues is kept and a procurement order is placed as soon as the quantity touches reorder point. These items being comparatively less costly, a safety stock of upto 3 months may be kept whereas it needs a stock of fortnight or so in case of A-items. B-items also require careful storage and handling.

In brief, B-items need every care but not so intensive as is required for A-items.

B-items generally account for 20 to 15% of the total inventory cost and constitute about 15 to 20% of the total items.

3. C-items are low valued, but maximum numbered items. These items do not need any control, rather controlling them is uneconomical. These are the least important items like clips, all pins, washers rubber bands, etc. They are generally procured just before they finish. No expediting is necessary, no records are normally kept and a safety stock of 3 months or even more can be purchased at an instant. Future requirements of such items are never calculated and a two bin system is sufficient to hint procurement.

C-items generally account for 10 to 5% of the total inventory cost and they constitute about 75% of the total items.

THE KARDEX SYSTEM

The Kardex System applied to Stores record is one of the most popular systems of Loose Leaf stores recording system used in India. This record consists of cabinets of trays (or) drawers each containing packets in which stores accounts stock cards (or) other useful and necessary documents are kept. Metal cabinets of varying sizes which can be selected according to the nature and size of store requirements are now freely available in the market. Bound books containing packets .are also, available. Such packet can hold one to

four cards and sometimes both sides of the card may be used. The system offers knowledge of uptodate stock position and the action taken in connection with its permitted replace both the stock ledger and the stock ledger card.

A typical performance of Kardex Card is given here.

One outstanding feature of the Kardex System is that with only one drawing out of a tray (or) drawer, there are immediately visible 'Sixty-one' Accounts each of which simultaneously shows a mass of information. This is possible by placing strips of transparent celluloid on the edge of each record coloured card (or) strips may be used to indicate different types of inventory such as Slow Moving, fast moving, dead or obsolete stock, good on order, goods in transit etc.

Receipts and issues are made in these records. The issue notes are priced by referring to the appropriate account in the cabinet for the desired information.

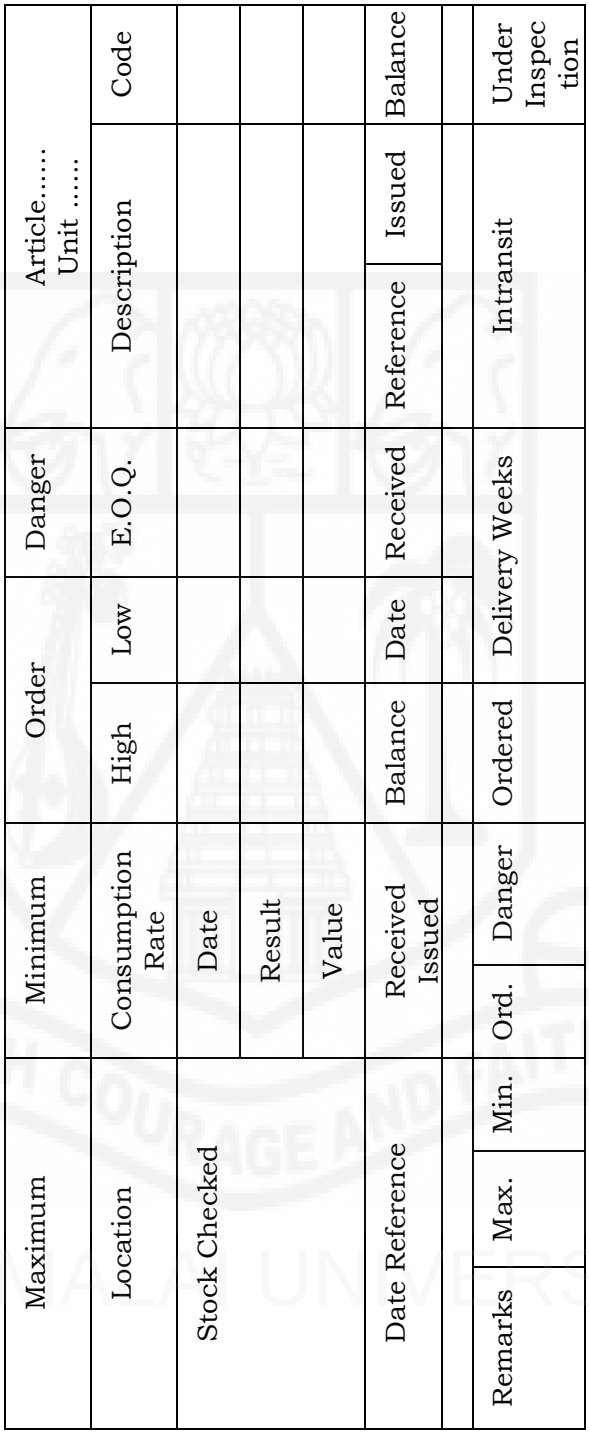
The Kardex System saves a great deal of clerical labour and speeds up the process of maintaining stores record. The account is visible and straight a way accessible. It provides a compact and safe method of recording which avoids mishandling and confusion.

DISADVANTAGE OF THE KARDEX SYSTEM

1. Sometimes the writing may be illegible
2. It may not give complete reference
3. There is greater possibility of errors (or) mistakes separately maintained

Delays in posting and balancing may prevent availability of desirable information in time (or) as and when required.

KARDEX CARD



Signals: Plastic slips of different colours indicating different positions.

15.4. REVISION POINTS

Inventory in various aspects clasification, control, advantages, disadvantages, scope, functions.

Classification and codification. The ABC analysis. Revive order quality and the Kordex system.

15.5. INTEXT QUESTION

15.5.1. Explain the ennumerance order quality.

15.5.2. Explain the store keeping.

15.5.3. Explain the objectives of inventory control

15.5.4. What are the duties of a store keeper.

15.5.5. Explain kordex system.

15.5.6. Explain ABC analysis.

15.6. SUMMARY

The difficult types of inventory control can be discussed here with analysation. The safety study is needed because of incertainity. Uncertain quality is usually small and will be neglected in any discussion.

15.7. TERMINAL EXERCISES

15.7.1. Explain ordering cost.

15.7.2. Explain buy and

15.7.3. Explain lead time.

15.7.4. Explain various levels of stock.

15.8. SUPPLEMENTARY MATERIALS

Visit to a factory and collect or function chart inventory. inventory control, by asking with the cenemed personnel.

15.9. ASSIGNMENTS

For the above collected infunction field the infunction and make a repert.

15.10. SUGGESTED READING

Gopalakrishnan. P. F. Sundaram. Material management on integrated approval.

15.11. LEARNING ACTIVITIES

Then learning aspects ably needs practical knowledge or experience needed practical knowledge or experience needed really to understand the discipline.

15.12. KEY WORDS

Stock records: Detailed records of goods reserved, received, ordered, issued and an hand need be maintained for 'A' category of items. Tight and accelerate controls are required for such item.

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LESSON - 16

QUALITY CONTROL

16.1. INTRODUCTION

Quality: "The degree to which a product meets the requirements of the customer" - European Organisation for Quality Control: A system whereby design, customers, suppliers, Production Processes, Parts, Components and Assemblies, Inspection and test come under active surveillance.

Inspection: "Is the process of measuring the quality of a product or service in terms of established standards

-Dr.W.R.SPRIEOAL.

16.2. OBJECTIVES

Quality Control: It aims to attain quality of design and conformance that will satisfy the customers on delivery and during subsequent use and to achieve this at the lowest possible cost.

FACTORS AFFECTING QUALITY

1.	Men	-	Right man for the job
2.	Money	-	Cost of Quality should be contained and Quality costs Money
3.	Management	-	It should draft the quality policy and provide all the necessary support
4.	Materials	-	Care should be taken when purchase is made as it directly goes into the product
5.	Machine	-	Machine should be able to produce at the specified tolerance limits and be reliable
6.	Miscellaneous	-	This includes product design, inspection etc.

16.3. CONTENT

16.3.1. Factors affecting quality

16.3.2. Stages of quality control

16.3.3. Organisation

16.3.4. Quality levels

16.3.5. Quality control in india.

16.3.6. Future

16.3.7. Statistical quality control

16.3.8. Control charts.

16.3.9.Contorl charts for variable.

