UNIT - 1

Introduction

Industrial Engineering :—

Industrial Engineering is a branch of Engineering which deals with the optimization of complex Processes, systems or Organizations. Industrial Engineers work to Eliminate waste of time, money, materials, manhours, machine time, energy and other resources that do not generate value.

According to American Institute of Industrial Engineering defines Industrial Engineering as "Concern with the design, improvement and installation of Integrated Systems of people, materials, Equipment and Energy. It draws upon specialized knowledge and skill in the mathematical, physical and social Sciences together with the principles and methods of Engineering analysis and design to specify, predict and Evaluate the results to be obtained from such systems."

Industrial Engineering is mainly Concerned with the improvement of productivity.

Applications of Industrial Engineering :—

→ Before 1940, Industrial Engineering was mainly applied to manufacturing industries for improving methods of production, to develop work standards & to formulate production control and wage policies.

→ Later on, the use of industrial Engineering also spreaded to non-manufacturing activities such as,

(i) Construction and transportation
(ii) Air-line operations and maintenance.
(iii) Public utilities.
(iv) Government and military operations.

→ Still today, Industrial Engineering finds major applications in manufacturing plants and industries.

→ In an industry besides the production, other departments utilising Industrial Engineering concept are Marketing, finance, purchasing, Industrial Relations Etc.

* Role of an Industrial Engineer :—

(1) ~~Advisor~~ Advisor :-

There are different types of Roles and Function which has been performed by the Industrial Engineer. It is considered that more than form of role and Functioning may occur Simultaneously at the same time.

Role and Functions of Industrial Engineering :—

(*) Advisor :- They act as Interpretor, Reviewer.

(2) Advocate / Activist :— They facilitate in actively promoting a process.

(3) Boundary Spanner :- They help in removing the gap between industrial Engineering and user interest.

(4) Motivator :- Provide stimulus and skill ~~data~~ availability to a grap or individual.

(5) Decision maker :- Select a performance from among many alternatives for topic of concern.

(6) Designer/planner :- Produce the solution specifications.

(7) Innovator/Inventor :- Seek to produce a creative or advanced technology solution.

(8) Negotiator :- Acts as Negotiator while dealing with suppliers, peers, subordinates and also with parties of business.

(9) Expert :- Provide a high level of knowledge, skill, and experience on a specific topic.

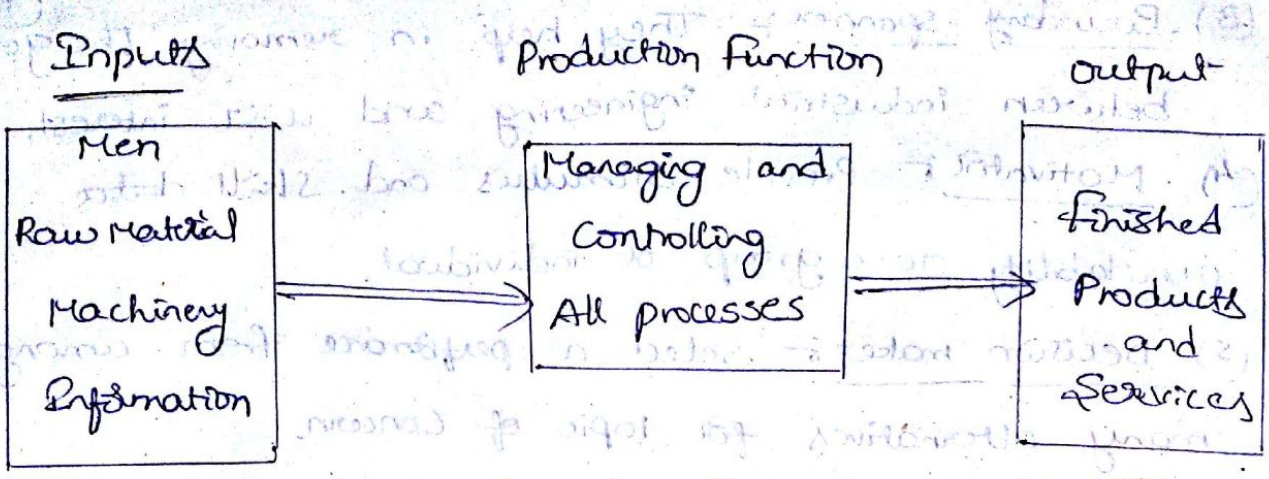
(10) Project manager :- operate, supervise and Evaluate projects.

(11) Trainer/Educator :- in the skills and knowledge of industrial Engineering.

** Production Management :-

Production Meaning :-

Production may be referred to as the Process concerned with the conversion of inputs (raw materials, Machinery, information, Manpower and other factors of Production) into output (Semi finished and finished goods and services)



Production is step by step process for the conversion of raw-material into finished goods

Production Management

Definition :-

Production Management refers to the application of management principles to the production function in a factory. In other words, Production Management involves application of planning, organizing, directing, and controlling the production process.

Production management is an organizational life cycle function within a company dealing with the planning, forecasting, and production, or marketing of a product at the stages of product life cycle.

Difference between Production Management and the Industrial Engineering :-

Production Management	Industrial Engineering
(1) Definition Production management refers to the planning, Coordinating and controlling the resources of production department.	Industrial engineering refers to the process of designing, developing and installing integrated System to the available resources of a Production System.
(2) Objective Its main objective is to optimal utilization of resources so as to produce desired output.	Its main objective is to design such an integrated system which ensures the improvement in the Productivity.
(3) Functions :- The Functions include Selection of material, machinery and the Equipment loading, Scheduling, dispatching, Inspection and Evaluation.	The Functions include Advising, Advocating, Analysing, Decision-making, data gathering and measuring.

(4) Application

It is applied in the Production activities only.

(5) Area of Focus :-

It focus on the individuals to make them aware of using various tools, techniques

(6) operation :-

Production manager operates the design system.

(4) It can be applied to manufacturing and non-manufacturing activities.

(5) It focus on systems to make them highly Production / productive.

(6) Industrial Engineers design the system, does not operate regularly.

* Quantitative Tools of Industrial Engineering

The various quantitative tools and techniques used in Industrial Engineering are,

(1) Network analysis
(2) Inventory Models
(3) Queuing Theory
(4) Simulation technique
(5) Mathematical programming.

(1) Network Analysis :- A network is defined as a combination of nodes which are linked by

activities (or) arcs. The network is represented by letters $\{N, A\}$.

where,

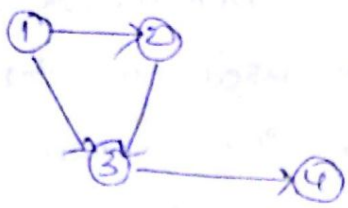
N = The set of nodes

A = The set of activities

$N = \{1, 2, 3, 4\}$

$A = \{(1,2), (1,3), (2,3), (3,4)\}$

Example :-



The two most widely used network techniques are PERT and ~~CPM~~. CPM.

In almost all the Projects of Public Sector and Private Sector, there are significant delays due to lack of proper planning, Scheduling and Controlling. PERT and CPM helps in performing systematically to complete the job in the shortest possible durations.

(2) Inventory Models :- Inventory is maintained to meet the future requirements. So, a firm should maintain inventory due to the following reasons,

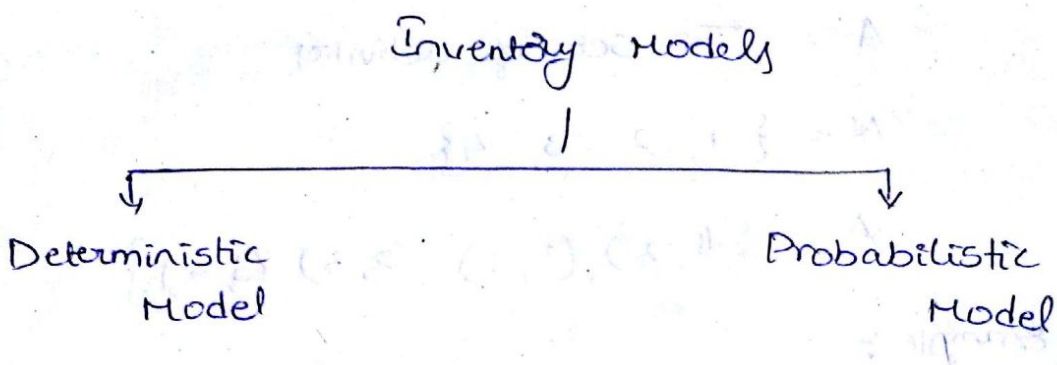
(a) Inventory provides smooth and efficient running of business.

(b) It reduces the possibility of duplicating of orders.

(c) It gives adequate service to customers.

(d) It increases the cashflow by timely shipment of customers orders etc.

Inventory models are two categories.



(1) Deterministic model :- Deterministic models of inventory control are used to determine the optimal inventory of a single item when demand is mostly largely obscure. Under this model inventory is built up at a constant rate to meet a determined or accepted, demand.

(2) Probabilistic Model :- This model is based on the assumption that the average demand for inventory items is reasonably constant overtime.

(3) Queuing Theory :- Customers arrive at some service station for some service and may have to wait for service. This gives rise to queues. A queuing model is used for analysis of a given queuing system, using the operating characteristics of the system.

Applications of Queuing Theory :—

* Telecommunications
* Traffic control
* Determining the sequence of computer operations
* Health services (E.g.. control of hospital bed assignments).
* Airport traffic, airline ticket sales
* layout of manufacturing systems.

Models of Queuing Theory :—

The queuing models are two categories,

(a) Deterministic model

(b) Probabilistic model.

(a) **Deterministic model :—** If Each customer arrives at known intervals and the service time is known with certainty, the queuing model is said to be deterministic in nature.

(b) **Probabilistic model :—** If Either the arrive of the customer or the service times of the customer or both of the queuing system is not known with certainty and expressed only in probabilistic nature.

(4) **Simulation Technique :—** Simulation is the Process of designing a model of real system.

and Conducting Experiments with this model for the purpose of understanding the behaviour for the operation of the System.

(5) Mathematical programming :- Mathematical Prog-raming techniques are linear programing, Integer Programming, Goal Programming and Dynamic Programming. These techniques are useful for maximization of profit and minimization of cost.

Productivity Measurement :-

Productivity meaning :-

Productivity is a measure of the efficiency of production. Productivity is a ratio of what is produced to what is required to produce it.

Productivity is the determinant of the efficiency of an Enterprise to convert its variable reso-urces into useful finished goods and services.

In otherwords, Productivity is a measure of how much input is required to produce a given output i.e, the ratio

$$\text{Productivity} = \frac{\text{output}}{\text{Input}}$$

When we consider an industry as a whole, the Productivity can be expressed in terms of the ratio between the value of the goods and services Produced to the value of the resources utilized for this production.

$$\text{Productivity} = \frac{\text{Value of goods and services produced}}{\text{Value of resources utilized for this Production}}$$

Productivity refers to efficient utilization of the resources. The resources utilized for product-ion are; land & Building
Materials
Machines
Manpower

Types of productivity Measurements :-

(1) Material Productivity
(2) Labour Productivity
(3) Capital Productivity
(4) Machine Productivity

(1) **Material Productivity** :- Many industries have to important a very large proportion of their basic raw materials and pay for them in scarce

foreign currencies. under either of these conditions the productivity of materials becomes a key factor in Economic production or operation.

$$\text{Material productivity} = \frac{\text{Number of units produced}}{\text{Cost of material}}$$

Raw material productivity Can be increased by:

(1) Proper choice of design

(2) Proper training and motivating of workers by way of better handling of materials and reduction of rejection

(3) Better material planning and Control

(4) waste reduction, Scrap Control.

(5) Recycling and reuse of materials.

(2) Labour Productivity :- It is the relationship between total revenue from Production and expenditure on labour.

$$\text{Labour productivity} = \frac{\text{Total Revenue from Production}}{\text{Expenditure on labour}}$$

The labour Productivity Can be increased by:

(1) Providing training to use best method of Production.

(2) Constantly motivating workers by providing financial and non-financial incentives.

(3) keeping high morale of Employes.

(4) Improving working conditions in the plant.

(5) By providing opportunities for self-development.

(3) **Capital Productivity** :- It is the relationship between Turn over and Capital Employed.

$$\text{Capital productivity} = \frac{\text{Turn over}}{\text{Capital Employed}}$$

Capital productivity can be improved by :

(1) Better utilization of capital resources like land, building, machines.

(2) Careful make or buy decision.

(3) By using modren techniques of production, maintenance, flexible manufacturing system, proper plant layout etc.

(4) **Machine Productivity** :- It is the relationship between output and Actual machine hours utilized.

$$\text{Machine productivity} = \frac{\text{output}}{\text{Actual machine hours utilized}}$$

Machine productivity can be improved by following:

(1) Preventive maintenance.

(2) use of proper speed, feed, depth of cut Etc.

(3) using method study techniques

(4) Use of skilled, properly trained wokers.

Concepts of Management :—

Management involves the activities to Control and monitor the people in an Organisation to achieve the desired goals of the Organisation. The roles of management include planning, organising, Staffing, directing and Controlling the Employees.

Definitions of Management :—

Different Experts Expressed their views on what management is. The following Explain the Concept and nature of management.

Henri Fayol :—

" To manage is to forecast and plan, to Organise, to Command, to Coordinate and Control."

Peter F Drucker

" Management is Concerned with the Systematic Organisation of Economic resources and its task is to make these resources productive.

F. W. Taylor :—

" Management is knowing Exactly what you want men to do and then Seeing that they do it the best and Cheapest way."

Nature of Management :-

(1) Management is an activity :
(2) Management is a Social process
(3) Multidisciplinary
(4) Management is a group effort
(5) Management is a profession
(6) Management is Situational in nature
(7) Management is both a Science and an Art
(8) Management is goal Oriented.

(1) **Management is an activity :-** It is a process of activity relating to the effective utilization of available resources.

(2) **Management is a Social process :-** Social process refers to the series of activities that are perfor-med in the society.

Management is an integral part of the Social process.

(3) **Multidisciplinary :-** Management uses knowledge from many different subjects also. It draws knowledge and concepts from various disciplines. Management draws from Economics, it draws the theories of consumption and production, from operations research - linear programming, Queuing theory, from statistics - Quality and Quality

Control, Decision theory, from Psychology – Participative theories and Behavioural theories, from mathematics Integral Calculas, matrix, algebra and so on.

(4) Management is group effort :– Management is an essential part of a group activity as no individual can do all the work by himself, so he combines his efforts with fellow beings and works in an organized group to achieve what he can not achieve individually.