16.3.10. Control charts for attributes.

STAGES OF QUALITY CONTROL

Buffa distinguishes four stages:

1. policy Level
2. Engineering Design.
3. production
4. Field

ORGANISATION

Basically there are four types of quality control or inspection

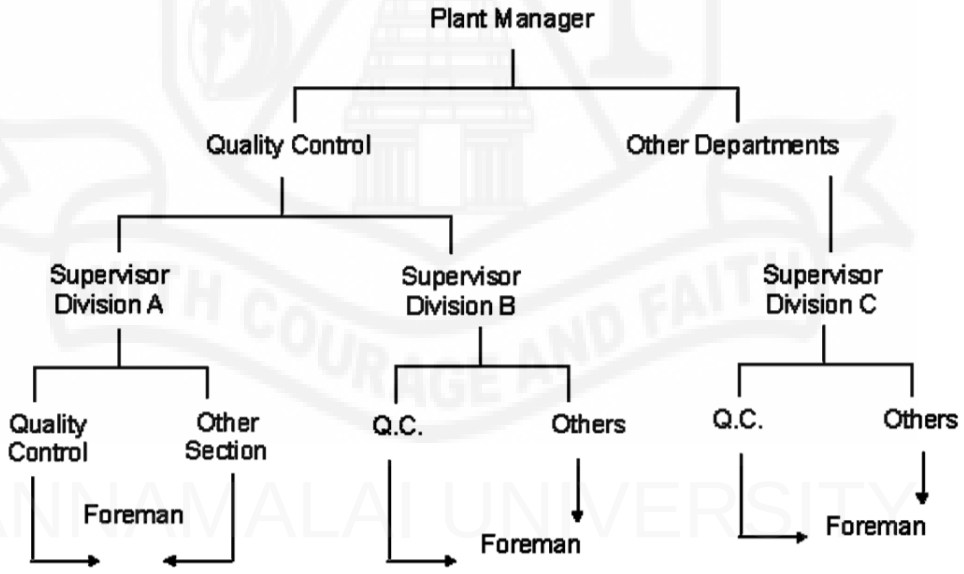
1. No separate quality control on Inspection department - i.e., the operator himself perform quality checks. Eg. Followed in low volume, high precision, high technology industries.

2. Definite inspection wing with supervisor as final authority i.e., No quality control department.

3. Quality Control Organisation at par with production organisation but process control done by production department.

4. Autonomous Quality Control and Inspection Department. Eg. Followed in high volume or Assembly operation industries.

Chart for a typical Autonomous Quality Control and Inspection Department.



8. SETTING UP OF STANDARDS

1. Customers - market research will give the quality level the customer expect.

2. Top Management - Policy may decide where to be in quality - Top, Bottom or Middle.

3. Design - it may set a tolerance that a certain part must meet, if it is to fit properly with other parts.

9.INSPECTION STANDARDS

1. For Raw Materials
2. For work in Progress (or) Work in Process
3. For Finished product
4. For Completed Mechanism
5. Working Inspection Standards

10. FUNCTION OF QUALITY CONTROL DEPARTMENT

1. New Design Control - involves establishment and specifications of desirable cost, quality for the product including elimination or location of possible source of manufacturing trouble before the start of production.

2. Incoming Material Control - involves receiving and stocking the material at economical levels of quality.

3. Product Control - involves the control of processed parts and assemblies at the source of production

4. Special Process Studies - involves conducting investigation and test to locate the cause of defective product

5. Setting up of Standards
6. Appraising Confonnance
7. Taking Corrective actions.

QUALITY LEVEL

Quality costs money and that is customers money. So the purpose of Quality control is to get away from the idealistic attitude and to create a factual and measurable approach to the subject. The need is to strike a proper point of balance between too much quality and too little quality.

INDIAN STANDARD INSTITUTION

This Institution came into being for actively controlling the quality of some important products. In the course of the years it has widened its scope.

QUALITY CONTROL IN INDIA

India is slowly catching up with quality. Till recently almost all products had sellers market and the sellers were not interest in quality. They were able to sell whatever they manufacture. The best example in the automobile industry. They were giving inferior products, now they are trying to improve quality at exhorbitant cost because of competition. This is evident from their price. Eg: Bajaj Auto is able to sell their scooters well below than other manufacturers because they had concentrated on quality even when they were having a sellers market.

Another interesting point is that India is dominated in the industrial scene by Medium Scale Industries. These industries invariably compete with a multinational or large industry who is the market leader. This forces these medium industries to sell at a

price lower or atleast equal to that of the large industry. This in turn prevents these Medium Industries from spending more on quality.

QUALITY CONTROL IN AN INDUSTRY

In foundries the molted metal is tested for its contents by doing a lest known as Chill Test. Here a small portion of the molten metal if. irisn and put in water. The resulting metal's colour will give an idea of the contents. If any ingredient is lacking the required quantity is added.

The steel industry the contents of the molten metal is tested in the laboratory and the result is given to the production department. The production department takes corrective action if necessary.

In the pharmaceutical industry the formulations are tested at various stages to find out whether the required ingredients are preserjt and whether the required purity is being maintained. All pharmaceutical manufacturers have an analytical laboratory in then-premises.

Eg. for Quality Assurance in a value manufacturing industries.

The costing necessary for value are made on sub-contract basis. The company rate their vendor before they are given contracts. After selecting the vendor, a Radiography test report of the pattern is called for. This radiography test report is called for at periodical intervals. When the products are received the measurements and appearance are tested according to the Manufacturer Specification Standards (U.S.A.)

FUTURE

Quality dimension of output will grow in relative importance as firms adjust to changing times. Organisation like Consumer Guidance Society of India which advocates high quality are getting stronger day by day. New legislations are being enacted to assure quality and the arms of institutions like I.S.I, are lengthened to bring more products into their network.

STAT1STSCAL QUALITY CONTROL (S.Q.C)

Quality Control in a manufacturing industry is a wide subject and means, different things to different people. It should be concerned with the procedure, action and supervision required to ensure that the .inal product has the desired attribute. The main reason for controlling quality is to meet the customers' requirements at an economical cost and enable a firm to operate at a profit.

Control procedures should be means to practical end: they should not become too statistical and they should be part of the production schedules. They are a business investment which should show a return.

For any quality control system to be effective, the data collected by the testing procedure must be analysed and studied. For proper analysis, an attractive and effective presentation of data is essential. The three basic methods of presenting data are to enumerate them in the text, to tabulatein the form of tables, and to plot graphically as charts. The analysis of the data may include simple statistical techniques as the average,

standard deviation, range and coefficient of variation, or it may involve some of the advanced methods as analysis of variance, correlation and reliability of means.

The statistical quality control chart is probably the most commonly used statistical technique in the textile industry. Most control charts are constructed on the basis of "three sigma limits". This means that three standard deviations of the distribution involved are added to and subtracted from the average of the data to serve as control limits. Control charts are effective only if the correct action is taken when they indicate that the process is out of control.

The term "Quality" of fabric denotes two functional properties, such as drape, texture, strength, dimensional stability etc. on the one hand and freedom from defects on the other hand. All the functional qualities are determined by the design specification of the fabric type of fibers used, count and twist of warp, and weft, end and pick density, type of weave, type of chemical finishing and process employed, prints etc. The freedom from faults mainly depends on the quality of the yarn, but is to some extent influenced by the efficiency of the preparatory processes. The incidence of other defects is, to a very large extent, Influencing by the mechanical condition of the looms. Therefore the classical approach of statistical quality control (SQC) as a technique to maintain or improve quality has been to:

i. assess process capability and improve it wherever possible

ii. fix tolerance limits, such that the quality within these limits is acceptable, and

iii. modify the process conditions suitably whenever the quality is significantly below the prescribed minimum

CONTROL CHARTS

Control is the process of regulating an activity to verify its conformance to a standard and to make corrective action if required.

Quality Control: Therefore QC is the regulatory process for those activities which measure a product's performance compare that performance with established standard and take corrective action.

Quality is controlled, during process and prior to manufacturing by Inspecting the incoming raw materials. So this plays an important role in reducing the burden of QC people.

During the process inspection is carried out at various stages for the purpose of acceptance, which generally carried out on a sampling basis just to decide, to accept the lot or not.

Now, we will see how the process of quality control is carried out. The datas collected from the Inspection samples are plotted m the form of charts and analysed, on the basis of which, the regulatory action is decided.

To start with, there are two classification of charts are available:

1.Control Chart for variables

2.Control Chart for attributes

CCfor variables

No two parts can be produced with identical measurements by a manufacturing process, and some variability of size should be tolerated during manufacture. These variations are due to variety of causes such as

i. variations in properties of malts

ii. Coolent

iii. Temp, fluctuation

iv. Condition of machine

v. Tool wear

vi. Tool setting

CONTROL CHARTS FOR VARIABLES

So, the main purpose of this chart is to indicate changes in quality so that adjustments can be made to correct the process before large qualities of scrap are produced.