(5) Management is a profession :– Management helps to carry out every profession in a scientific manner. The managers are professional in their approach and are governed by code of ethics, If the manager violates the code of conduct, he can be dismissed from the organisation.

(6) Management is situational in nature :– Managers adapt their style according to the situation. They adjust their plans, policies, decisions, and styles to suit different situations.

(7) Management is both a science and an Art :– The management, as a science provides general principles, which can guide the managers in their professional activities. The management as an art, provides the best possible solutions

of the problems and the best possible Exploi-tation of available resources.

(8) Management is Goal-oriented :- The purpose of management is to achieve certain goals. The main objective of management is to maximize efficiency and Economy of human efforts.

* Importance of Management :-

Management is compulsory for Evey Enterprise. The Existence of management Ensures proper functioning and running of an Enterprise. The importance of management is mentioned below.

(1) Management meets the challenge of changes.
(2) Accomplishment of Group Goals.
(3) Effective functioning of Business.
(4) Effective utilization of Business
(5) Sound Organization Structure.
(6) It facilitates the achievement of goals through limited resources.
(7) It is key to Economic growth.
(8) Management directs the Organization.

(1) Management meets the Challenges of Changes :-

An Efficient management can save the business from the ~~dang~~ dangers brought in by the challenges of changes.

(2) Accomplishment of Group goals :- Management organises available resources for the accomplishe-ment of the goals of an enterprise. It adds effectiveness to the efforts of a group of persons organized to achieve objectives.

(3) Effective functioning of Business :- Some of the factors responsible for the effective functioning of business are ability, experience, mutual understanding, coordination, motivation and supervision. Management make sure that the abilities of workers are properly used and cooperation is obtained with the help of mutual understanding.

(4) Effective utilization of Resources :- There are Eight 'M's in the business, which are men, money, material, machines, methods, motivation, markets and management. Management has control over other remaining M's.

(5) Sound Organization Structure :- Management lays down the foundation for sound organization structure which clearly defines the relationship between authority and responsibility.

(6) It facilitates the achievement of goals through limited resources :- An organisation, if well managed, can accomplishment its goals even

though its resources are limited. The resources are scare, they have to be effectively allocated and utilised in an optimum manner. This is possible only through management.

(7) It is the key to the Economic growth :—

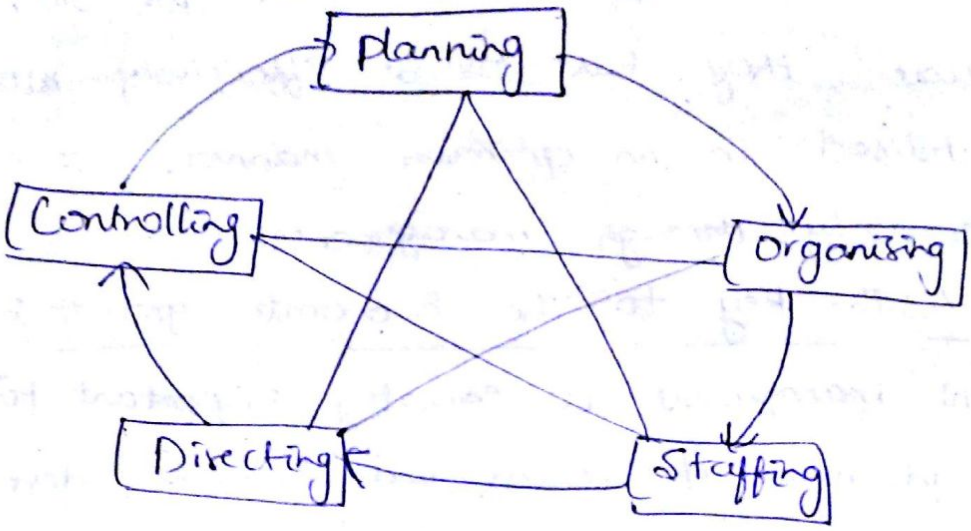
Efficient management is equally important for the nation in terms of Social and Economic development. The Economic development of a country largely depends on the quality of management of its resources.

(8) Management Directs the Organization :— Management directs and controls the functioning of an Organization just like the way a human mind directs and controls the functioning of the human body.

** Functions of Management :—**

There are five categories of functions. The basic functions of management are,

(1) planning
(2) Organising
(3) Staffing
(4) Directing
(5) Controlling

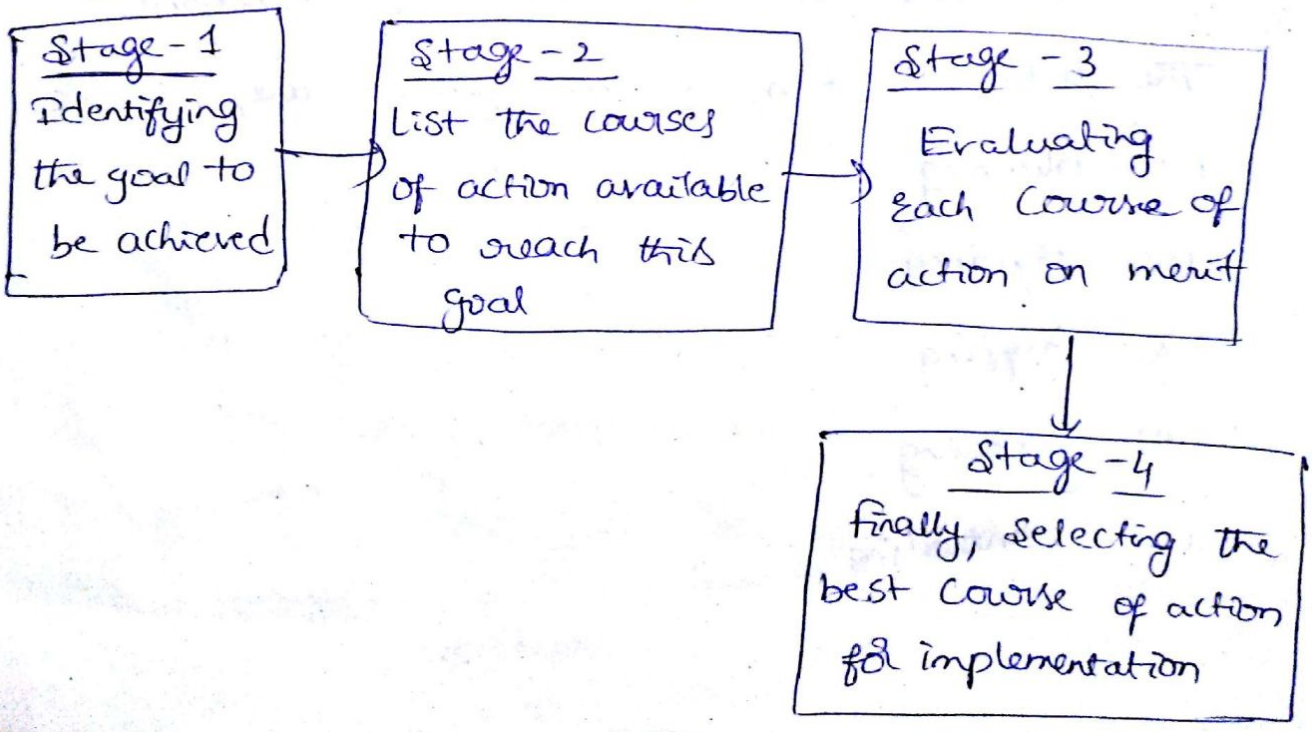


(1) Planning :- It refers to deciding now what is to be done in the future. It bridges the gap between the present and future. The Corporate goals set the direction for planning function.

Planning is also referred to as the Process of determinging the best Course of action to achieve the given goals.

Stages in planning

Planning Consist four stages



(2) Organising :- Organising refers to the process of grouping the related activities and assigning them to a manager with authority to supervise it. organising is an Essential function that makes the plans operational by identifying and classifying necessary activities.

Fayol explains organisation as a structure of relationships. It explains superior - subordinate relationships. Organising shows how the tasks can be achieved with the given resources.

Therefore, it involves the following steps:

(a) Activities determination
(b) Staff recruitment
(c) work allocation
(d) Authority and duty determination
(e) power delegation.

(3) Staffing :- Staffing refers to filling the position in the organisation with the right people. Staffing function covers many jobs such as recruitment, selection, training, placement, appraisals, promotions and Career planning.

(4) Directing :- Directing is concerned with issuing orders and guiding the subordinates so that they can perform their jobs as planned. A manager has to lead his group of people

Effectively, keep them motivated with financial and non-financial incentives, Communicating both form formally and informally, if necessary. It is necessary for the manager to be very good at coordinating the performance of his group of people.

(5) Controlling :- Controlling consists of making the results tally with targets or achieving close correspondence between plans and performance. The process of measuring the current performance of the employees and assessing whether the given objectives are achieved or not.

Controlling is the actual measuring of the performance of employees and comparing the task to the desired goal or outcome.

Scientific Management :—

F.W Taylor is known as Father of the Scientific management the utility of scientific methods to the problems of management was first introduced by F.W Taylor.

Scientific management may be defined as " The Art of knowing exactly what is to be done and the best way of doing it."

Fredrick Winslow Taylor spent a lot of time looking for solutions to the problems on shop floors with an aim to increase efficiency.

Scientific management is the process of application of scientific principles to systematically analyse the work and to find solutions to all the problems associated with improving the efficiency of the methods of working.

Principles of Scientific Management (F.W Taylor)

(1) Replacing the rule of thumb by scientific methods.
(2) Selecting, training, teaching and develop the workman.
(3) Division of work and responsibility.
(4) Cooperation between management and workers.

* Theory X and Theory Y

(Douglas Mc Gregors Theory)

Douglas Mc Gregors has formulated two theories based on the assumptions made by a manager about his employee's nature.

Mc Gregors has characterized these assumption into two opposite view points i.e, Theory 'x' and Theory 'Y'.

Theory X :- This is the traditional theory of human behaviour. The assumptions about the human behaviour are stated as negative in this approach. Based on these assumptions Organi-Zations and managers who belive in theory X kind of human nature attempt to structure, control and closely supervise their Employees. These managers feel that internal control is a must as the Employees are irresponsible.

Assumptions :-

(1) Workers are inherently lazy.
(2) They dislike work.
(3) They have very little ambition
(4) They avoid responsibility, when a opportunity was given.
(5) They require constant guidence and support.
(6) They are inherently ~~self~~ self-centered.

Theory Y :- The assumptions in Theory Y are totally opposite to what we have seen in Theory X. This theory Emphasizes the need for a cooperative effort from management of today i.e, to get maximum output with minimum amount of input, control and direction.

Assumptions :-

(1) These Employees are self direct and self Contro
-lled.

(2) They face all types of challenges and are highly comitted to the Organization.

(3) Whenever a responsibility is given They are ready to accept it.

(4) They are Comitted to Organizational goals.

(5) Most of the workers are Creative.

** Fayol's Principles of Management :-

Henry Fayol is known as Father of Principles of management, Administrative management, Modren management. He was Born in France. An Important Contribution of Fayol is that management is not restricted only to business Organisations. But Can be applied to all Spheres of life.

Fayol defined management functions planning, Organizing, commanding, Coordinating, and controlling While studying Organizations, Fayol Split all Organi
-zational work under six prominent functions.

(a) Technical, - for production

(b) Commercial, for buying and selling

(c) financial, for procuring capital

(d) security, for protecting Organizational resources

(e) Accounting, for maintaining account books

(f) Managerial, for planning and controlling.

~~Faybo~~

Fayol's 14 Principles of Management

(1) Division of work

(2) Authority and responsibility

(3) Discipline

(4) unity of Command

(5) unity of direction

(6) Subordination of interest

(7) Remuneration

(8) Centralization of authority

(9) Scalar chain

(10) Order

(11) Equity

(12) Stability of tenure

(13) Initiative

(14) Esprit de Corps

(1) **Division of Work** :— Works in an Organization must be divided among the various Employees based on their skills and talents. Division of work helps avoid wastage of time and effort.

(2) Authority and responsibility :— Authority is the Power & right to take decisions and responsibility is the obligation for accepting authority. Hence, authority must be Equal to responsibility for the successful Completion of any task.

(3) Discipline :— It means obedience of the rules and regulations set by the Organization and also following of orders and instructions given by Superiors that must be followed for the successful Completion of any work.

(4) Unity of Command :— A Subordinate should rece -ive orders from only one Superior. In turn, the Subordinate should report only to one Superior. This helps in Smooth functioning of the Organization.

(5) Unity of direction :— Same directions should be given to all Employees performing similar activities. In the absence of the unity of direction, there would be Confusion among the Employees.

(6) Subordination of interest :— Every Employee & a group ~~that of an Employee~~ should work in the interest of the Organization and not for his/her own self-interest.

(7) Remuneration :- The wages and salaries must be fair and Bring out the best possible Commit-ment in the Employees to achieve the Siganiz-ational goals. Equal pay for Equal work.

(8) Centralization of authority :- Fayol stated that certain matters are to be centralized and others to be decentralized. Authority is to be centralized when decision-making powers are retained at the top level.

(9) Scalar Chain :- There should be a scalar chain of authority and Communication, ranging from the highest to the lowest and reverse. Each Communi-cation going up or coming down must flow through each position in the line of authority.

(10) Order :- This principle relates to the arrang-ement of things and people in the Siganization. Every-thing in the Siganization should be at the right place.

(11) Equity :- Equity means social justice. Fayol stressed that managers must Exercise justice and kindness while dealing with their subordinates.

(12) Stability of tenure :- An Employee should be given basic security of job which will allow sufficient time to the employee to settle down and successfully perform.

(13) Initiative :- Managers should encourage their employees to take initative to generate suggestions and ideas, think out the plan of action, and execute it. This raises the morale of the employees and gives them a sense of belonging to the organization.

(14) Esprit de corps :- This means "union of strength". Superiors must encourage team spirit among their subordinates. It is team spirit that results in loyalty, dedication, and commitment of the employees toward their departments and organization in general.

Development of Industrial Engineering (History)

→ What industrial engineering is today and aspires to be in future is determined by what has gone before.

→ Industrial Engineering had its roots in the industrial Revolution (around 1750). It was Enriched by various management scholars.

→ Industrial revolution was the result of new inventions, majorly in the textile industry, later steam Egine, advanced metal cutting and manuf-acturing of machine tools. These resulted in factories with large number of workers

→ Management thought began with the growth in the size of Industries. The application of the scientific method of analysis, Experimentation and practical demonstration had been Extended to the production of machine tools, more complicated processes, and better products. Now it was being extended to man's thinking on Organisation and management principles and methods.