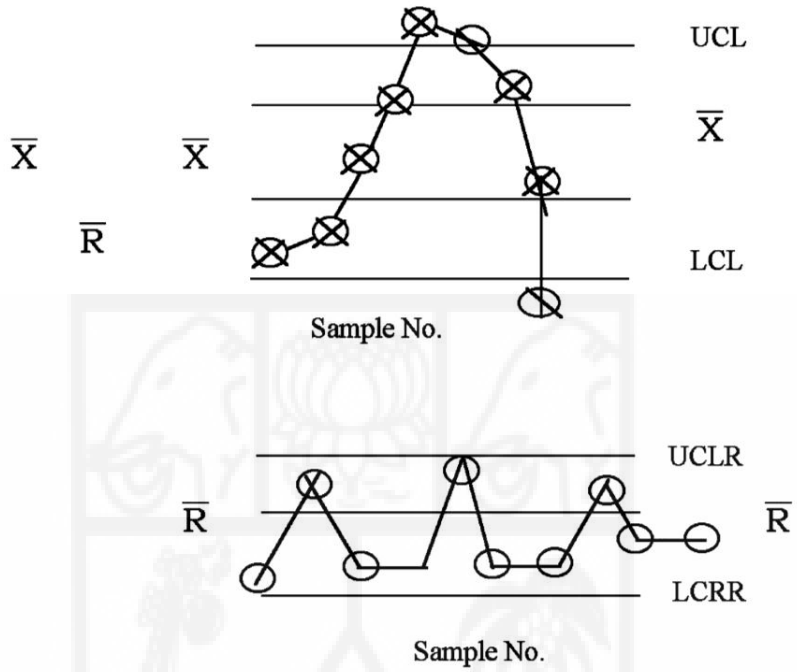
For the variable control charts, the inspector checks the parts by "measurement" not gauging more expensive. With the sample data in the form of measurements, it is possible to prepare control charts such as X Chart - process mean R Chart - showing the deviations in variability

PROCEDURE

A number of samples are taken over a period of time. The sample size is usually 5, but 10 to 15 also taken. They are measured and X, $\overline{X}$,R, $\overline{R}$ are calculated.

Table

S.No	Size						
	a	b	c	d	e	$\overline{X}$	$\overline{R}$



FORMULA

$\overline{X}$ -Chart	R-Chart		
$\overline{X}+A_2R$	$D_3\overline{R}$	UCL	A_2,D_3,D_4(624)
$\overline{X}-A_2R$	$D_4\overline{R}$	LCL	depends on sample size

Problem

1	10	10.1	10.1	10.2	9.7	$\overline{X}$	$\overline{R}$
2	10	10.2	10.3	9.9	9.8		0.4
3	9.8	9.9	10.3	10			
4							
5							

Process out of control: Presence of assignable causes various reasons:

Faulty tools, new malts, properties, breakdown of lub.m/c, speed m/c.

WHAT DOES THEY SAY?

X does not give satisfactory results due to old m/c, worn out parts, misalignment. Here Range Chart is used for additional control. The Purpose is to have an additional check over the variability of the process whose variability must be carefully held within limits (Pharma and Electrochemical)

CONTROL CHARTS FOR ATTRIBUTES

There are instances in industrial practice where direct measurement are not required or possible. They are inspected with "GO", "NO GO" gauges. The produces are inspected only to decide defective or not defective. Good or bad but not how much good.

The various CC for attributes are

(i) P-Chart

This is for percent defectives or fraction defectives. This is used whenever the quality characteristics are expressed as the number of units conforming or not conforming.

UCLP

$\bar{P}$

P.D.= $\frac{\text{Total defectives}}{\text{Total Inspected}}$

CL P

LCL P

Sample No.

$UCLP : \bar{P} + 3P$

$LCLP : P - 3P$

$\sqrt{\frac{\bar{P}\,(1-\bar{P})}{n}}$

S.No.	S.S.	Def.	P.	$P = \sqrt{\frac{0.025(1-0.025)}{100}}$
1.	100	3	3	
2.	100	4	4	2.5+
3.	100	1	1	2.5-
4.	100	2	2	

$\bar{P} = \frac{10}{400} = 0.25 = 2.5$

C-Chart

Used to find out number of non-conformities per sample or in an inspected item.

$UCL_c = \bar{C} + 3\sqrt{C}$

$LCL_c = \bar{C} - 3\sqrt{C}$

$\bar{C} = \frac{Total\ defects}{No.of\ units inspected}$

16.4. REVISION POINTS

The importance of the study reveals chart the factors affecting quality, storage of quality control, quality control in an industry and the control charts for hosh variable and attributes.

16.5. INTEXT QUESTION

16.5.1. Briefly explain control chart.

16.5.2. Explain quality control programme.

16.5.3. What is quality control

16.5.4. Explain the various quality control charts.

16.6. SUMMARY

The future of quality control department, industry and in future discussed. The statistical quality control and the control chart for variables and for attributes are discussed here.

16.7. TERMINAL EXERCISE

16.7.1. What is cc variable.

16.7.2. Make note on quality control in india.

16.8. SUPPLEMENTARY MATERIALS

Take a king sale new about various quality control measures taken by various industries visit and collect in future to the respective departments.

16.9. ASSIGNMENTS

From the collected department in future make a feasibility report of it.

16.10. SUGGESTED READINGS

Ratta. A. K. Integrated materials mgt.

16.11. LEARNING ACTIVITIES

In shut the growth and development cut of skill and experience we have to apply or knowledge to procure air neded merits.

16.12. KEY WORDS

VARIABLES

The characteristic which can be measured in called variable. For these variables are may be interested in controlling their mean or the range of variation R, or the standarded deviation.

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LESSON - 17

STANDARDIZATION

17.1. INTRODUCTION

- Standards are the base of all mass production. They make possible thousands of different articles to be placed within the reach of everybody.

- When one purchases a new spark plug for a scooter or car, he knows that it will screw into the engine head all right. Why? Because spark plug threads are standardized.

- Standards convey the sense that there are only certain specific sizes made and sold.

- Standards are carefully established specifications for products, materials, etc.

- Standardization means producing maximum variety of products from the minimum variety of (i.e., standardized materials, parts, tools and processes,

- Standardization is one way which leads to economical products. Standardization usually means that non-standard products will not be produced – except when a customer orders them to be made.

- Standardization is the process of establishing standards D or units of measure by which extent, quality, quantity, performance, etc., may be compared and measured.

17.2. OBJECTIVES

Steps Involved:

a. With the help of market research, sales statistics, etc., decide what to sell in future.

b. Then, define a standard range of products

c. From the range, ask the designer to develop minimum variety of components to match the range.

Introduce new materials, ask the designer to develop minimum variety of components to match the range. An approach to standardization necessitates the classification of materials and component parts.

17.3. CONTENTS

STANDARDIZATION PROCEDURE

Classification

- 'Classification' is of great value in material and component standardization.

- Classification aims at, systematically, grouping items, together by their common features and subdividing them by their special features.

- A system of classification and coding is necessary for the design of new products within the range defined.

Such a system should readily: i. Identify and locate identical items. ii. Facilitate the use of standard items in new designs iii. identify substitutes in case of stock outs iv. Help developing Group Technology v. Aid to improve parts location in the store.

- Classification procedures involves the following steps:

i. Define all items

ii. Classify each item according to its basic characteristics

iii. Identify each item by allocating to it some meaningful code number.

A code consists of letters and numbers. The aim is to classify from general to particular.

- Taking an example of grinding wheels for classification and coding purposes, various wheel features are denoted by letters and numbers. A code is marked on the grinding wheel.

According to Indian Standard Specifications, for example, a grinding wheel is specified as follows:

G	C	54	G	6	V	BE
↓	↓	↓	↓	↓	↓	↓
Green (Prefix)	Silicon carbide abrasive	Medium grain size	Soft grade	Dense structure	Vitrafied bond	Suffic (Trade secret) Depends upon the process and type of manufacturing

3. ADVANTAGES OF STANDARDIZATION

All sections of a company benefit to some degree from standardization.

1.Design Department

- Fewer specifications, drawings, and part lists have to be prepared and issued.

- Thus more time is available to develop new designs or to improve established designs.

- Better resources utilisation

- Allocation of work to suit available talent

- Lesser design mistakes and design alternations

- Less qualified personnel can handle routine design work.

2.Manufacturing Department

- Lower unit costs
- Better quality products
- Accurate delivery dates
- Better methods and tooling
- More effective training
- Better services of production control, stock control, purchasing, etc.
- Fewer tool changes and process set-ups
- Increased interchangeability of parts
- Longer production runs are possible with fewer changeover; wider use of automation and mechanisation.
- The operations can be analysed and broken down into short repetitive cycles which can be easily mastered.

3. A *Marketing Department*

- Marketing section gets better quality products of proven design at reasonable prices.

This leads to a greater sales volume

- Increased margin of profit.
- Less pressure of after-sales-services
- Better product deliveries
- Easy availability of spare parts

4. Production Planning Section

- Scope for improved methods, processes and layouts
- Opportunities for more efficient tool design
- Greatly reduced pre-production planning activities. Fewer issues of new planning cards.

5. Production Control Department

- Well proven design and methods improve planning and control
- Chasing small batches (of products) consumes less time
- Fewer delays arise from waiting for materials
- Accurate delivery promises.

6. Purchase and Stock Control Section

- Holding stock of standard items, (i.e., less variety of materials and components) means less paper work and fewer requisitions and orders.
- Storage and part location can be improved.
- Because of large purchase quantities involved, favourable purchase contacts can be made.
- Newer techniques can be used for better control of stocks.

7. Quality Control Department

- Better inspection and quality control is possible
- Operators become familiar with the work and produce jobs of consistent quality.
- Quality standards can be more clearly defined.

8. Work-Study Section

- Efficient break down of (limited) operations into short repetitive cycles and effective work measurement afford considerable opportunities for work-study.