→ Frederick Taylor Came up with the philosophies of management and the Concept of productivity. He was father of industrial Engineering and Scientific management.

→ In united states during nineteenth century the formal Education of industrial engineering was introduced. Few people who instigated the studies of industrial engineering are,

(1) Frederick. A. Halsey who is the father of the Halsey premium plan of wage payment.

(2) Henry. L. Gantt who introduced Gantt charts.

(3) Henry R. Towne, Towne Emphasized the Economic aspects and responsibilities of the Engineer's job in a paper that he presented to the ASME.

→ Frederick W. Taylor who was a mechnical Engineer, his writings was the initiation in the stream of industrial engineering under the aegis of ASME.

He suggested much logical and planned methods to the problems of production and shop management. Further, he was also involved in research on metal cutting and the technical issues of production.

→ A highly significant era in the development of industrial engineering began after World War-II. A great many new activities developed and the application of principles and techniques was vastly broadened.

The activities were:

(1) Industrial Engineering and Computer.
(2) Development of system analysis and design.
(3) Application of mathematical and statistical tools.
(4) Network planning techniques and their application.
(5) Value Engineering
(6) Behavioural Science and human factors.

Difference between Management and Organisation

Management	Organization
(1) Management is defined as the process by which managers in an Organization accomplish things through the efforts of other people in a grouped activities.	(1) Organisation is an identifi-able group of people Contributing their efforts towards the attainment of common goals.
(2) Management is a profession which helps the the Individuals to perform Every profession in a Scientific manner.	(2) Organisation is a structure which defines the relationships b/w individuals and positions in an organisation.

(3) It helps in attainment of goals through limited resources.	(3) Strong and result oriented internal Organization helps in growing and diversifying the business.
(4) It makes sure that Organizational operations are carried out smoothly without any difficulty	(4) It makes sure that all the resources are utilized in an optimum manner.
(5) It is an art and Science	(5) It is not an art & science. It is a social group designed for attaining certain goals.

Difference between Administration, Organisation and Management

Administration	Organisation	Management
(1) It mainly deals with the formulation of Corporate policy and coordination of all the functional areas	(1) It is a social group created mainly for attaining specific objectives.	(1) It is a process of developing and maintaining an environment in which individuals works together in groups for attaining the Organizational objectives.

(2) It deals with the objectives policies of the Organization	(2) It is a framework for management process	(2) It performs these policies for attaining the Organizational objectives.
(3) It provides adequate direction and is considered as a directing function	(3) It is machinery for aligning the objectives of the company in a team spirt.	(3) It implements the policies so it is considered as an execution function.
(4) It is regarded as legislative and determinative	(4) It is a system	(4) It is regarded as an art and science.
(5) It does not requires technical ability	(5) Organization also needs technical ability for its progress and development	(5) It needs technical ability for its effective functioning.
(6) It is not productive in nature	(6) It is productive in nature	(6) It is productive in nature

UNIT - 2

PLANT LAYOUT

* Plant Location

" Plant Location refers to the choice of region and the selection of a particular site for setting up a business or factory. But the choice is made only after considering cost and benefits of different alternatives sites. It is a strategic decision that cannot be changed once taken."

Plant Location means deciding a suitable location, area, place, etc., where the plant or factory will start functioning. plant layout involves two major activities. First, to select a proper geographic region and second, selecting a specific site within the region. Plant ~~layout~~ location plays major role in the design of a production system as it determines the cost of

(a) getting suitable raw material

(b) Processing raw material to finished goods; and

(c) finished products distribution to customers.

* Factors affecting plant location :—

(1) Quick availability of raw materials.

(2) Transport facilities.

(3) Nearness to Markets.

(4) Availability of labour
(5) Availability of fuel and Power
(6) Availability of water
(7) Climatic conditions
(8) financial and other Aids
(9) Land
(10) Community Attitude

(1) Quick availability of raw materials :—

It is important for a business, to understand and analyze the proportion of cost of raw material to cost of production for every product. The cost of getting possession of the raw materials from the supply points can be minimized to a great extent if the plant is located close to the place where there is easy access & availability of raw materials.

It will be extremely beneficial set up a plant close to the supply of raw materials, Especially, when the raw materials required are Extremely heavy and delicate to handle. This is the main reason why most rice mills are located close to the paddy fields.

(2) Transport facilities :— A lot of money is spent both in transporting the raw materials and finished goods. Depending up on the size of raw material and finished goods, a suitable method of transport-ation like roads, rail, water & air is selected

and accordingly the plant location is decided.

(3) Nearness to Markets :— It reduce the cost of transportation as well as the chances of the finished products getting damaged and spoiled in the way (especially perishable products). Moreover a plant being near to the market can catch a big share of the market and can render quick service to the customers.

(4) Availability of labour :— stable labour force, of right kind, of adequate size, and at reasonable rates with its proper attitude ~~towa~~ towards work are a few factors which govern plant location to a major extent.

(5) Availability of fuel and Power :— Because of the wide spread use of Electric power, in most cases fuel has not remained a deciding factor for plant location. Even then steel industries are located near source of fuel to cut down the fuel transportation costs

(6) Availability of water :— Water is used for processing, as in paper and chemical industries, and is also required for drinking and sanitary purposes. Depending upon the nature of plant, water should be available in adequate quantity and should be proper quality.

A chemical industry should not be set up at location which is famous for water shortage.

(7) Climatic Conditions :- With the developments in the field of heating, Ventilating and air-conditioning, climatic of the region does not present much problem. Of course, control of climate needs money.

(8) Financial and other Aids :- Certain States give aids as loans, feed money, machinery, built up sheds, etc. to attract industrialists.

(9) Land :- Area, the shape of the site, cost, drainage and other facilities, the probability of floods, Earthquakes etc. influence the selection of plant location.

(10) Community Attitude :- Success of an industry depends very much on the attitude of the local people and whether they want work or not.

* Plant layout

A plant layout is an arrangement of facilities and services in the plant. It outlines relationship between production centres and departments.

Plant layout can be defined as an optimum arrangement of industrial facilities, including personnel, Equipments, storage space, material

dling equipments and all other supporting service on existing or proposed plants.

Plants layout can be defined as: "A technique of locating machines, processes and plant services within the factory inorder to secure the greatest possible output of high quality at the lowest possible total cost of production."

Objectives of a Good plant layout :-

(1) Integrate the production centres.
(2) Reduce Material Handling
(3) Effective utilization of available space.
(4) Worker Convenience and Job Satisfaction.
(5) Flexibility
(6) Quick disposal of work
(7) Avoids Industrial accidents.

Importance of Plant layout :-

(1) The layout determines the arrangement of facilities and services in the plant. It outlines the relationship between production centres and service departments.
(2) It determines the type of handling systems their integration in the overall production Programme, and the cost of their installation.
(3) It specifies the location, accessibility, and size of stores, and also the space and location of temporary storage for work in process.

(4) Machine utilization is partly determined by layout.

Factors Influencing plant layout :—

(1) Management policy.
(2) Manufacturing process
(3) Nature of product.
(4) Volume of production
(5) Type of Equipment
(6) Type of building
(7) Availability of total floor area
(8) Arrangement of material handling Equipment.
(9) Service facilities
(10) Possibility of future expansion.

(1) Management policy :— Management has to decide on many matters, E.g. nature and quality of products, Size of the plant, Integration of production process, plans for Expansion, amount of inventory in Stock, Employee facilities etc.

(2) Manufacturing process :— The type of manufacturing Process, E.g. Synthetic / analytical, Continuous / intermittent and repetitive / non-repetitive, which will govern the type of plant layout.

(3) Nature of Product :— The type of product to be manufactured affects plant layout in several ways. Small and light products can be moved Easily

to the machines whereas for heavy and bulky Products the machines may have to be moved

(4) Volume of Production :- The plant layout and material handling Equipment in the large Scale Organisation will be different from the same in the Small Scale manufacturing industry.

(5) Type of Equipment :- The use of Single purpose and multi-purpose machines Substantially affects the plant layout.

(6) Type of building :- The plant layout in a Single Storey building will be different from that in a multi storey building. The Covered area, the number of Storeys, Elevators, Stairs, Parking and Storage area all affect the layout.

(7) Availability of total floor area :- The allocation of space for machines, work benches, Sub-Store, etc. is made on the basis of the available floor area.

(8) Arrangement of material handling Equipment :-

The plant layout and material handling services are closely related and the latter has a decisive effect on the arrangement of production process and plant Services.

(9) Service facilities :- The layout of factory must include proper service facilities required for the comfort and welfare of workers. These include canteen, lockers, drinking water, first aid etc.

(10) Possibility of future Expansion :- Plant layout is made in the light of future requirements and installations of additional facilities.

* Principles of Plant layout :-

According to Muther, there are six basic Principles of best layout, which may guide the plant layout Engineers. These Principles are;

(1) Principle of overall Integration
(2) Principle of minimum movement
(3) Principle of Smooth and Continuous flow.
(4) Principle of Cubic Space.
(5) Principle of Satisfaction and safety.
(6) Principle of flexibility

(1) Principle of overall Integration :- According to this principle, the best layout is one which integrates the men, materials, machinery, supporting activities and any other such factors that results in the best compromise.

(2) Principle of minimum movement :- According to this Principle, the number of movements

workers, and materials and the distance moved should be minimized. The material should be transported in bulk rather than in small amounts.

(3) Principle of Smooth and Continuous flow :— It states that, bottlenecks, Congestion points and backtracking should be removed by proper line balancing techniques.

(4) Principle of Cubic Space :— Besides using the floor space of a room, if the ceiling height is also utilized, more materials can be accommoda-ted in the same space.

(5) Principle of Satisfaction and Safety :— working places — safe, well-ventilated and free from dust, noise, fumes, odours and other hazardous conditions helps to increase the Efficiency of the workers and improve their morale.

(6) Principle of flexibility :— It means that the best layout is one which can be adopted and re-arranged at a minimum cost with least inconvenience.

Types of layouts (plant layouts)

There are four types of layouts. They are;

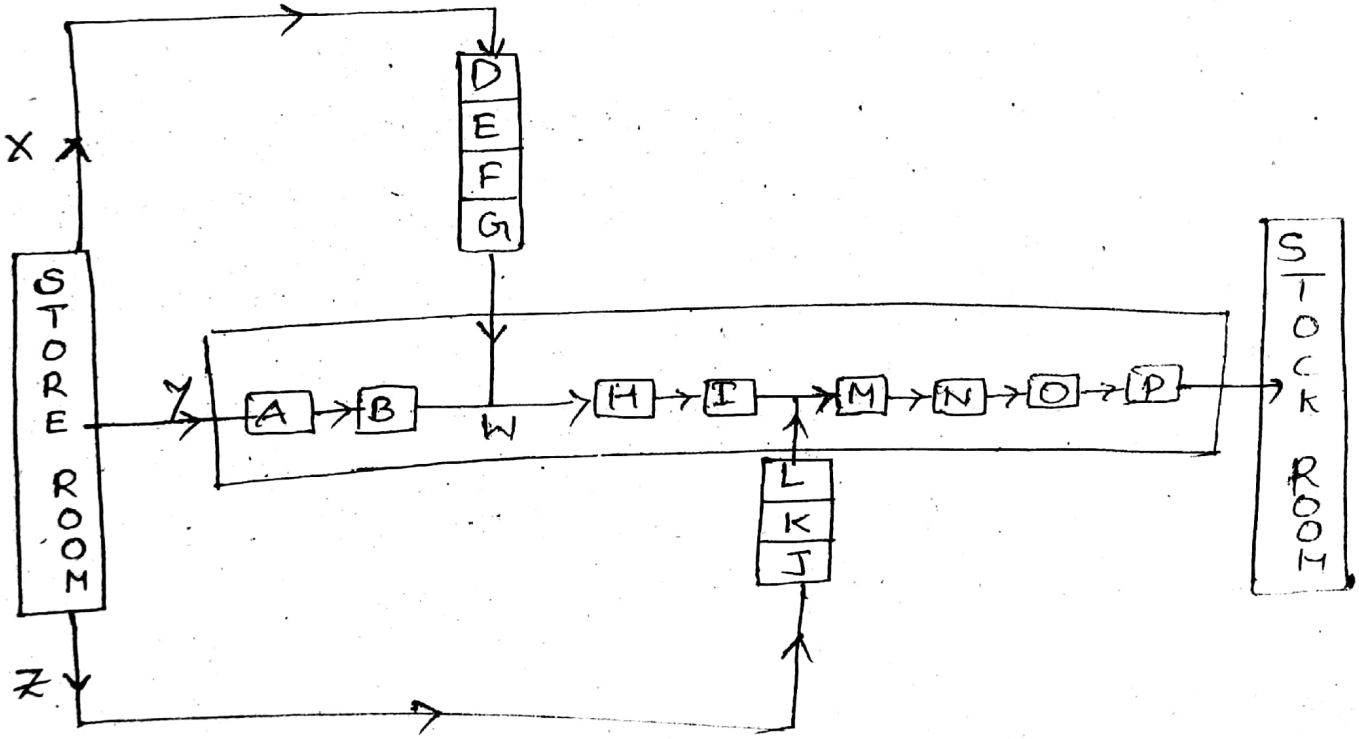
(1) Product layout

(2) Process layout

(3) Fixed position layout

(4) Combination layout.

(1) Product layout :- It is also known as line layout. It implies that various operations on raw-material performed in a sequence and the machines are placed along the product flow line, i.e, machines are arranged in the sequence in which the raw-material will be operated upon. This type of layout is preferred for continuous production.



Product layout

Raw material from the Stole is fed to three lines X, Y and Z. Material in X line gets Processed on machines D, E, F and G and meets material of Y line after it has been processed on the main assembly line machine A & B. Products of X and Y lines are assembled at W and get processed on machines H and I till another part comes from Z line and assem - bles with the main product at V. After that the total assembly get worked on machine M, N, O and P and goes to the Stock room.

Advantages :—

(1) Less Space requirements for the Same Volume of production.

(2) Automatic material handling, lesser material handling movements, times and costs.

(3) Less in - process inventory.

(4) Product completes in lesser time.

(5) Better Co-ordination and Simple production planning and Control.

(6) Smooth and Continuous workflow.

(7) Less Skilled workers may Serve the purpose.

Disadvantages

(1) Since the specified product determines the layout, a change in product involves major

Changes in layout and thus the layout flexibility is considerably reduced.