9. Supervision

- All the above points help the supervisor to run his department efficiently and more effectively
- Less time is wasted in resolving production snags such as wrong informations, faculty tooling, etc. Reduced rejections and scrap.
- More time is available to the supervisor to make useful records and preserve statistics.

10. Costing

- Costing can obtain better control by installing standard costing.

4. DISADVANTAGES OF STANDARDIZATION

- Reduction in choice because of reduced variety and consequent loss of business or custom.
- Changes in public taste seriously affect a company producing only standardized product range.
- It becomes difficult to introduce new models because of less flexible (existing) production facilities and due to the high cost of specialised production equipment.
- Standardization tends to favour large famous companies, because small or new concerns can rarely get much business even by producing same items and by- selling them at the same price as the big companies.
- Standards once set, resist change and thus standardization may become an obstacle to progress.

5. APPLICATIONS OF STANDARDIZATION

Standardization can be applied to a major extent in the following fields:

1. Finished products, e.g., cars and televisions
2. Subassemblies and components, e.g, automobile gearboxes and auto-electric bulbs.
3. Material standardization, e.g., both of direct materials (plain carbon and alloy steels, arc welding electrode core wires etc.) and indirect materials (such as oils and greases).
4. Production equipment standardization, e.g., that of machine tools, presses, welding equipments, etc.

6. INTERNATIONAL STANDARDIZATION

- It becomes very necessary to follow international standards if a country has to capture the export market.
- The work of international standardization is carried out under the aegis of ISO (International Organisation for Standardization).
- Most, industrialized countries are members of ISO.
- ISO was founded after World War II.
- ISO does not issue independent standards of its own but it makes recommendations which are included in the national Standards of the collaborating countries.

7. NATIONAL STANDARDIZATION

Every country has its own national standards. IS in India, BS in UK, DIN in Germany are a few examples of national or home Standards.

II. SIMPLIFICATION

1.Introduction

- The concept of simplification is closely related to standardization
- Simplification is the process of reducing the variety of products manufactured (known as variety reduction)
- Simplification is concerned with the reduction of product range, assemblies, parts, materials and design
- A manufacturer may reduce the number of different types of radio sets from a dozen to three or four to simplify his range.
- Simplification makes a product, assembly, or design, simpler, less complex or less difficult.
- Simplification removes the superfluous. It decreases variety of sizes; for example a garment factory making tea-shirts in sizes 16, 161/4, 161/2, 163/4,17,171/4, etc. can eliminate superfluous sizes and thus simplify his production line.
- A production line is generally simplified when it possesses unnecessary complexity and confusion.
- Often variety reduction will reveal that a subassembly or component needs simplification

- Variety reduction.

i. Variety reduction consists of identifying the existing variety and then removing unnecessary items from the system.

ii. Classification and codification (refer section 1.2) help locating and identifying all items (i.e., products, materials, components, etc.)

- The availability of suitable standards assist in simplification.

2. Considerations in simplifying items (i.e., products, components, etc.)

i. Can simplification be effectively achieved depending upon the nature of item?

ii. How the simplification will affect customer demand and volume of sale?

iii. Does market competition permit simplification or it encourages product diversification?

3. Advantages

(i) Simplification involves fewer, parts, varieties and changes; this reduces manufacturing operations and risk of obsolescence.

- Since simplification reduces variety, volume of remaining products may be increased.

- Simplification provides quick delivery and better after-sales- service.

- Simplification reduces inventory and thus results in better inventory control

- Generally speaking simplification implies fewer parts and lower the production costs.

- Thus simplification reduces price of product

- Simplification improves product quality,.

III. SPECIALIZATION

1. Introduction

- Specialization is the natural outcome of the application of standardization and simplification

- Specialization means concentrating efforts on a particular field of action or towards a specific attempt.

- A worker is said to be specialized in a work when he acquires skill and proficiency in it by concentrating solely on it (i.e. on that particular work or job). A mechanic, brick-layer or an engineer is a specialist in his Held.

- Factory producing spark plugs only is a specialist in its production.

- Specialization as applied to human activities on shop floor can be defined as 'Division of Labour'.

This means that if a worker instead of completing the full product, performs one small operation on the product and attains proficiency in that particular activity, becomes a specialist in that.

2. Advantages

1. Operators achieve a high state of skill and proficiency
2. They take smaller times to complete the activity in which they are specialized
3. Thus they raise their salaries and their standard of living.

3. Limitation

1. Specialized labour and equipment are not flexible, i.e., they cannot be used for other purposes.
2. Specialization may result in monotony.

4.Applications

1.Specialization is universal in application; it is a rule rather than exception in today's industry.

2. Specialization has been applied to
   i. products
   ii. processes
   iii. Individuals
   iv. Companies.
   v. Jobs
   vi. Equipments, etc.

17.4. REVISION POINTS

Standardisation procedure – Advantages – Simplification – Specialisation.

17.5. INTEXT QUESTIONS

17.5.1. Explain standardisation.

17.5.2. Explain simplification.

17.5.3. Explain specialization.

17.6. SUMMARY

This lesson focusses standardisation procedure, advantages and disadvantages of standardization simplification and specialization.

17.7. TERMINAL EXERCISE.

17.7.1. What is classification.

17.7.2. Briefly explain advantages of standardization points.

17.8. SUPPLEMENTARY MATERIALS

How the standardization can be done in organisation. Verify or give examples.

17.9. ASSIGNMENTS

Standardization is the process of setting standardization elucidate.

17.10. SUGGESTED READING

Ratta A. K. Integrated materials mgt.

17.11. LEARNING ACTIVITIES

Standardization may refer to the product and to the process of production then how will standardise your learning activities by means of habit, time management, skill application may attribute the learning power.

17.12. KEY WORDS

Specialization Specialization means concentrating effect on a particular field of action a towards a specific attempt.

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LESSON -18

MATERIALS HANDLING

18.1. INTRODUCTION

Materials handling is a specialized activity in the production management which gets maximum concentration nowadays.' This activity by nature, is costly (90% of factory overheads) but in turn adds little to the value of the product. It has been estimated that 50-75% of the cost production is spent en materials handling activities. It is virtually non-productive and the product form remains unchanged during transportation. Hence a proper management of materials handling in order to reduce its time and cost is highly essential.

Materials handling refers to the moving of material from the storeroom to the machine and from one machine to next during the process of manufacture. American materials handling society defines material handling as the "Art and Science involving movement, packing and storing materials in any form of means of gravity, manual effort or power actuated machinery".

18.2. OBJECTIVES

The objectives are,

1. Eliminate handling wherever possible, if not minimise and mechanise
2. Lower the unit material handling cost
3. Reduce the manufacturing cycle time.
4. To provide uniform flow of production (free of bottlenecks).
5. To provide for unproved working condition and greater safety in handling.
6. Allow increased utilization of storage space
7. Gain higher productivity and lower manufacturing cost.

18.3. CONTENT

18.3.1. Importance of material handling

18.3.2. Function

18.3.3. Principles

18.3.4. Factors affecting material handling consideration.

18.3.5. Material handling rent

18.3.6. Material handling device selection.

18.3.7. Maintenance of material handling equipments.

IMPORTANCE OF MATERIALS HANDLING

Materials handling is of major importance not only in the storehouses but also throughout the production processes. We must not lose sight of the fact that the handling facilities controlled by the store department may have to be correlated to the methods employed in the production shops. The basic considerations of materials handling relate to the

position of the storehouse, economy of movement, selection of suitable machines storehouse layout, training of operators etc.

Unless the whole storehouse procedure is carefully planned and properly supervised there will invitably be a certain amount of wanted effort. This can occur of various stages. At the time of receipt it is not uncommon to find materials unloaded from the carriers vehicle and dumped on the nearest available empty space perhaps in an untidy manner. Another problem is inspection. Too much of adherence to the principle of inspection before storage may lead to heavy loads being placed in the inspection bay to await clearance before being removed to their ultimate location. Double handling could be avoided by locating the goods in the storage area in the first place and notifying the inspector so that he can either examine them there or take samples. Bad planning easily results in overcrowding sections of the storehouse and major movements may have to be undertaken to rectify the position. Inadequate supervision can lead to confusion about proper location necessitating subsequent relocation and had timing of issues sometimes means that goods sent out to have to be brought back into the storehouse because the user is not in a position to take delivery.

The flow of materials in the storehouse and stockyard should be carefully examined and planned to reduce to a minimum the frequency of movements and the distances through to which the goods have *to* be moved.

FUNCTIONS

The important functions are

1. The movement and positioning of purchased materials for the purpose of storage.
2. The internal transportation between the place of storage and the place of use.
3. Intra department and inter departmental movement for the purpose of working or temporary storage.
4. The movement and positioning of finished stock for the purpose of slocking or sale.

PRINCIPLES

Some guiding principles in economic handling are,

1. Minimise and mechanise handling wherever possible
2. Avoid congested layout and have clear flow patterns
3. Have proper analysis and planning for installation, operation and maintenance.
4. Have need analysis before purchasing equipments
5. Transport at constant speeds and at unit loads
6. Avoid rehandiing, back tracking, unnecessary mixing and subsequent sorting
7. Use gravity wherever possible
8. Design adequate aisles and assess areas
9. Select flexible and standard devices
10. Train operators and provide for repairs and maintenance of equipments

11. A group may be held responsible for efficient handling.

FACTORS AFFECTING MATERIALS HANDLING CONSIDERATION

Engineering and economic considerations in installing a handling system are

1. Factors of plant and operating methods
2. Here we study the existing systems and facilities which form the basis for planning.
3. Factors depending upon materials and parts handled, the nature of materials, the quantities handled and the distance to be travelled have an impact and they are to be considered.
4. Factors relating to handling equipment. The kind, capacity, size, utilization and durability of the equipment to be purchased are analysed.
5. Money factors such as initial cost, cost of operation and maintenance, the benefits derived must be studied.

MATERIAL HANDLING DEVICES

More than 430 devices are available and some important devices are discussed here. The devices can be classified as,

A. Manual : In this we have man and pushing type devices like wheel barrows

B. Mechanical : This one have sub-divisions as

   i. Lifting and lowering devices including block and tackle, hoist, winches and elevators

   ii. Transporting devices such as box trucks, car puller, rail road cars etc.

   iii. Combination devices such as conveyors, cranke trucks, spiral chutes fork lifter.

These devices can also be divided as fixed path and variable path devices.

MATERIAL HANDLING DEVICE SELECTION

1. Type of product, its size and shape
2. Volume of production and production system
3. Production rate and sequence of processing
4. The distance to be covered and space availability
5. The capacity, cost, utilization and maintenance of the equipment.
6. The number of times the materials are to be handled (frequency)
7. Possibilities for future expansion if any
8. The requirement, availability and charges of labour
9. The power availability to operate
10. The location of assembly, testing and shipment.

SELECTION OF MATERIAL HANDLING EQUIPMENT

A wide variety of material handling equipments is in the market; some equipments are for general purpose use and others are of special purpose use. The choice of a particular equipment depends upon the specific requirements or the conditions of an industry. Naturally, the best equipment will be one which permits smooth and continuous production flow, involves less accidents, reduces production cycle time, promotes better working conditions, incurs less fatigue to operators and brings down the total material handling costs.

The following factors may be considered while selecting a material handling equipment:

(a) *Material to be moved.* The size of material, its shape, weight, delicacy, nature (solid, liquid, gas) and its chances of getting damaged during handling, etc should be considered.

(b) *Plant buildings and layout.* Widths of aisles, inequality in floor levels, width of the doors, height of the ceiling, strength of floor and walls, columns and pillars, etc., to a great extent influence the choice of a material handling equipment. For example, low celling heights may not permit stocking of palletized materials, weak roofs limit the use of overhead conveyors and steps between two floors will not allow trucks to operate.

(c) *Type of production machines.* Different machines have different outputs per unit time. The material handling equipment should be able to handle the maximum output.

(d) *Type of material flow pattern.* A Vertical flow pattern will; require elevators, conveyors, pipes, etc. Whereas horizontal flow pattern will need trucks, overhead bridge cranes, conveyors, etc.

(e) *Type of production.* The type of production affects to a large extent the selection of the material handling equipments. Conveyors are more suitable for mass production on fixed powered trucks for batch production; because conveyors though costly, can handle more volume of production per unit time as compared to trucks whereas a truck is a more flexible equipment.

(f) Cost of material handling equipment

(g) Handling costs

(h) Life of the equipment

(i) Amount of care and maintenance required for the material handling equipment.

MAINTENANCE OF MATERIAL HANDLING EQUIPMENTS

The proper maintenance of material handling equipment is extremely essential for preventing the occurrence of bottlenecks or point of congestions. Production line flow can be maintained only if the material handling equipment is in the proper working order.

Preventive maintenance is by far one the best maintenance techniques suggested for material handling equipments.

By preventive maintenance, the equipments can kept running there by minimizing costly interruptions in the production schedule. A little periodic inspection and minor adjustments may be enough to prevent equipment breakdown. Preventive maintenance consists of frequent inspections and examination of the material handling equipments, with special attention to the components requiring it. The aim is to uncover conditions leading to breakdown or harmful depreciation. Preventive maintenance also includes lubrication, adjustment, or repair while the equipment is still in a minor stage of defect.

Three stages of preventive maintenance are:

a. Inspection

b. Repair, and

c. Overhaul.

The maintenance system for a few material handling equipments like cranes, hoists, and conveyors has been discussed below:

1. HOISTS AND CRANES

a. *Inspection:* All parts, open or covered are inspected for wear and tear. Worn out or unworkable components like wire ropes, wheels, bearings, bolts, etc. are removed. Brakes are adjusted and lubrication is provided wherever necessary.

b. *Repair:* The repairable parts of the system, after inspection are corrected for small repairs and minor defects are rectified. Systems like open gear transmission, couplings, riveted, and bolted joints, trolley, brakes, guards, etc., may be repaired.

c. *Overhaul:* Overhauling involves dismantling the complete, mechanism and replacing all damaged components. Crane, structure, buffers, rails, open gear transmission, pulley blocks, etc., may be replaced and various sub-mechanisms may be aligned and adjusted.

2. CONVEYORS

a. Inspection: Belts or rollers are inspected for tensions and wear and tear. Gear box is properly lubricated, various fasteners are tightened and safety guards are checked.

b. Repairs: Rollers and belts are checked, adjusted or repaired. Coupling, packings, safety guards, steel structures, gear transmission, bearings, fasteners joints, threaded components, etc., are adjusted or repaired as per their conditions.

c. Overhaul: The conveyor system is completely dismantled. Components worn out and beyond repair like belts, bearings, packings, oil seals, rollers, drums, fasteners, and couplings are replaced. Structures, safety guards, etc., may be repaired as per their conditions.

3. REPAIR CYCLE

A typical repair cycle may be as follows:

(a)	New Equipment	(b)	Inspection - 1
(c)	Inspection-2	(d)	Inspection-3
(e)	Repair -1	(f)	Inspection – 4
(g)	Inspection-5	(h)	Inspection-6
(i)	Repair -2	(j)	Inspection-7
(k)	Inspections - 8	(l)	Inspection-9
(m)	Repair-3	(n)	Inspection – 10
(o)	Inspection - 11	(p)	Inspection – 12
(q)	Repair - 4	(r)	Inspection – 13
(s)	Inspection – 14	(t)	Inspection - 15
(u)	Overhaul -1		

This cycle involves 15 inspections, 4 repairs and 1 overhaul. The time duration between two stages say (c) and (d) or (d) and (e) may range from 1 month to 6 months or even more, depending upon the type of material handling equipment and the time for which it has been used.

7.TYPES OF MATERIAL HANDLING EQUIPMENTS

7.1. Introduction: A wide range of material transporting and handling equipments are available suitable to most of the industrial requirements. Such equipments though need a high capital investment, prove very paying in the long run. They

1. minimize the total handling time;
2. promote, easier, safe and cleaner handling;
3. eliminate idle time of workers and machines which would be there, otherwise, while waiting for the materials for necessary operations;
4. make material movements fast;
5. decrease fatigue incurred by the workers;
6. add to safety;
7. locate, and stock materials better and in less space; and
8. lastly their operations can be automated to increase production.

18.4. REVISION POINTS

Objectives – Function – Principles – Factors affecting material handling consideration material devices – selection.

18.5. INTEXT QUESTIONS

18.5.1. Define material handling.

18.5.2. What is principle of any handling device.

18.5.3. Briefly explain the factors chart influenced the selection of material handling equipment.

18.5.4. Discuss the importance of material handling.

18.5.5. Discuss the important material handling equipment.

18.6. SUMMARY

This lesson deals about function, principles, factor affecting materials handling, material handling hence and the selection of material handling device and its maintenance.

18.7. TERMINAL EXERCISE

18.7.1. How would you select material handling equipment.

18.8. SUPPLEMENTARY MATERIALS

Practically apply the material handling equipment and learn about their operative functions.

18.9. ASSIGNMENTS

Tell about your experience about operative procedures, costs, involved with the material handling equipment.

18.10. SUGGESTED READING

Work book on material handling, service, maintenance, repair etc, are available.

18.11. LEARNING ACTIVITIES

How to apply the skill and experience is an concern to minimize the cost by means of operating and maintenance cost is a trend setting new on the focus of learner device metabolism. On the equipment and machinery concerned with while featuring about operating proceeding and maintenance and service aspects when facing the repair aspects also.

18.12. KEY WORDS

Wheel Based Hand operated equipment is a shallow power with shaff and wheels. It is used for maintenance of small pests with the store.

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LESSON - 19

WORK STUDY

19.1. INTRODUCTION

Work study mainly comprises, two distinct yet completely interdependent basic techniques, namely, the Method study (or Motion study) and Work Measurement (or Time Study). Method Study deals with the problems as to how should a job be done, whereas the work Measurement is concerned with the problems as to how much time a job should take for completion. The objective of work study is to determine the best method of performing each operation and to eliminate wastage so that production increases with less fatigue. Work study is also used in determining the standard time that a qualified worker should take to perform the operation when working at a normal pace.