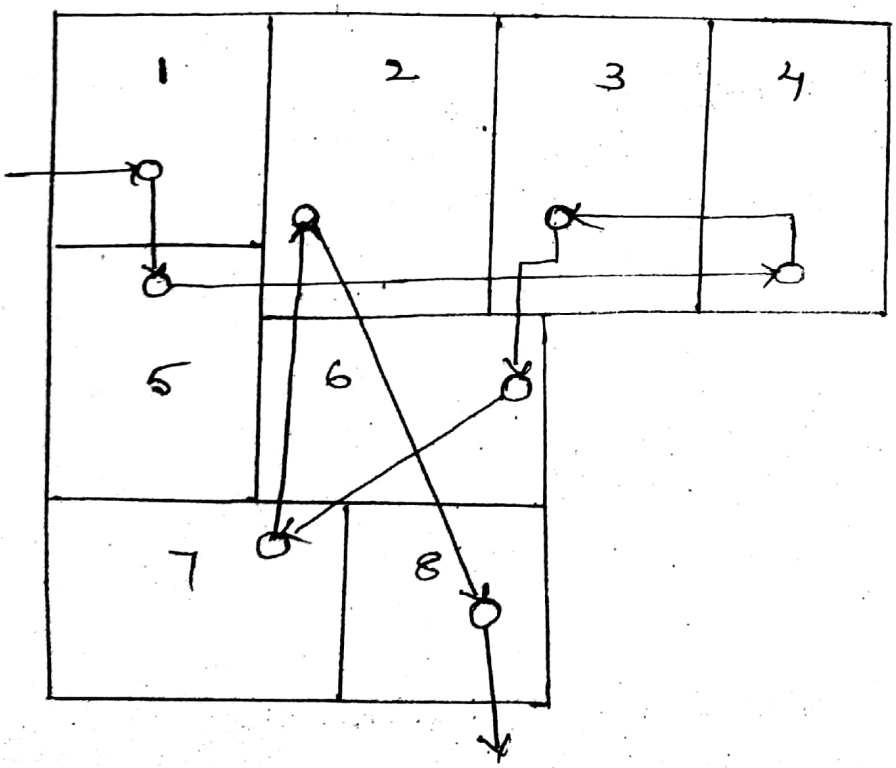
(2) It is quite expensive.

(3) Once the layout is made expansion is difficult.

(4) It is difficult to increase production beyond the capacities of the production lines

(5) Failure of even one machine leads to shutdown of the complete production line.

(2) Process layout :— It is also known as functional layout and is characterised by keeping similar machines & similar operations at one location. In other words, all lathes will be at one place, all milling machines at another and so on, that is, machines have been arranged according to their functions. This type of layout is preferred for job order production.



(1) Store room
(2) Inspection Department
(3) Broaching section
(4) Milling section
(5) Lathe section
(6) Shaper section
(7) Drill section
(8) Stock Room

Advantages :—

(1) Comparatively less number of machines are needed, thus involving reduced Capital investment

(2) Better product Quality, because the Supervisors and workers attend to one type of machines and operations.

(3) Better utilization of the available Equipment.

(4) Machine breakdowns can easily be negotiated by shifting the work to other machines.

(5) Workers in one section are not affected by the nature of the operations carried out in another section. for Example, a lathe operator is not affected by the rays of the welding as the two sections are quite separate.

Disadvantages :—

(1) Automatic material handling is extremely difficult.

(2) More material - in - process remains in queue for further operations.

(3) work in process inventory is large.

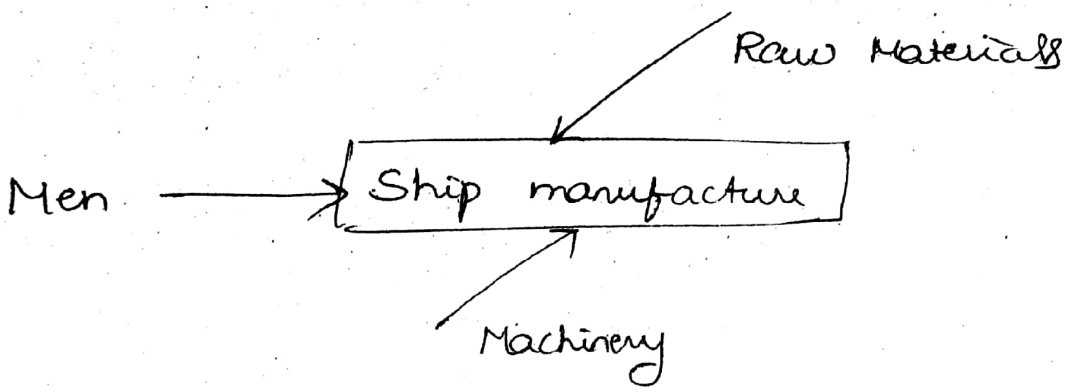
(4) Production Control becomes difficult.

(5) Material handling cost will increase.

(6) Raw material has to travel larger distances for being processed to finished goods. This increases material handling and the associated costs.

(3) Fixed layout :- In this type of layout, al manufacturing facilities are brought and arra at the work site. The required input resou (such as machines, Equipments, men, materials, are shifted from their respective positions to one fixed position, where production operation are required.

Example :- Layout by fixed position of the Production is inherent in ship building, aircraft manufacturing and flyover Constructions.



Advantages

(1) It involves least movement of materials thereby minimizing material handling cost.

(2) We can achieve maximum flexibility and adaptability in production and process.

(3) It is possible to assign one or more skilled workers to a project from start to finish in order to ensure continuity of work.

(4) Space can be effectively utilized and the same layout can be used for many different projects

Disadvantages :-

(1) It usually involves a low content of work - in - progress.

(2) There appears to be low utilization of labour and Equipment.

(3) It involves high Equipment handling costs.

(4) It sometimes proves to be unsafe and hazardous as workers are engaged in different activities simultaneously on the same job.

(4) Combination layout :- It is also known as Cellular layout. Combination layout is a layout formed by taking into consideration the advantages of functional layout and product layout. In this layout machines are grouped into cells as similar to that process layout and these cells function on the lines of product layout within large shop floor. Each cell produces a single part of a family. The machines are arranged according to the similarity of operations.

Example, casting, milling, welding etc., and these parts of the family are assembled taking into considering the advantages of product layout.

Combination layout is useful where items or products are being made in different types and sizes.

Combination layout

Process layout	Product layout
Produce Various operations Stamping | welding | Heat treatment	Manufacturing various Components parts. Assembly. A → B → C → D → E

Advantages :-

(1) less work - in - process.
(2) Reduces handling costs.
(3) Improves & Enhances production control.
(4) Increases the responsibility of workers.

Disadvantages :-

(1) Reduces the manufacturing flexibility.
(2) Increases the machine idle time.
(3) Requires huge capital Expenditure.
(4) Machines can not be replaced easily.

** Difference between Product layout and Process layout :-

Product layout	Process layout
(1) It is very much suitable for a standard Product where mass production is required.	(1) It is highly concerned with different job orders & different types of products.

It requires less floor area.	(2) It requires larger floor area when Compared to product layout.
3) Less skilled workers may serve the purpose.	(3) It requires dedicated skilled workers.
4) Better production control is possible.	(4) Production control is difficult.
5) Involves less production time.	(5) Requires more production time compared to product layout.
(6) Involves less-in-process inventory.	(6) Involves high inventory and inventory carrying cost.
(7) Full utilization of the plant is possible.	(7) utilization of plant greatly depends on the nature of product.
(8) Supervision is very simple.	(8) It requires extensive supervision.

Layouts Applications

Applications of product layout :- (Line layout)

The following are the circumstances in which Product layout is used.

(1) Product layout is used when one or few Products are standardized.

(2) When a firm has to Produce large volume of items.

(3) When the inspection needed during the sequence of operations is less.

(4) If the same machine or a work station is not applied for performing more than one operation.

(5) When the materials and products allow continuous handling by mechanical methods.

Application of process layout :-

(1) Process layout is used when several types of products are produced or when special orders are emphasized.

(2) It is used when the volume of production of individual items is relatively low.

(3) It can be used when many inspections are needed during a sequence of operations.

(4) Process layout is used when the same machine or work station is used for two or more different operations

(5) It is used when materials or products are in substantial amount and allows continuous handling by mechanical methods.

(6) It is mostly used in intermittent production

Applications of fixed position layout :-

(1) When the material used in operations needs only tools or simple portable machines.

(2) When manufacturing only few pieces of items.

3) When the cost of transferring the bulk volume of material is very high.

4) When the skill of workmanship depends on the abilities of the workers.

Applications of Combination layout :-

(1) It helps in producing products having different parts.

(2) It can applied in the work centres having easily movable machine tools.

(3) It is used when the production of a product is independent of its capacity.

(4) A combination layout is suitable when an item has to be produced in various forms and size.

(5) It can be employed when several items are produced in same sequence but these items should not be produced in bulk.

** Plant Maintenance

Plant :- A plant is a place, where men, materials, money, equipment, machinery etc., are brought together for manufacturing products.

Maintenance :- Maintenance is defined as that function of production management concerned with the day to day problem of keeping the physical plant in good operating condition.

Maintenance management is concerned with the direction and organisation of resources in order to control the availability and performance of the industrial plants to some specified level.

Scope of Maintence Management :-

It is very Essential for all the manufacturing organisations to manage maintenance as machines breakdown, parts wear out and buildings deteriorate after a particular period of time.

The scope of maintenance management includes two types of functions are as follows,

(1) Primary functions
(2) Secondary functions

(1) Primary functions :-

(a) To maintain existing plant and Equipments.
(b) To install new Equipments and buildings.
(c) To maintain Existing plant buildings and grounds.
(d) To modify Existing Equipments and buildings
(e) To inspect Equipment and lubrication.

(2) Secondary functions :-

(a) To keep the stock of spare parts.
(b) To protect the plant.
(c) To provide insurance against fire, theft etc.
(d) To reduce pollution and control noise.
(e) To dispose off the waste.

Objectives of Maintenance Management :-

(1) It reduces the loss of productive time due to equipment failure.
(2) To reduce the repair time and repair cost.
(3) It is optimally utilise maintenance personnel and equipments.
(4) To Enhance the quality of products and to bring improvement of productivity.
(5) To reduce the losses incurred due to stoppage of production.
(6) To reduce the frequency of accidents by regularly carrying out the inspection and repair of the safety devices.
(7) To maintain all productive assets in a good operating condition.
(8) To Extend the life of capital assets by improving their handling mechanisms.

Plant Maintenance :-

Plant maintenance is concerned with actions taken by the plant user to maintain an Existing System and facilities or to restore it to an operating condition.

Plant maintenance - methods, strategies, and Practices used to keep an industrial factory running efficiently.

The general aim of plant maintenance is to Create a productive working Environment that is also safe for workers.

Objectives of plant Maintenance :—

(1) The objective of plant maintenance is to achieve minimum breakdown and to keep the plant in good working condition at the lowest possible cost.

(2) Machines and other facilities should be kept in such a condition which permits them to be used at their optimum (profit making) capacity without any interruption or hindrance.

(3) Maintenance division of the factory ensures the availability of the machines, buildings and services required by other sections of the factory for the performance of their functions at optimum return on investment whether this investment be in material, machinery or personnel.

** Types of Maintenance :—

Maintenance may be classified into following categories.

(1) Corrective or Breakdown maintenance.
(2) Scheduled Maintenance
(3) Preventive maintenance
(4) Predictive maintenance.

(1) **Breakdown Maintenance** :— Breakdown maintenance implies that repairs are made after the Equipment is out of order and it cannot

perform its normal function any longer, e.g, an electric motor will not start, a belt is broken, etc.

under such conditions, production department calls on the maintenance department to rectify the defect. The maintenance department checks into the difficulty and makes the necessary repairs.

After removing the fault, maintenance engineers do not attend the equipment again until another failure or breakdown occurs.

Objectives of Breakdown Maintenance :-

(1) To restore the normal functioning of an Equipment by repairing it so as to minimise the production interruptions. This objective has a direct impact on production capacity, production costs, product quality and the level of customer's satisfaction.

(2) To supervise and control the cost of repair crews which is inclusive of regular time and overtime labour cost.

(3) To manage and to reduce the operation cost of repair shops.

(4) To use adequate amount of repairs for each breakdown.

~~Advantages~~ Typical Causes of Equipment Breakdown :-

(1) Failure to replace worn out parts.

(2) Lack of lubrication.

(3) Neglected cooling system.
(4) External factors (such as too low & too high line voltage, wrong fuel etc).

Advantages :—

(1) It is highly economical for the Equipments & machines whose downtime & repair cost is low.
(2) The cost incurred on this type of maintenance is less when compared to the other types of maintenance.
(3) It involves very less administrative work.
(4) Considerably small number of Employees are able to handle breakdown maintenance.

Disadvantages :—

(1) Breakdowns generally occur at inopportunate times. This leads to poor, hurried maintenance and excessive delays in production.
(2) Reduction of output.
(3) Faster plant deterioration.
(4) Increased chances of accidents and less safety to both workers and machines.
(5). More spoilt material.
(6) Direct loss of profit.
(7) Breakdown maintenance practice cannot be employed for those plant items which are regulated by statutory provisions, for example Cranes, lifts and pressure vessels.

* Scheduled Maintenance :-

→ Scheduled Maintenance is a stich - in - time procedure aimed at avoiding breakdowns.

→ Breakdowns can be dangerous to life and as far as possible should be minimized.

→ Scheduled maintenance practice incorporates (in it) inspection, lubrication, repair and overhaul of certain equipments which if neglected can result in breakdown.

→ Scheduled maintenance practice is generally followed for overhauling of machines, cleaning of water and other tanks, white - washing of buildings, etc.

(3) Preventive Maintenance :- Preventive maintenance is a schedule of planned maintenance actions aimed at the preventive of breakdowns and failures. The primary goal of preventive maintenance is to prevent the failure of Equipment before it actually occurs.

It is designed to presolve and Enhance equipment reliability by replacing wan Components before they actually fail.

In other words, Preventive maintenance means daily maintenance (cleaning, inspection, oiling and re - tightening).

Objectives of Preventive maintenance :—

(1) To minimize the possibility of unanticipated Production interruption & major breakdown by locating & uncovering any condition which may lead to it.

(2) To make plant Equipment and machinery always available and ready for use.

(3) To maintain the value of Equipment and machinery by periodic inspections, repairs, overhauls, etc

(4) To maintain the optimum productive efficiency of the plant Equipment and machinery

(5) To maintain the operational accuracy of the plant Equipment.

(6) To reduce the work content of maintenance jobs

(7) To achieve maximum production at minimum repair cost.

(8) To attain maximum production at less repair cost.

Advantages :—

(1) Helps in increasing the service life of machines and Equipments by reducing its damage.

(2) Reduces the frequency with which machines undergo breakdowns.

(3) It helps in improving the productivity by reducing machine downtime and loss of production

(4) Ensures secure working conditions for worker causing less accidental damages.

(5) Through reduced breakdowns and repairs the reliability of a production system can be increased.

(6) Increased equipment life.

(7) Reduced breakdowns and connected down-time.

(8) Improved safety and quality conditions.

Disadvantages :—

(1) Preventive maintenance is very expensive in short run and during the early stages of maintenance programme.

(2) In preventive maintenance, the inspection of plant, equipment and machinery need careful planning before its implementation.

(4) Predictive Maintenance :— It is comparatively a newer maintenance technique. It makes use of human senses or other sensitive instruments such as, Audio gauge, vibration analyzers, Amplitude meters, pressure, temperature and resistance strain gauges, etc., to predict troubles before the equip-ment fails.

In predictive maintenance, equipment conditions are measured periodically or on a continuous basis and this enables maintenance men to take a timely action such as equipment adjustments, repair or overhaul.

Predictive maintenance extends the service life of an equipment without fear of failure.

UNIT-III

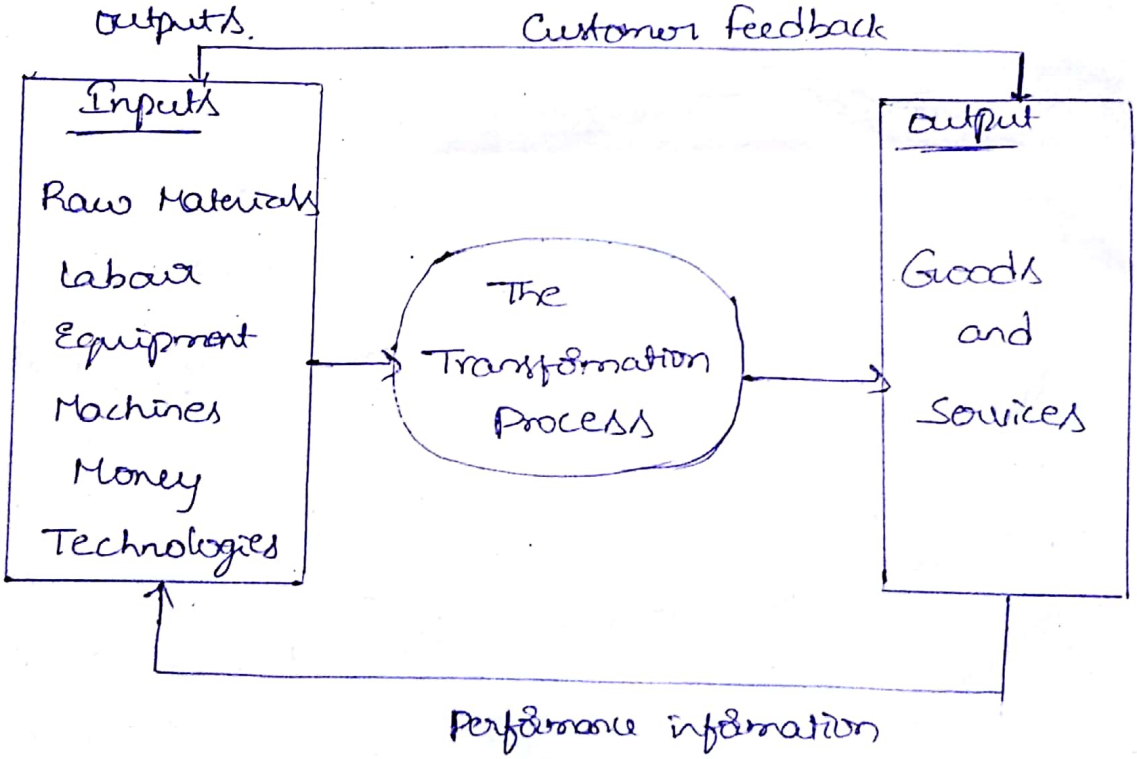
OPERATIONS MANAGEMENT

Operation Management :—

Operation management is an area of management Concerned with designing and controlling the process of Production and redesigning business operations in the production of goods or services.

Operation management is the set of activities the Create value in the form of goods and Servi-ces by transforming Inputs into output.

Operation management transforms inputs to outputs.



Scope / objectives of operation management :—

The main aim of operations management is to increase the customer satisfaction at the least cost. As such, its scope includes long term strategic decisions and short term planing.

Scope of Operations Management

- Long term Decisions
  - (1) Product design and selection
  - (2) Process design and selection
  - (3) Facility location
  - (4) Plant layout design
  - (5) Capacity planning
- Short term Decisions
  - (1) Production planning
  - (2) Production Control
  - (3) Inventory Control
  - (4) Quality Control
  - (5) Maintenance and Replacement

Importance / significance of operations Management :—

→ Improving better supplier management
→ Elimination of unproductive resources / wastes.
→ Increasing the productivity
→ Gaining competitive advantages over the competitors
→ Producing efficient products / services which satisfies the customers.

Work Study :—

One of the most powerful tools to in improving Productivity is work study.

Work study is :-

* The systematic examinations of the methods of carrying on activity
* To improve effective use of resources
* To set up standards of performance.

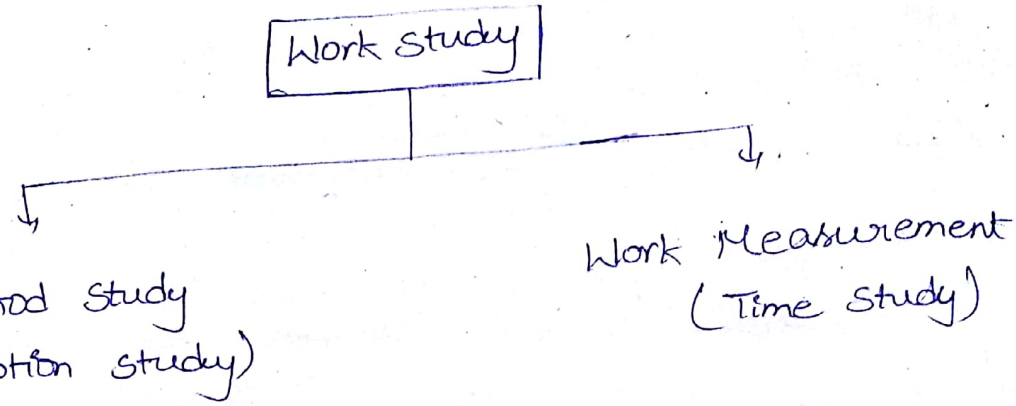
Actually, work study investigates the work done in an organisation and it aims at finding the best and most efficient way of using avail -able resources, i.e., men, material, money and machinery. Every organisation tries to achieve best quality production in the minimum possible time.

Objectives of Work study :—

* To analyse the present method of doing a job, systematically in order to develop a new and better method.
* To measure the work content of a job by meas -uring the time required to do the job for a qualified worker and hence to establish standard time.
* To increase the productivity by ensuring the best possible use of human, machine and material resources and to achieve best quality product/

Service at minimum possible cost.

(4) To improve operational efficiency.



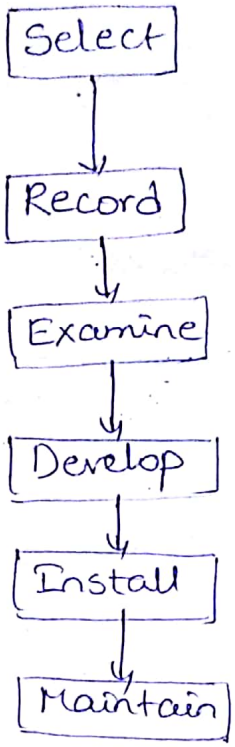
(1) Method Study :—

"Work methods analysis or method study is a scientific technique of observing, recording and critically examining the present method of performing a task or job or operation with the aim of improving the present method and developing a new and cheaper method"

Objectives of Method Study :—

(1) Improvement of processes and procedures
(2) Improvement in the design of plant and Equipment
(3) Improvement of layout (work place layout)
(4) Improvement in the use of men, materials and machines
(5) Economy in human effort and reduction of unnecessary fatigue.
(6) Improvement in safety standards
(7) Development of better working Environment.
(8) Efficient and fast material handling

Method Study procedure :-



(1) Select :- Select the work with studying and define the objectives to be achieved. An objective may be to reduce the manufacturing cost, or to reduce bottlenecks or to reduce fatigue incurred by the workers in order to increase their efficiency.

(2) Record :- Record all relevant facts about the job or process or operation using suitable charting techniques.

(a) Process charts :-

(i) Outline process chart

(ii) Flow process chart (Man type, Material type an Equipment type)

(iii) Two handed process chart

(iv) Multiple activity chart.

(b) Diagrams :

(i) Flow diagram

(ii) String diagram

(iii) Cyclegraph

(iv) Chronocyclegraph.

(c) Motion and film Analysis

(i) Simo Chart

(d) Models, etc.

(3) Examine :- Examine the recorded events critically and in sequence. Critical examination involves answer to a number of questions. An activity can be eliminated, simplified & combined with another. The basic questions are,

Purpose.	what is done?
Person	who does it?
place	where it is done?
Means	How is it done?
Sequence	when is it done?

Alternative ways of doing. what else could be done, who else could do it, where else it could be done, how else it could be done. and when else it could be done.

Best Method of doing. what should be done, who should do it, where it should be done, how it should be done, and when it should be done

(4) Develop :- Develop the best method as resulted from critical examination and record it. The developed method should be,

(i) Practical and feasible.

(ii) Safe and effective

(iii) Economical

(iv) Acceptable to design, production control, quality control and sales departments.

(5) Install :- Install the (best) developed method. Installation involves three phases, namely - planning, arranging and implementing. During first two stages the programme of installation and a time table, are planned and the necessary arrangements of resources, equipments, tools and instructions to workers, over time, etc, are made. The implementation involves the introduction of developed method as standard practice.

(6) Maintain :- Maintain the new method, i.e., ensure the proper functioning of the installed method by periodic checks and verifications.

Work Measurement / Time Study :-

Work Measurement may be defined as the application of different techniques to measure and establish the time required to complete the job by a qualified worker at a defined level of performance.

It is concerned with the determination of the amount of time required to perform a unit of work. It is very important for promoting productivity of an Organization.

Objectives of Work Measurement :—

(1) Determine the time required to do a job; thus it compares alternative methods and establishes the fastest method.

(2) decides man power required for a job; It helps in man power economy.

(3) To decides Equipment requirements

(4) Provides information for effective production planning and maintenance procedures.

(5) To decides realistic labour budgeting and Provides a basis for standard costing system.

(6) Provides a basis for fair and sound incentive Schemes.

(7) results in effective labour control.

Uses of Work Measurements :— (Advantages)

(1) It is used in planning work and in drawing out schedules

(2) It is used to determine standard costs.

(3) It is used as an aid in preparing budgets.

(4) It is used in balancing production lines for new products.

(5) work measurement is used in determining machine effectiveness.

(6) To establish supervisory objectives and to provide a basis for measuring supervisory efficiency.

(7) To determine time standards to be used as a basis for labour cost control.

Work Measurement procedure :-

Work Measurement

↓

Aim : To develop Time standard

↓

Procedure

* Describe the given work for Measurement
* Break the job into elements
* Measure the performance of operator
* Determine the basic time
* Provide time allowance for fatigue etc
* Determine standard time

↓

Result

Increased efficiency and Higher productivity through
* Scientific basis to develop incentive systems
* Maintain reasonable levels of Employment
* Reliable means of planning and control

Difference between Method study and work measurement :-

Method Study	Work measurement
(1) The systematic maintenance and key examination of the ways to perform task & job with an aim of to improve is Considered as Method study.	(1) It facilitates qualified worker to perform a task at a specified rate of working through application of techniques.
(2) It deals with Elimination of unnecessary work Content of a job (&) operation.	(2) It deals with the investigation and unnecessary time involved.
(3) It usually reviews the methods, layout and equipment.	(3) It measures work load on the basis of time standards.
(4) It is also known as methods of Engineering & work design.	(4) It is called as time study.
(5) It Comprehensively determines the collection of analysis techniques which deals with improvement of men and machines Effectiveness.	(5) It is Considered as Essential for planning and control of operations.

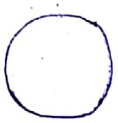
Process charts

A process chart is a classification and graphic representation of production activities in a plant. Thraigh these charts the whole process can be systematically analyzed by subdividing the various operations and material moments constituting the production process and then their effectiveness.

The study of these charts can oreveal the operation that can be eliminated rearranged or simplified to achieve economy in production

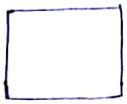
Process charts symbols :—

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

Event	Symbol	Description
1. operation		This involves performing an action which changes the current form of the product.
2. storage		This involves putting away ready products for storage. Example:- Whe the bottled drinks are put into the store after inspection.

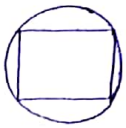
3. Transport ⟹ This involves moving the product & parts thereof from one location to another. Example:- Moving the bottled drinks to the inspection section.

4. Delay  This arises when the product waits for next stage in the process. Example:- When there is a defect spotted in a specific batch of bottled drinks.

5. Inspection  This involves checking whether the quality and quantity of the product is satisfactory & not.

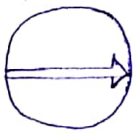
Additional symbols:-

(1) operation - cum - Inspection



This occurs when inspection is taking place during the production process.

(2) operation - cum - Transportation



This occurs when assembly is taking place while the spares are transported by the belt conveyer.

Process charts are three types:-

(1) Outline process chart.
(2) Flow process chart.
(3) Two handed process chart.

(1) Outline Process Chart :- outlines main events sequencewise. It consider only operation and inspections in the given job.

Example :- Refilling the gas cylinder at home.

Task :- Replacing the used gas cylinder with a new one.

Chart begins with :- unscrew cap

Chart Ends with :- Screw cap

unscrew Cap

Remove the old Refill

Bring the new Refill

Screw the cap tight

Test whether the gas stove lights up or not

4 operations

1 Inspection

(2) Flow process Chart :- This is a detailed version of the outline process chart and it records all the events. The modern flow process chart

Provides information about the time taken for all the events and the distance involved for movement of work, materials, machinery, and men.

The flow process chart can be of three types:

(1) Man type → Records only what the man does

(2) Material type → Records only what happens to materials

(3) Equipment type → Records only what happens to the Equipment.

The following flow process chart is typically Presentation of information pertaining to an existing sequence of operations relating to making a screw.