19.2.OBJECTIVES

Some important objects of the method study are as follows:

i. To find the best way of doing a job

ii. To eliminate the wastage of time and labour

iii. To train the individual worker in its practice because it can be learnt more easily when reduced to elements

iv. To reduce fatigue and boredom of work by avoiding unnecessary movements.

v. To standardise the method of doing the job by breaking the whole work into elements.

19.3. CONTENT

19.3.1. Proceeding for method study.

19.3.2. Analysis in the form of a chart.

19.3.3. Work measurement

19.3.4. Technique of work management.

19.3.5. Standard data.

19.3.6. Advantages of work management.

METHOD STUDY

Method Study is concerned with the way in which the work is performed. It is a technique which analyses each operation, of a given piece of work, very closely in order to eliminate unnecessary operations and to approach the quickest and easiest method of performing each necessary operations. It also includes the systematic recording, analysis, critical examination of existing and proposed ways of doing work.

2.1 Procedures for Method Study

The procedure for method study consists of the following steps: *Step 1:* Break up the operation of the job. For the present method of manufacturing a job (item), make a list of all the details regarding the high costs, long work cycle time, bad quality of work such as lack of accuracy or poor presentation, complaints from both inside and outside the organisation, etc. All the material handling machine work and manual work is also included in this detail.

Step 2: Obtain all the facts about the details (operations). A method study analyst must obtain the information regarding the nature and amount of work, its purpose, the people who did it, the place and time of doing it and the methods used. Following questions about the information to be gathered.

a. What is the purpose of this operation? Why is the work done?
b. Where is the best place to do this operation?
c. Who will do this operation? Who can do it in a better way?
d. What nature of work is done?
e. When is the best time to do this operation and whether it can be done at the same time as before or at any other better time?
f. How is the work done?

Following are the various methods used in obtaining the facts:

i. Direct observation including sampling,
ii. Interview and discussion
iii. Information provided by staff, and
iv. Questionnaire.

Step 3: Examining the present method. After obtaining facts about the details, the. recorded facts should be examined critically by a questioning process, as shown below:

1.	Purpose	--	Fact	:	What is being achieved?
			Reason		Why is it achieved?
			Alternative		What else can be achieved?
2.	Place	--	Fact	:	Where it is achieved?
			Reason		Why there?
			Alternative		Where else can it be achieved?
3.	Sequence	--	Fact	:	When is it achieved?
			Reason		Why then?
			Alternative		When else can it be achieved?
4.	Person	--	Fact	:	Who achieves it?
			Reason		Why that person?
			Alternative		Who else can achieve it?
5.	Means	--	Fact	:	How is it achieved?

Reason	Why that way?
Alternative	How else can it be achieved?

After examining critically the questions on the above five points, these are further critically examined on the following two questions:

1. What are the advantages and disadvantages of each alternative?

2. What can be elected for development?

Step 4: Develop New Method: After considering the above questions, the same questioning process will be adopted with the modification that the questions will be "what should be done?" etc., instead of "what forcing done?". Apart from the above considerations, before finalising that new method, the following facts should also be thought over during method study:

a. Elimination

Every detail (or operation) of the job should be considered whether it can be eliminated without any harm

b. Combination

In this aspect, it is observed whether two or more operations can be combined without any adverse effect to save operation time.

c. *Rearrangement*

If rearrangement in the sequence of operations helps in simplification or in any other aspect then it should be done. For example, in a factory the main sequence of operation, is of "assembling, storage inspection and despatching".

In the above sequence, inspection was carried before despatching. After some time it was felt that storage before inspection yields unnecessary more material handling and internal transports of defective components. It can be achieved, it inspection is carried out before sending the products for storage. Then this sequence of operations is rearranged as follows:

Assembling Inspection Storage Despatching

(d) Simplification

In simplification, it is found that if the operation is possible with any other easy, safe and economical method that should be adopted.

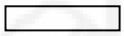
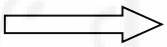
2.2 Analysis in the Form of a Chart

This is a technique by which analysis for developing the methods can be done quickly and easily. Many variations of these charts have been used, but the most important among them are given below:

(i) Operation Process Chart

The process chart consists of the small individual component elements, showing the step-by-step performance of these different elements in a particular sequence. The most common elements are Operation, movement, inspection, delay and storage or filing. The symbols used to denote each of the above-mentioned elements are given.

The time consumed in the process of each operation Is determined. Also the distance covered and the number of steps involved are recorded. Wherever possible each operation is further sub-divided to show such activities as referencing, posting, filing, sorting, assembling etc.

EVENTS	SYMBOL
OPERATION	
INSPECTION	
MOVEMENT (OR) TRANSPORT	
DELAY	
STORAGE	
OPERATION AND INSPECTION	

ii. Activity Chart

The way of tabulation to record the activities of an individual, and the time taken for each activity is known as activity chart. This type of chart is generally prepared in consultation with the employee to ensure that no activity has been left over.

iii. Work Distribution Chart

This chart shows all the activities of individuals in a department. This can also be considered as a departmental activity chart. In this chart, the name of each individual and a brief history of his activities are recorded.

iv. *Form Distribution Chart*

The chart showing the flow of documents and forms used in an organisation is called the form distribution chart. This chart gives all the information regarding the origin of forms, number of copies prepared, the departments or sections through which the forms pass and the action taken by each department.

v. *Layout Chart*

In this chart, the physical arrangement of work tables and the movement of documents from one table to another, both within and outside the department, are recorded. This distance covered and the time taken are also covered in this chart. This chart is also commonly known as string diagram and is mainly used to study for possible improvements in the existing layout of a department and/or the location of a department within an organisation.

DISCUSSION QUESTIONS

1. What do you understand by the term Work Study?
2. How has Method Study developed?

3. State the different charts which are used as tool of method study.
4. What are TherbKgs? Explain their importance.
5. Explain the Flow Process Chart. How does it differ from operation charts?
6. What the steps employed in examining, developing and installation of new procedures?

3. WORK MEASUREMENT

Work measurement has, in general, two major components, namely, the measure of the volume of work and the measure of the employee's time used up. It is an important technique to measure the work of an office as to what a fair day's work should be. Yet it is not possible to carry our work measurement for certain activities which are creative in nature, such as research, art, book writing etc. For certain activities, irrespective of the volume of work, it is necessary to employ some one, as in the case of a secretary to an executive.

3.1 Techniques of Work Management

Following are the six principal techniques of work measurement:

a. Time Study

Time study may be defined as the art of observing and recording the time required to do each detailed element of an industrial operation.

The term industrial operation includes a manual, mental and machining operation. Manual time is divided into three types of operations, i.e., handling of tools, handling of machines and handling of materials. Mental time includes time taken by the worker for thinking over some operations. Machining time includes time taken by the machines in doing its share of work. Thus, the time study standardises the time taken by an average worker to perform these operations.

Following are the distinct steps in time study:

1. Elements to be time studied are defined
2. Readings are to be taken with the help of stop watch
3. Rate of worker's speed
4. Adjusted speed of the worker is computed
5. Allowances for fatigue, rest, etc. are to be made
6. Standard allowed time is to be determined.

b. Work Sampling

Work sampling (also known as Ration Delay Analysis) is a statistical technique to find out how the time of employees is spent during observation period. This technique is based on the theory of probability. Random observations are made to determine the ratio of productive time to idle time of employees/machines in a given department. It is a simple and inexpensive method; besides, it is also easily understood. This method also tells the present rate of working.

c. Standard Data

Generally the management is anxious to have the time standards before the jobs are actually manufactured for cost estimating, scheduling, planning and other decision-making purpose. In this case advantage of previous time standards already on hand can be taken.

Every operations consists of a number of small work elements which are repeated in various combinations. The time values for these small work elements are established accurately, and these values are used without further time study, whenever that element occurs. These standardised things for such elements are known as Standard Data

For calculation of standard time using the standard data, first step is to standardise the method (by method study) and then break the operation into small elements and note down their timings from standard data tables and then add the timings of all such elements to get the standard time of the operation.

d. Synthetics of Work Study Data

Synthetics are used to determine times for repetitive work. The main advantage of synthetics is the reduced cost of application. It is found that it has given savings upto 90% of the cost of time study. The amount of savings depends very much on the type of operation but in practice synthetic method can be applied as satisfactorily and more economically than the time study method for the time calculation of jobs.

e.Analytical Estimating

For the non-repetitive tasks, it has been found that it is difficult to apply time study method. The method of analytical estimating consists in employing trained and skilled craftsmen in estimating the time required. These craftsmen are required to break the job into , elements and for each element the time required is estimated based on the estimator's experience. Where predetermined standard times are available for some of the elements, they are used in place of the craftsman's estimate, and the total standard time is determined by adding the times of all elements.