Flow Process chart :- Example - 1

Name of the Component :- Screw

Department :- Manufacturing

NO	Description of the process	Symbols ○ □ ⇨ D ▽	Distance in meters	Time in minutes	Remarks
1.	MS rods from Stores				
2.	To lathe		45	20	By hand trolley
3.	Turning operation				
4.	To Inspection department		20	5	By hand trolley
5.	Inspection				
6.	To boring machine		14	8	By hand trolley
7.	Boring operation				
8.	Inspection				on the shop floor
9.	To lathe for thread cutting		3	5	By hand
10.	Thread Cutting				
11.	To Inspection department		15	10	By hand trolley
12.	Inspection				
13.	To heat treatment section		10	5	By hand trolley
14.	Heat treatment				
15	Inspection				
16.	To Stores		20	10	By van

Summary :-

Activity	Existing
operation	4
Inspection	4
Transportation	7
Delay	0
Storage	2

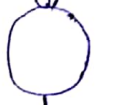
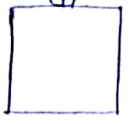
Example - 2 :- Material type flow process Chart

Activity	Symbols	Distance moved	Time	Remark
1) Casting lying in foundry store		–	–	–
2) Moved to gas cutting machine		10	3	By trolley
3) wait, cutting machine being set		–	5	–
4) Risers cut		–	20	–
5) wait for trolley		–	10	–
6) Moved to machine shop		20	6	By trolley
7) Inspected before machining		–	15	–

(3) Two hand process chart :- This records the activities of the left hand and right hand (of an operator) as related to each other. For certain jobs such as typing, watch repair, nail hitting, Cooking, and so on, it is but common to find the operator using both hands.

Let us see how both the hands of the operator are involved in the simple job of nail hitting as shown below.

Job : Nail Hitting

	Left hand	Symbols		Right hand
		Left hand	Right hand	
1	Pick up nail			Pick up the hammer
2	Fix the nail at the required point on the box			Idle
3	Hold			Strike
4	Idle			Inspect

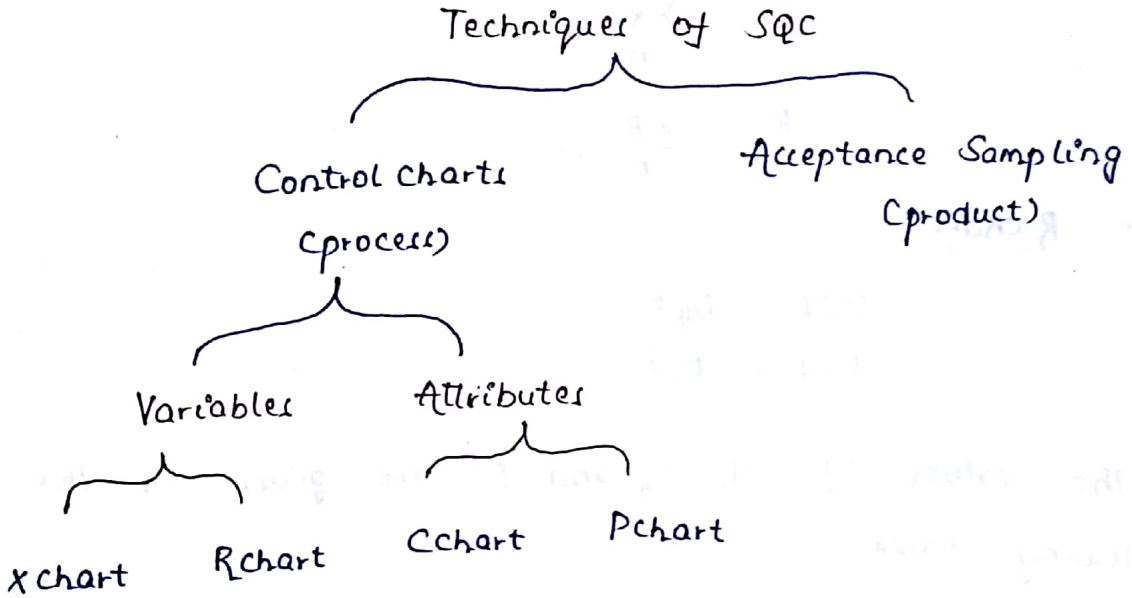
Summary :-

left hand	Right hand
○ 2	○ 2
D 1	D 1
▽ 1	▽ nil
□ nil	□ 1

UNIT - IV

STATISTICAL QUALITY CONTROL

Statistical Quality Control is an Industrial management technique by means of which the product of uniform acceptable Quality are manufactured. It is mainly Concerned with setting things rather than discovering and rejecting those made wrong.



→ Control charts for Variables:

A Variable is one whose Quality measurement changes from unit to unit. The Quality of these Variables is measured interms of hardness, length, fitness.... The Control charts for Variables are drawn using the principle of normal distribution

There are 2 types of Control charts for Variables

- $\bar{\bar{x}}$ Chart
- R Chart

- $\bar{\bar{x}}$ chart :

For each chart there are

- Upper Control limit (UCL)
- Lower Control limit (LCL)

$$UCL = \bar{\bar{x}} + A_2 \bar{R}$$

$$LCL = \bar{\bar{x}} - A_2 \bar{R}$$

$$\bar{\bar{x}} = \frac{\Sigma \bar{x}}{n}$$

$$\bar{R} = \frac{\Sigma R}{n}$$

- R chart :

$$UCL = D_4 \bar{R}$$

$$LCL = D_3 \bar{R}$$

The Values of A_2, D_4 and D_3 are given in the following table

n	A_2	D_3	D_4
2	1.880	0	3.268
3	1.023	0	2.574
4	0.729	0	2.282
5	0.577	0	2.114
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

- $\bar{\bar{x}}$ chart :

For each chart there are

- Upper Control limit (UCL)
- Lower Control limit (LCL)

$$UCL = \bar{\bar{x}} + A_2 \bar{R}$$

$$LCL = \bar{\bar{x}} - A_2 \bar{R}$$

$$\bar{\bar{x}} = \frac{\Sigma \bar{x}}{n}$$

$$\bar{R} = \frac{\Sigma R}{n}$$

- R chart :

$$UCL = D_4 \bar{R}$$

$$LCL = D_3 \bar{R}$$

The values of A_2, D_4 and D_3 are given in the following table

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8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

Question 1 :-

Construct $\bar{\bar{x}}$ and R chart from the following information and state whether the process is in control or not. Each of the following $\bar{x}$ has been completed computed from a sample of 5 units drawn at an interval of half an hour from an ongoing manufacturing process

Sample	$\bar{x}$	R
1	20	23
2	34	39
3	45	14
4	39	5
5	26	20
6	29	17
7	30	21
8	34	11
9	37	40
10	23	10

* $\bar{x}$ chart :-

$$\bar{\bar{x}} = \frac{\Sigma \bar{x}}{n}$$

$$= \frac{317}{10} = \underline{31.7}$$

$$\bar{R} = \frac{\Sigma R}{n}$$

$$= \frac{200}{10} = \underline{20}$$

$$UCL = \bar{\bar{x}} + A_2 \bar{R}$$

$$= 31.7 + 0.577\ (20) \quad (\because \text{Given at 5 units} = A_2 = 0.577)$$

$$= 43.24$$

$$LCL = \bar{\bar{x}} - A_3 \bar{R}$$

$$= 31.7 - 0.577\ (20)$$

$$= 20.16$$

- **R chart:**

$$UCL = D_4 \bar{R}$$

$$= 2.114 \times 20$$

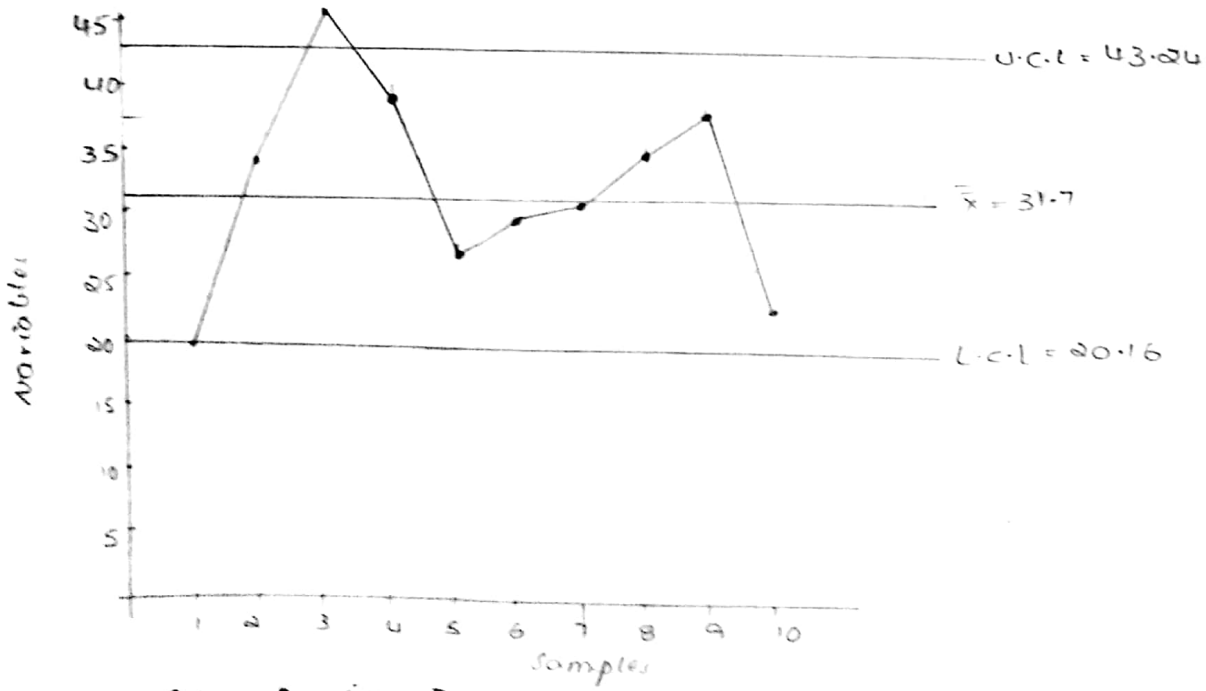
$$= 42.28$$

$$LCL = D_3 \bar{R}$$

$$= 0 \times 20$$

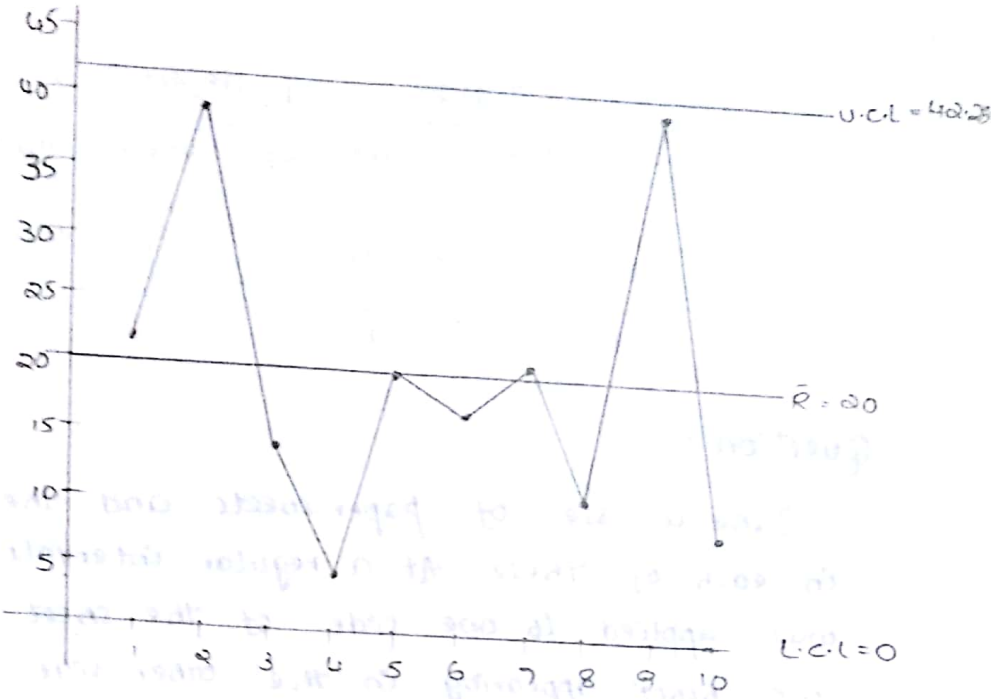
$$= 0$$

* **$\bar{\bar{x}}$ chart :**



At points 3 i.e., $\bar{x} = 45$ the process is not in control it exceeds the UCL

- R chart :



All the points are in between UCL and LCL. So the process is in control.

→ Control Units for Attributes :

The Quality of Attribute can be determined on the basis of Yes or No. In other words in case of a mirror even if there is one scratch on it it is not considered as Quality mirror. Each scratch is a defect. In some cases if no of defects per unit is low it can be sold as second Quality item. The Control charts for Attributes are

- C Chart
- P Chart

* 'C' chart :

C Chart is used where there are no of defects per unit. this Controls the no of defects per unit. A Control unit Chart reveals the pattern of the quality.

$$\bar{c} = \frac{\text{Total no. of defects in all samples}}{\text{Total no. of samples Inspected}}$$

$$UCL = \bar{c} + 3\sqrt{\bar{c}}$$

$$LCL = \bar{c} - 3\sqrt{\bar{c}}$$

Question :.