This method may give extremely incorrect result if inexperienced persons are entrusted with the job of estimating. It is widely used in maintenance and repair workshops.

f. Non-Random Sampling

This method combines the features of time study with those of work sampling. For work sampling the randomness of observations is essential; for non-random sampling this is not a must. Intead, observations are continuous and the intervals between observations are reduced to periods so short that the employee cannot consciously adjust his actions to distort the picture.

3.2 Advantages of Work Measurement

Following are the major advantages of the work measurement study:

i. It is useful in determining the standard time for various operations, which helps in fixing wage rates and incentives.

ii. It is useful to estimate the cost of product accurately .

iii. It helps in production control

iv. It helps in predicting accurately as to when the work will be completed and hence customers can be promised to take delivery on fixed date

v. Using the work measurement techniques it can be found that how much machines an operator can run.

DISCUSSION QUESTIONS

1. Discuss the methods of Work Measurement, showing the suitable areas of application
2. What are the objectives of "Time Study?"
3. Explain the meaning and purpose of rating a worker during time study?
4. Explain the following terms:
5. Rating, Standard time, Fatigue allowance
6. Discuss the role of work study in increasing the productivity of a plant. To what extent production planning depends of Work Study?
7. Discuss the importance of Work Study in a manufacturing plant, showing its specific applications and scope thereon.

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QUESTIONS BANK

1. INTRODUCTION- MATERIALS MANAGEMENT

1. What are the chief function of material management. Give the importance of material management in the context of the present complex production?
2. Explain the objectives of materials management with examples.
3. What is the role of materials management with efficient running of a business.

2. PURCHASING DEPARTMENT

1. Define purchasing? What are the goals of purchasing department. Give its importance.
2. State the meaning of purchasing? What are the objects of scientific purchasing?
3. State the main responsibility of the procurement department.
4. Write short notes on the following:
   a. Vendor rating
   b. Importance of Material Management.

3. PURCHASING ORGANIZATION

1. What are the essential of successful purchasing? What are the various methods of purchasing?
2. How will you classify purchasing? Enumerate the steps for carrying out effective purchasing.
3. What are the functions of purchasing organization?
4. Explain the different methods of purchasing.

4. STORES DEPARTMENT

1. What are the functions of store organization. Explain in detail?
2. Describe briefly the stores system and procedures.
3. How the physical stock verification will be carried out in Industry?
4. What are the function of store keeping? Give the criteria for location of store? How will you judge the success of store keeping?
5. Discuss the main features of the Kardex System as applied to store record. What are the demerits of the system?

5. INVENTORY MANAGEMENT

1. What is meant by Economic Order Quantity? Derive a relation for it?
2. Describe ABC analysis? What are the polices for ABC class items.
3. What are the function of Inventory Management? Describe any one in detail.

6. QUALITY CONTROL

1. Determine between Inspection and Quality? Why is Industrial Inspection necessary.
2. State the advantages of Quality control. Show clearly how it can reduce the cost of production.
3. Differentiate between Inspection and Quality control.

7. STANDARDISATION

1. What do you understand by standardization? Explain with example?
2. Discus the advantages. Also describe the pre-requisition for effectively practising standardisation.
3. What do you understand by "Simplification" and "Specialisation. Explain with example.
4. Explain the term material handling and discuss the objectives of a good material handling system.

9. **METHOD STUDY**

1. What is method study? What are its objectives?
2. Write basic procedures for method and discuss critical examination.
3. Define 'Method Study" Outline and justify the general procedure of method study?
4. Outline the General procedure for developing the Time Standard by Stopwatch Time Study. Justify the same.
5. What are techniques of "Work Measurement"? Explain each of them briefly?
6. What is 'Method Study"? How will you determine the areas that need method study application in an industry?
7. Discuss the main difference between the two constitutions of work study (ie) Method Study and Work Measurement.

19.4. REVISION POINTS

Introduction – method study – objectives – proceeds for method study – analysis in the form of a chart – work measurement – technique of work management – advantages of work management.

19.5. INTEXT QUESTION

19.5.1. What is work study?

19.5.2. Explain join enrichment?

19.5.3. Explain acceptance sampling.

19.5.4. Explain method study.

19.5.5. Explain work measurement.

19.6. SUMMARY

This lesson deals about method study procedures, analysis by way of chief and work measurement.

19.7. TERMINAL EXERCISE

19.7.1. Use the events to symbolise.

19.8. SUPPLEMENTARY MATERIALS

The sign board like process chart is expressed in this context. You can give meaning as well explain them charts by way of procedure and denumerate in an industry reference.

19.9. ASSIGNMENTS

Make a block of process chart with the given examples.

19.10. SUGGESTED READING

Visit to an industry and know about various charts used.

19.11. LEARNING ACTIVITIES

With space production of these department aspects use will be able to understand commonly and easily the various steps followed inside the organisation for the purpose of easy go.

19.12. KEY WORDS

Measurement of time required for certain tables it can help establish standard levels of performance which can be used as a basis of wase payment. It can help faster simplification and standardization of operation.

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LESSON - 20

CASE STUDY

CASE DETAILS

1. Alpha Mineral prospecting and Exploratory Drilling Company Limited
2. Anand Metal and Tin Products private Limited
3. Dynamic Electrical Engineering Corporation
4. Bengal Earthmovers and Equipment Limited
5. The International Cosmetic Company

ALPHA MINERAL PROSPECTING AND EXPLORATORY DRILLING COMPANY LIMITED

(A case in wrong specification, packing and despatch instruction)

The company is a medium-size contracting firm engaged in mineral production by diamond drilling method and undertake deep drilling job for mineral prospecting based on geological studies before starting mining operations. Its main business is concentrated in the coal-fields and copper belts on long-term contract basis. It charges it customers on actual metres drilled based on core recovery and depth measurement.

It maintains a number of heavy duty rotary diamond drilling rigs with hydraulic devices for upward and downward pressures for pull-out and insertion of drill rods etc. The drilling accessories such as, core-barrels, flush coupled casing pipes of different lengths, drill rods and tools and other fittings are stocked at worksites so that no men-hour is lost for want of proper accessories, tools and other materials consumed in the process of drilling operation like, fuel and lubricants etc.

Jamming of rods and casing pipes in the drill holes at some depths are common features. The fishing out operation continues for days and many man-days are lost, sometimes making core-recovery impossible. Often, the whole operation has to be abandoned leaving the accessories in the hole and it cannot charge the customer for such losses. The imputed cost is therefore included in its charge.

In such cases, Bentonite Powder is used, which is a muddy substance and gets slippery when mixed with water. When poured in sufficient quantities into drill-holes this helps pull-out operation of roads etc, for purpose of recovery.

The Company's Purchase Department purchases these powders in huge quantities which are packed in gunny bags of standard cement bag size and then wagon-loaded for despatch to destination.

A purchase Order followed after acceptance of the quotation from a supplier with the following terms of delivery:

	Description of the Material	Qty.	Price	Packing & Delivery Instructions
1.	Bentonite Powder (Fine) for use in deepdrilling	500 ml.t.	@Rs... per m.t.	To be packed in standard gunny(mesh as per sample attached) suitable for the purpose. F. O. R. destination through rail in covered wagons.

A Small cut-piece of gunny to be used was tagged with the order copy to the supplier. But the supplier when packing them did not bother to see that the gunny mesh were of such netting as not to hold the fine powder intact in since it conformed to sample piece. When the wagon reached tie destination and delivery was taken, in as much as half of the tonnage weight was lost in transit due to movement and subsequent handling.

The Company complained to the supplier for breach of contract and asked for compensating the loss in weight. But the supplier maintained that the powder were packed in gunny of standard size with such mesh as specified in the sample and they can use the carrier for the loss in weight, which however was duly noted at the time of delivery from the railways.

Suppose the company and the supplier had fought a legal battle, who would have won the case. Is the term of delivery. "F.O.R. destination" a part and parcel of the purchase contract? Are the descriptive languages in the purchase order sufficient to convey the accurate description of the materials ordered for?

Do you think that the ground that they were packed in gunny of standard-size cement bags with wider meshes as per sample should be overhauled by the requirement of suitability over the brought to the Court of Law?

ANAND METAL AND TIN PRODUCTS PRIVATE LIMITED

(A case in higher inventory level and better customer service)

Anand Metal and Tin Products Pvt. Limited is a large distributing firm dealing in metal and tin products. It has six regional ware-houses for serving adjacent states and six offices in regions with its headquarters in New Delhi. Six warehouses act as sales outlets, which are autonomous in character. The purchasing and inventory policy is determined by each Product Manager in consultation with Warehouse Managers in each zone, but the broad policy directives are given by the General Manager in New Delhi.

Mr. C.L. Anand, Chairman of the company found to his utter dissatisfaction that the company has not been able to make any profit during the last three years, nor sales have appreciably increased. Although its profit-to-sales ratio has been low in comparison to other competitive firms in the line during the previous years, but during the last two to three years it has dwindled further even though there are good demands for metal and in products in the market.

In an effort to bring about a change in his company, Mr. Anand fired Mr. B.N. Misra, the General Manager of the company who had been holding the position for the last seven years. He was replaced by Mr. S.P. Srivasatava with an alluring pay and liberal perquisites.