Take a case of paper sheets and the no. of defects in each of these, At a regular intervals a coloured ink was applied to one side of the sheet. Each individual ink blocks appearing in the other side of the sheet within 3 minutes is counted as a defect. The particulars of the no. of defects in each sample is given Below

Sample no.	No. of Defects
1	5
2	4
3	9
4	7
5	8
6	9
7	4
8	5
9	2
10	6
11	4
12	6
13	7
14	3
15	5
16	3
17	2
18	1
19	7
20	3

$$\bar{c} = \frac{\text{Total no. of defects in all samples}}{\text{Total no. of samples inspected.}}$$

$$= \frac{100}{20} = 5$$

$$UCL = \bar{c} + 3\sqrt{\bar{c}}$$

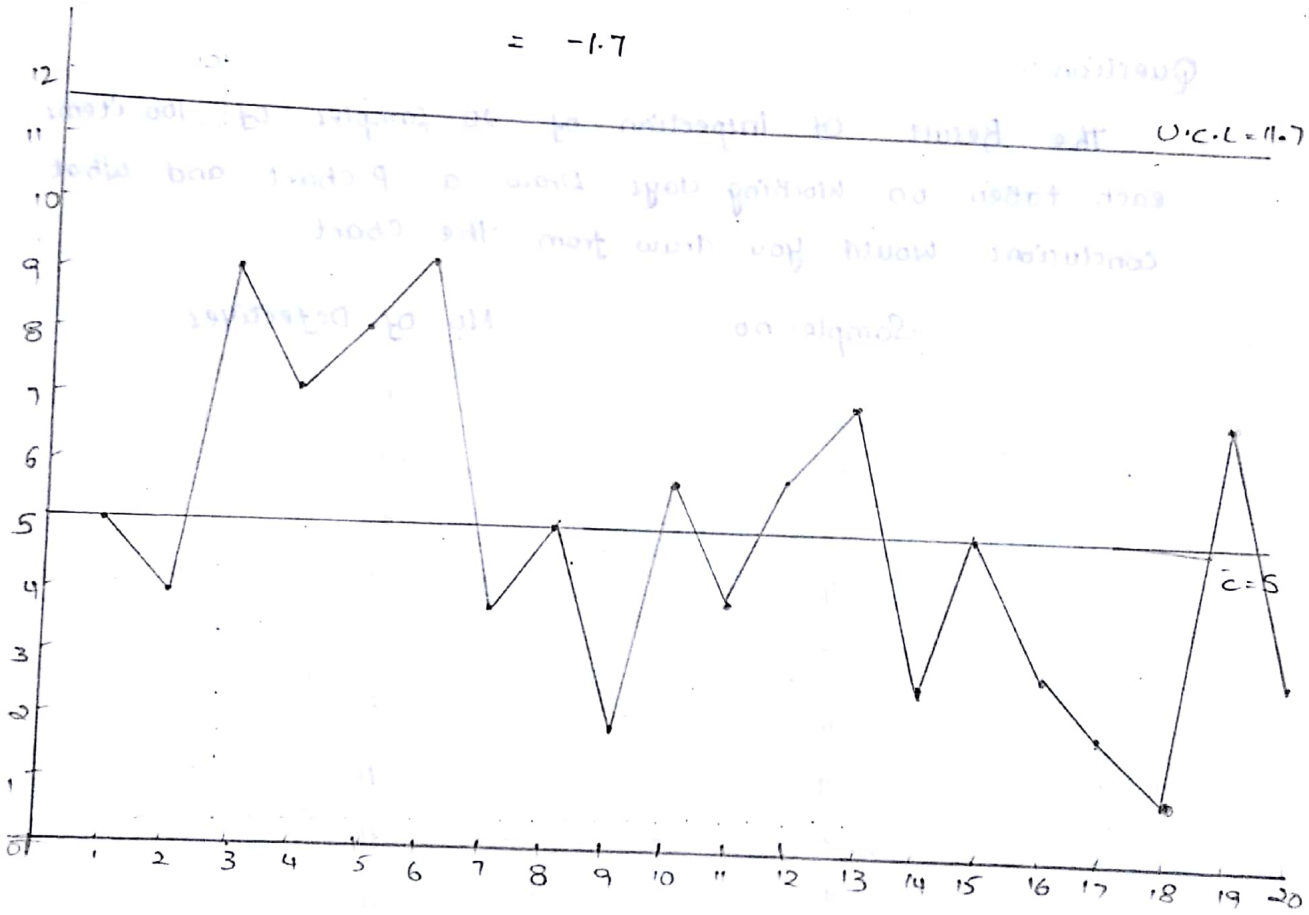
$$= 5 + 3\sqrt{5}$$

$$= 11.7$$

$$LCL = \bar{c} - 3\sqrt{\bar{c}}$$

$$= 5 - 3\sqrt{5}$$

$$= -1.7$$



* **P chart :-**

These charts are constructed by recording atleast 20 sucessive inspections. The percentage of defective items is then calculated. The control limits for P chart are given below.

$$\bar{P} = \frac{\sum p}{nk}$$

$$UCL = \bar{p} + 3\sqrt{\left(\frac{\bar{P}(1-\bar{P})}{n}\right)}$$

$$LCL = \bar{p} - 3\sqrt{\frac{(\bar{P}(1-\bar{P})}{n}}$$

$\bar{P}$ = Central line

p = no of defective items in a sample

k = Total no of samples

n = Sample size

Question :-

The Result of Inspection of 20 samples of 100 items each taken on working days. Draw a P chart and what conclusions would you draw from the chart.

Sample no	No. of Defectives
1	9
2	17
3	8
4	7
5	12
6	5
7	11
8	16
9	14
10	15
11	10
12	6
13	7
14	18
15	16
16	10

17	5
18	14
19	7
20	13

Total no. of items Inspected

= no. of samples x Units Inspected in each sample

= 20 x 100

= 2000 units

$$\bar{p} = \frac{\Sigma p}{nk} = \frac{\text{Total no. of defectives}}{\text{Total no. of items inspected}}$$

$$= \frac{220}{2000} = 0.11 \times 1000$$

$$= 11$$

$$C.L = 0.11$$

$$U.C.L = \bar{p} + 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

$$= 0.11 + 3\sqrt{\frac{0.11(1-0.11)}{100}}$$

$$= 0.20 \times 100$$

$$= 20$$

$$L.C.L = \bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

$$= 0.016 \times 100$$

$$= \underline{16}$$

→ Acceptance Sampling :

Acceptance sampling is the process of ensuring the quality of the products before they are sent for sale

Acceptance sampling is a technique where a sample is drawn randomly from a whole lot and it is checked for no of defectives before Accepting it

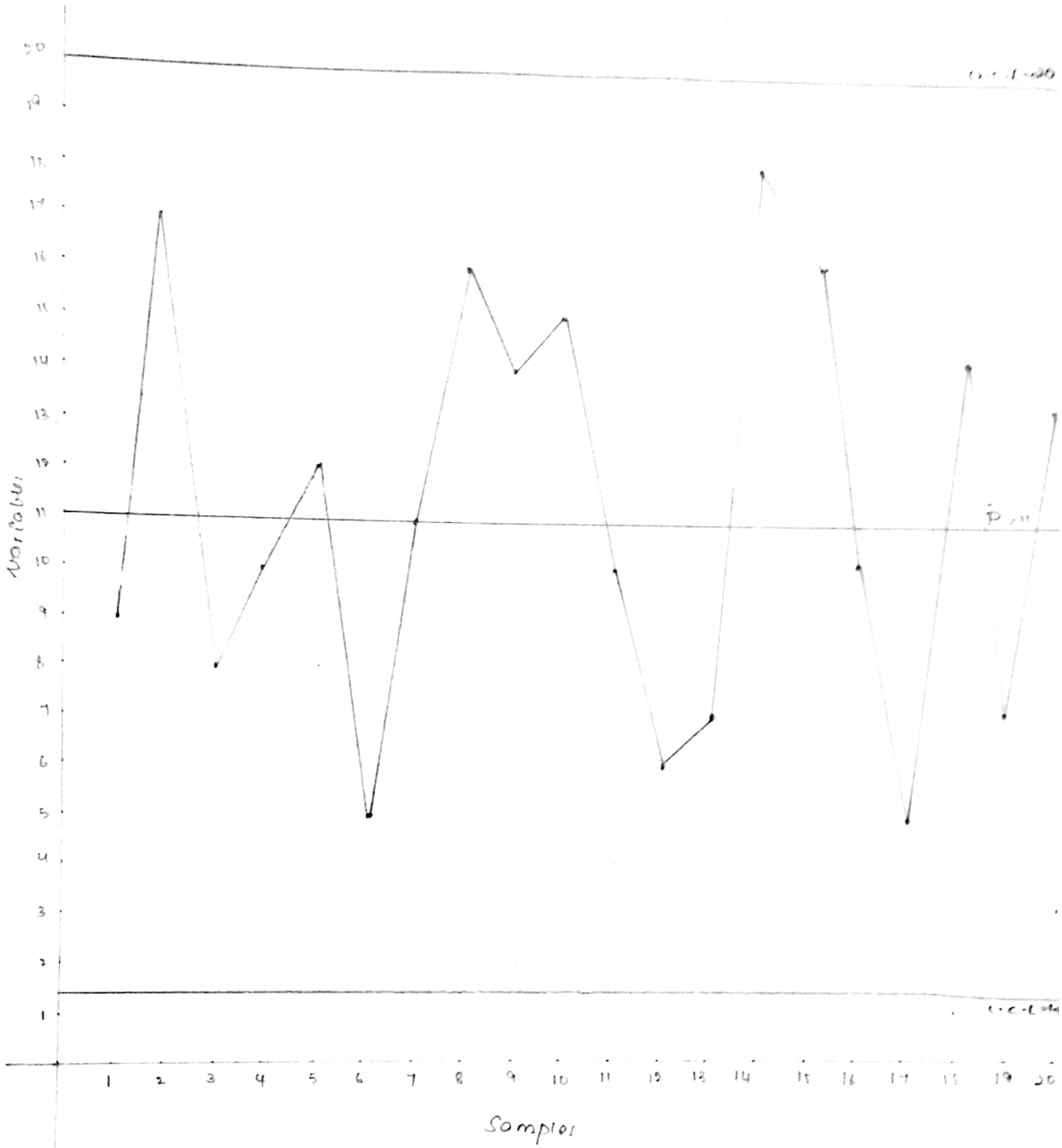
This process is widely applicable in buying food items and other Agricultural products

Advantages

* It is economical to carry out
* Smaller the no of inspection staff it is less complex, less Costlier
* Inspection errors can be minimised
* There is less damage to the product

Disadvantages

* High sampling risk
* Greater Administrative Cost
* less information about the product is available

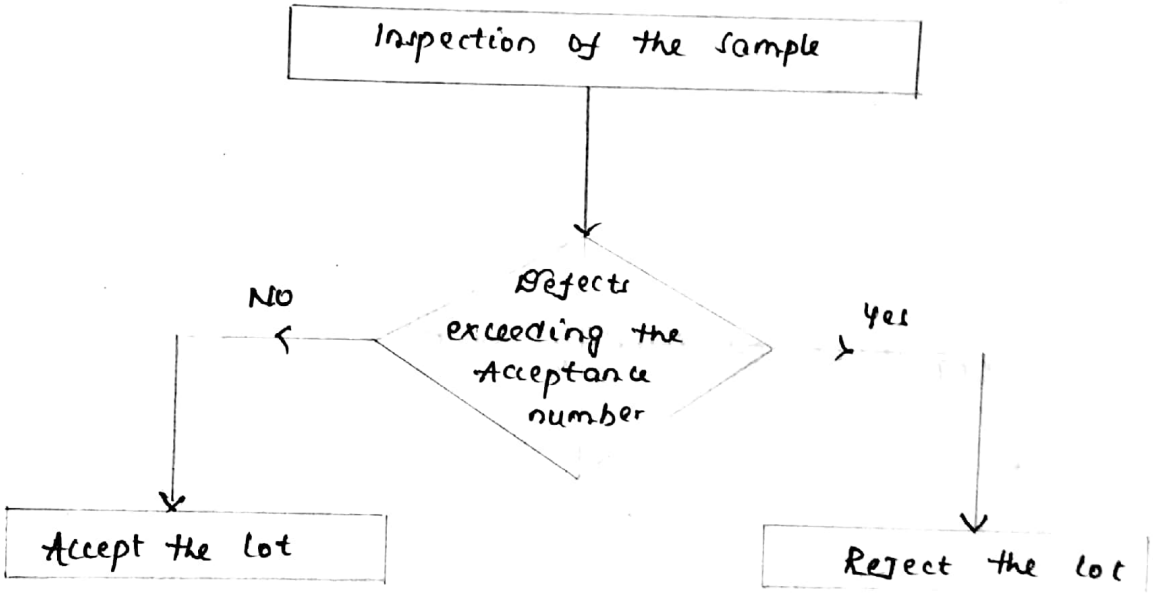


- Methods of Acceptance Sampling :

  - Single Sampling
  - Double Sampling
  - Multiple Sampling
  - Sequential Sampling

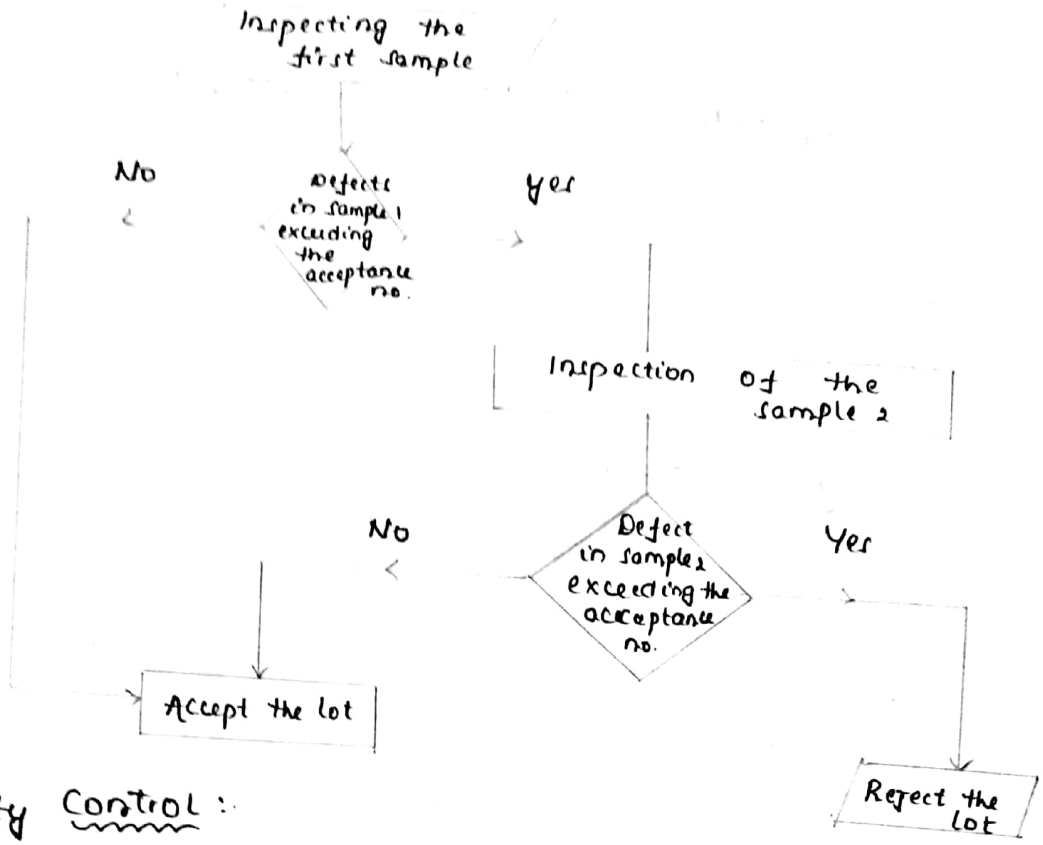
- Single Sampling :

In this method the Quality of the whole lot is decided depending on the Quality result of only one Sample. If the no. of defectives in the randomly Selected Samples is less than acceptance number, the entire lot is accepted



- Double Sampling :

In this method the Quality of a lot is ensured on the basis of the Quality results of two randomly but Sucessively drawn sample at the first stage the first sample is inspected for no of defectives If the no. of defectives in sample 1 exceeds the acceptance number sample 2 is Inspected for defectives and if the defects are less than acceptance number the entire lot is accepted otherwise it is rejected



→ Quality Control :

According to Alford Quality Control may be defined as that industrial management techniques or group of techniques by means of which products of uniform acceptable quality are manufactured.