On joining the company, Srivastava carefully went through the sales records and predicted sales increases for several products listed in the Sales Catalogue. In his estimates, he also convincingly declared increases in sales would turn the table and this would enable the company to make good profit. He therefore instructed all the regional product managers that they in consultation with the Warehouse Managers should immediately initiate purchase actions for all items. He outlines the inventory policy as follows:

a. An all-out effort should be made to get as much quantity discount as possible on all purchases in future.

b. Whenever possible, purchases should be in such lots as to be economical and optimal.

c. Stocks in warehouses may rise due to this larger quantity purchases, but increased carrying cost for higher inventory holding would be compensated by an increases in sales and better customer service.

Within a short time, sales picked up and by the year-end it was expected to go beyond all predictions. But all the warehouses reported huge stocks of unsold inventory. This superseded all previous records in the company history.

Following a rumour that there is an impending strike in the factories of a major metal and tin products manufacturer in the country, Srivasatva urged all the warehouses to increase stocks further and instructed product Managers to procure all items from any available source.

The strike, however, did not materialize owing to a union management settlement and the Product Managers promptly acting on his advice inflated stocks of the warehouses to a danger level. At the end of the year during final accounting it was found that even though there has been some improvement in the sales, the company has actually incurred a loss.

Do you think Mr. Anand was right in pinning his faith on Srivastava? Was Srivastava's actions for a policy of inventory built-up right, without studying pros and cons of the metal and tin products business?

CASE

DYNAMIC ELECTRICAL ENGINEERING CORPORATION

(A problem in buying ethics)

One evening the following conversations crossed abruptly between a junior buyer and the Managing Director of the above company.

"Goodnight, Mr. Modi!", called out the bright young man as Mr. Modi was slowly walking to his reserved parking space.

"Goodnight ... er, "Mr. Modi sputtered, as he could not remember the names of these young fellows who changed so often in his company's buying department. But Mr. Modi stared at the young man trying to squeeze a large "EXCEL" TV package into the back of his car. Mr. Modi was not so much suspicious as he was curious. As a man of principles Mr. Modi did not think badly of others. But the Excel Electronics and components were one of their suppliers and Excel's boxed were familiar sight at their receiving bay.

Mr. Modi thought again about the incident next morning and walked straight into the Chief Buyer's office and made discrete enquiries. Mr. Ajit Singh, who was the chief buyer of the company was, however, ready to discuss the matter quite openly.

"It is a small gift from Excel, " explained Mr. Singh, "a portable TV for you, Sir".

"A gift?" retorted Mr. Modi.

"Yes, Sir, that's right", repeated Mr. Singh.

'"Excel has made this special offer to the electrical goods buyers. As we doubled the order-size last month and paid within ten to fifteen days, they offered the product-buyer a choice of gifts. I got a stereo the same way from them last year. I have chosen a portable TV for you this year".

Mr. M6di was stunned, "Does it happen quite often?" he asked.

"Quite often," replied Mr. Singh, "many companies are now making special offers to buyers. In fact, I encourage my buyers to take advantage of this special deal. Our stationary buyer last year got a two-week holiday at Darjeeling as a part of such special offer."

"You see here," said Mr. Modi firmly. "I don't like that my company's reputation should be jeopardized this way of bribes"

"Not bribes, Sir, "retorted Singh angrily, "they are legitimate gifts and part of Excel's sales promotion efforts, made quite openly to every buyer." After a little pause, Singh started explaining, "our company has saved a lot of money as a result of such deals since bulk orders usually command high discounts. And what is more, I do not buy anything beyond our requirements. The way prices are soaring, we can't lose this amount."

"You obviously do not worry so much about the cost of stocking or cash flow problems, do you?" countered Modi. "If Excel wants to increase their sales or get earlier payments, they should offer more liberal discounts?"

"Our supplier says that a lot of companies are appreciating these offers as a means of giving their employees a tax-free bonus", sighed Singh.

But Modi was firm. "Well, I won't have it here, I don't like buyers of my company to be influenced by gifts", he told Singh quite frankly.

"I think you are not questioning my integrity", interrupted Singh who was not convinced by Modi's self-righteousness. "I am not at all influenced by these gifts, they are good incentives from my buyers. These have cut employee turnover in my department at no cost to this company. I think these perquisites are buyer's commissions, a natural reward for buyers".

"Our sales people work on commissions not to mention all kinds of free entertainments at company's cost. Why buyers can't profit from their efforts? I think., we contribute as much to this company's profitability and still my buyer's pay is much lower than that of any salesman. And yet you are complaining about a buyer's taking home a TV".

Modi had to agree that Singh was an honest man and running his department efficiently. He had cut cost by *5%* last year, delivery time for critical items had been greatly reduced despite scarcity. Still he felt that allowing employees to accept incentives from suppliers is ill-advised. On the other hand, if he demanded to put a stop to it, he might well face a revolt within the buying department of his company.

Do you think this practice of accepting gifts from suppliers is ethical or unethical? How can you classify some activities as distinctly ethical and some unethical? Define a policy and procedure for accepting gifts by a buyer form a supplier.

BENGAL EARTHMOVERS AND EQUIPMENT LIMITED

(A case in production hold-up and delay due to shortages and non-availability of parts and component materials in time)

BEEL is a large manufacturer in the private sector of a complete range of earthmoving equipment like tractors, excavators dirt- movers shovels as well as heavy and light-duty cranes and fork-lifters with a considerable amount of capital outlay and foreign collaboration. It has manufacturing facilities for almost all the parts and components used in equipment barring a very few items. Its production controller, who has joined the company very recently, shortly recognised that shortages and non-availability of,parts and component materials in time on the assembly line is the major problem in the production Control Department. It is not only the main reason for production hold-ups and delays, but also costing the company thousands of rupees in terms of excessive labour costs which accounts for idle labour and machine down-time costs.

In an attempt to shoot out the problem, he decided first to get a probe into the procedure for make-or buy of the company. Enquiries made at the Cost and Works Accounts Department revealed that actual costs of parts and components greatly varied from the production run to another for many reasons, the chief one being that during the assembly time many of the parts and components needed were either in short supply or not available at all. Consequently rush orders on machine shops for manufacturing these parts were being made, which upset the production schedule.

A further probe revealed that Marketing Department of the company usually forecasts sales of parts and equipment sufficient in advance, which varies from 10 to 12 months ahead. The Production Control Department prepares a bill of detailed parts and components requirement, adding a percentage allowance for spoilages: li/2% for major parts, 2% for intricate parts and 2i/2% for minor ones.

Quantities on inventory are then compared with this bill and in order to bring the inventory of each item to the required level the balance quantity is either purchased or manufacturing orders issued Cost and Works Department has so far followed a practice

trf. allowing excess labour costs due to shortages of parts and components on the assembly line to be included in the budgeted labour cost.

On receipt of a report from the new Production Controller the management of the company requests you to devise a suitable inventory control system so that this excess labour cost and resultant production holds-ups and/or delays due to. parts and component shortages on the assembly line can be eliminated.

Can you recommend a solution balancing inventory carrying costs and costs of idle labour time and production delays?

THE INTERNATIONAL COSMETIC COMPANY

CASE

i. The International Cosmetics Company is in the manufacturing and marketing field from the year 1890. It markets talcum powders, soaps and a few other related products but bulk of it sales consists of soaps and powders. Right from the beginning, the company's policy has been to produce and sell only good quality, mildly medicated cosmetic items so as not to compete with the giants who cater to the needs of the purely cosmetic class and mass markets. It does not want to enter the purely medicated or health markets on two grounds. They are:

a. The potential market

b. It requires strict adherence to the everchanging government controls. Being the pioneer in the field it has established itself as the market leader in several national and international markets and it has steadily been growing barring a very few depression periods.

The products of the company are premium priced and the gross margins range between 90 and 100 per cent factory. The retail prices are fixed and the retailers and the distributors are getting a combined main of profit varying between 35 and 45 per cent depending upon the products. A quantity discount up to 10 per cent is in vogue for bulk order. A company representative is looking after each zone. The company's promotional programme includes periodical point of purchase displays and advertisements in the printed media.

Quickies projection the mildly medicated appeal are shown in class A and Class B theatres all over the country. The brand image is very strong in certain regions and States in the country, In some regions one or two competitors dealing in cosmetic products have an edge over the company's share of the market.

The late 1974 and the early 1975 sales of the company reveal a distressing picture. The sales have been dwindling in several area. The consumer resistance is strong. But this has been the general trend for all producers. Some competitors lie low. Some extend additional dealer incentives. Some have entered vigorous promotional campaign. Some have started diluting the quality. Spurious products have entered the market with low price appeal.

The stocks of the company are pilling up at all levels in the national market. There is partial lay off in the company. The production has been sliced down to 40 per cent capacity. No change in the economic scence is predicted.

In the light of the company's established Business Policy.

(a) List and analyse the alternative courses of action and

(b) Suggest the right corporate strategy for

i. Keeping the strong pockets and

ii. Strengthening the weak pockets.

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