Objectives of Quality Control :

* To Improve the Quality of finished products at various stages of production process.
* To see whether the product confirms to the pre-determined standards and specifications.
* To Develop Quality Consciousness in the various sections of the manufacturing units
* To Acess various techniques of Quality control and suggest Improvements in it.
* To reduce wastage of raw materials men and machine during the process of production

→ Importance of Quality Control:-

The program of Quality control is Advantageous to both the producer and Consumer. A Quality product which Statisfy Consumer needs on the other hand the demand of the product will increase resulting in large scale production.

The Importance of Quality Control lies in the following facts.

* Reduction in cost
* Improve in the morale of employees
* Max utilication of resources
* Increase in sales
* Customer statisfaction
* Study of Variations

→ INSPECTION :-

Inspection is an Important and essential tool of quality control that ascertains and controls the Quality of the product. The main purpose of Quality Inspection is to safeguard Quality by Comparing materials, workmenship and products with the set of standards

- Definition :-

According to Kinball "Inspection is the art of Comparing materials, products or performances with the established standards."

- Objectives :-

- Maintainence of Quality
- Improving the product Quality
- Reduction in cost

- Maintainence of Quality :

The fundamental purpose of inspection is to maintain the Quality of the product items which confirm to the specifications or within the Acceptable limits are Accepted

- Improving the product Quality :

By comparing the Quality of the product against the set standards, the defective items are located and probably the reason for defects are established

- Reduction in Cost :

The rawmaterials are inspected to see whether they are as per standards or not. the defective raw materials are thus not allowed to use in production.

→ Inspection Methods (or) Types (or) Tools :

* Tool Inspection
* First piece Inspection
* Working Inspection
* Sample Inspection
* Operation Inspection
* final Inspection

→ Six SIGMA :

Six Sigma stands for six standard deviations from mean six sigma methodology provides the tools and techniques to improve the capability of reducing the defects in any process

→ Definition :-

According to James Harrington "Six sigma is a TQM Process that use process capability analysis as a way of measuring process."

→ History of Six Sigma :-

The Concept of Six Sigma Quality evolved in the motorola corporation in U.S.A Bill Smith an engineer of Company who is now called as father of six sigma. Conducted a statical corelation between life of the product and the defects detected during the manufacturing of the product

→ Objectives of Six Sigma :-

- To Decrease Deviations :-

The Main objective of six sigma is to Acheive zero variations both in the product and process

- To Bring down Defects/rework :-

Six Sigma reduces defects as it is a process Control technique

- To Enhance productivity level :-

Six sigma Aims at Improving the productivity of organization for proper utilisation of resources and reducing the wastage of different levels

- To Improve Customer Satisfaction :-

The principle objective of six sigma is to Acheive Customer Satisfaction by providing good Quality products and services to the Customers

⇒ Methods of Six Sigma:

- DMAIC
- DMADV

→ DMAIC (Define, Measure, Analyse, Improve, Control)

Six Sigma Methodology Improves any existing business process by constantly reviewing and returing the process. To Acheive This Six Sigma has user methodology as DMAIC

→ DMADV (Define, Measure, Analyse, Design, Verify)

DMADV is used by Organization where there is either no existing process in place (or) the process currently is being utilised in unworkable.

→ Total Quality Management: (TQM)

Total Quality Management was developed by william deeming, a management Consultant where work had Great impact in Japanese manufacturing. Total Quality management is a Comprehensive and Structured Approach to Organizational management that worm to Improve the Quality of product Services through on going refrigerants in response to Continous feedback.

* Definition:

According of Oakland "TQM is an Approach to Improving the effectiveness and flexibility of business as a Whole. It is essentially a way of Organizing and Evolving the Whole organization, every department, activity every single at every level."

According to Bilcreech "A Total approach to put Quality in every Aspect of management."

→ Objectives of Total Quality Management:

The Two Basic Objectives of Total Quality Management are * Customer Statisfaction
* Performance

* Customer Statisfaction:

Customers are Considered as Important objective part in every business Organication. The Sucess of Organication is only About the Statisfied Customer

* Performance:

Performance is the Important objective of firms TQM Where the firm mainly focus About the Superiority in the Areas

- Speed
- Quality
- Cost
- flexibility

→ The Other Objectives of TQM are:

- Making an Availability According to the Customer focus.
- Continous Improvement as a Cultural of Organisation according to the way of life.
- To change the Organisation from function focus to Customer focus
- To Create the Organisation where people (employees) and Customers are Core of every Activity and encourage the work into teams

→ Quality Circle :

It is a Small Group of employees in the same work area or doing a similar type of work who voluntarily meet regularly for About an hour every week to identify, analyse and resolve work related problems, leading to Improvement in there total performance and enrichment of the Work life.

"Quality Circles are a formal Institutionalized mechanism for productive and participative problem slowing Interaction Among Employees."

* Features Of Quality Circles :

- Quality Circle is a Small Group of employees
- Quality Circle is Organised in same work area or doing similar type of work.
- Quality Circles are Voluntary
- Quality Circles meet regularly for about an hour every week
- Quality Circle Identifies, Analyses and resolves work related problems
- Quality Circle leads to total performance
- Quality Circle enrich work life

CHAPTER 3

THE CONCEPT OF QUALITY CIRCLE

Introduction

The previous chapter presented the overview of literature on the research study. The aim of this chapter is to understand the concept of quality circles. It covers the meaning of quality circle, definition of quality circle, the essential elements and structure of quality circles.

3.1 Definition

There have been different interpretations of the concept of quality circles in various organizations in India and abroad. However, the most commonly accepted definitions in keeping with the essence of the philosophy as it originated in Japan are:

"Quality Circle is a small group of employees in the same work-area or doing a similar type of work who voluntarily meet regularly for about an hour every week to identify, analyse and resolve work-related problems, leading to improvement in their total performance, and enrichment of their work life" (Udupa 1986).

"Quality circles are a formal, institutionalized mechanism for productive and participative problem-solving interaction among employees"(Lozano & Thompson 1980).

"Quality control circle is not just a little room adjacent to the factory floor, whose occupants make a nuisance of themselves to everyone else. It is a state of mind and a matter of leadership with everyone from the president to production trainee involved"(Rehder 1981).

"Quality circle is a small group to perform capital quality control activities within the same workshop. This small group carries on continuously as a part of company wide quality control activities self development and mutual development and improvement within the workshop, utilizing quality control techniques with all member participating"(Dr.Ishikawa).

3.2 Meaning of Quality Circle

In Japan, quality circles are organized within a department or work area for the purpose of studying and eliminating production related problems. They are problem solving teams which use simple statistical methods to research and decide on solutions to workshop problems.

Quality circles in North America are similar to Japanese circles in spite in spite of the fact that each may emphasize a particular function such as problem solving, team building or quality control.

Underlying the quality circle concept is the assumption that the causes of quality or productivity problems are unknown to workers and to management. It is also assumed that shop floor workers have hands on knowledge, are creative and can be trained to use this natural creativity in job problem solving. Quality circles, however, are a people building, rather than a people using, approach.

3.3 Features of Quality Circles

The main features of quality circle are:

(a) Quality circle is a small group of employees

Quality circle is a small group of employee of 8 to 10. A circle with less than 5 members would lose its vitality due to high rate of absenteeism. This may cause a circle to become inactive. On the other hand, more than 15 members in a circle could result in denial of opportunity for active participation by every one. As

such, 8 to 10 are recommended as the minimum and maximum strength of quality circles respectively. The reason for such numbers is that number of interaction among members would be manageable.

(b) Quality circle is organized in the same work area or doing similar type of work

A quality circle is a homogeneous group and not an inter-departmental or inter-disciplinary one. Members participating in circle activities must be on the same wave-length. Discussions taking place at the meetings should be intelligible to each one of the members. This is possible only if the composition of the circle includes employees working in the same work area or engaged in a similar type of work. Designations of members need not necessarily be equal but the work in which they all are engaged should be common. For example, in any assembly area, turner, drillers, electricians, and unskilled workers, etc., could decide to form a circle. Similarly, circles could be composed of stenographers in an office, operators on a group of milling machines, nurses in hospitals, draughts men in an engineering section, clerks in a bank's. etc.

(c) Quality circles are voluntary

Employees decide to join quality circles on their own willingness. No compulsion, coercion or pressure can be brought on any employee to join or not to join quality circles. This is based on voluntarism principle.

(d) Quality circles meet regularly for about an hour every week

Normally, a quality circle meets for about an hour every week. It is therefore possible for the circle to meet atleast three or four times a month. The regularity of such meetings is very significant and it must be adhered to. These meetings could be conducted during or after working hours. This decision is left to quality circle members themselves. For example the Bharath Heavy Electric Ltd., Bangalore, have been conducting the meetings for an hour after the shift hours on every Saturdays (QCFI Convention Report 2008).

(e) Quality circles identifies, analyses and resolves work-related problems

The employees who work continuously in a work area knows best what problems are hindering achievement

(f) Quality circle leads to total performance

As quality circles resolve work related problems relating to quality, productivity, cost reduction, safety etc. the total performance of the work area naturally improves. This results in both tangible and intangible gains to the whole organization. Empirical data provided in chapter 5 would substantiate this feature of quality circle.

(g) Quality circle enrich work life

The spin off benefits of quality circles of the organization includes enrichment of the work life of their employees apart from attitudinal changes, cohesive team culture, etc. Improved working environment, happier relations with co-employees, greater job satisfaction etc. are responsible for this enrichment of their work life.

3.4 Assumptions of Quality Circles

The concept and philosophy of quality circles are derived from the following basic assumptions (Mathew George 1991):

UNIT-5

Resource Management

* Resource Management :-

In Organizational Studies, resource management is the efficient and effective development of an Organization's resources when they are needed. Such resources may include financial resources, inventory, human skills, Production resources, & information Technology.

* Human Resource Management :-

Human Resource management is a managerial function which facilitates the effective utilization of people in achieving the Organizational and individual goals.

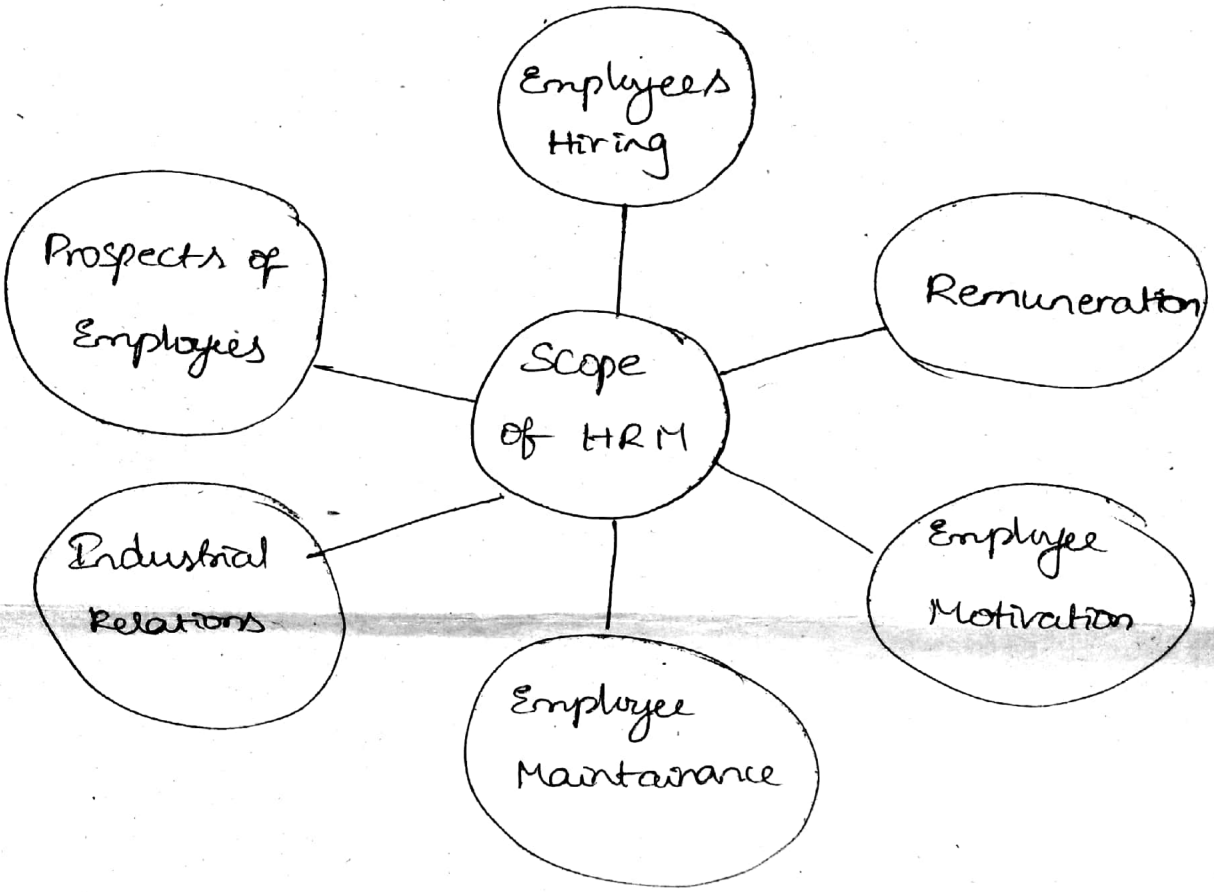
Simply, HRM is a managment function that helps the managers to recruit, select, train and develop the Organizational members for the Purpose of achieving the stated Organizational goals. It focuses on people in the Organisation.

Definition :-

According to Edwin B. Flippo, " HRM is the planning, Organising, directing and controlling

of the procurement, development, compensation, integration, maintenance and separation of human resources to the end that individual, Organisational and social objectives are accomplished.

Scope of HRM :-



Objectives of HRM :-

(1) To help the Organization to attain its goals effectively and efficiently by providing competent and motivated Employees.

(2) To utilize the available human resources effectively.

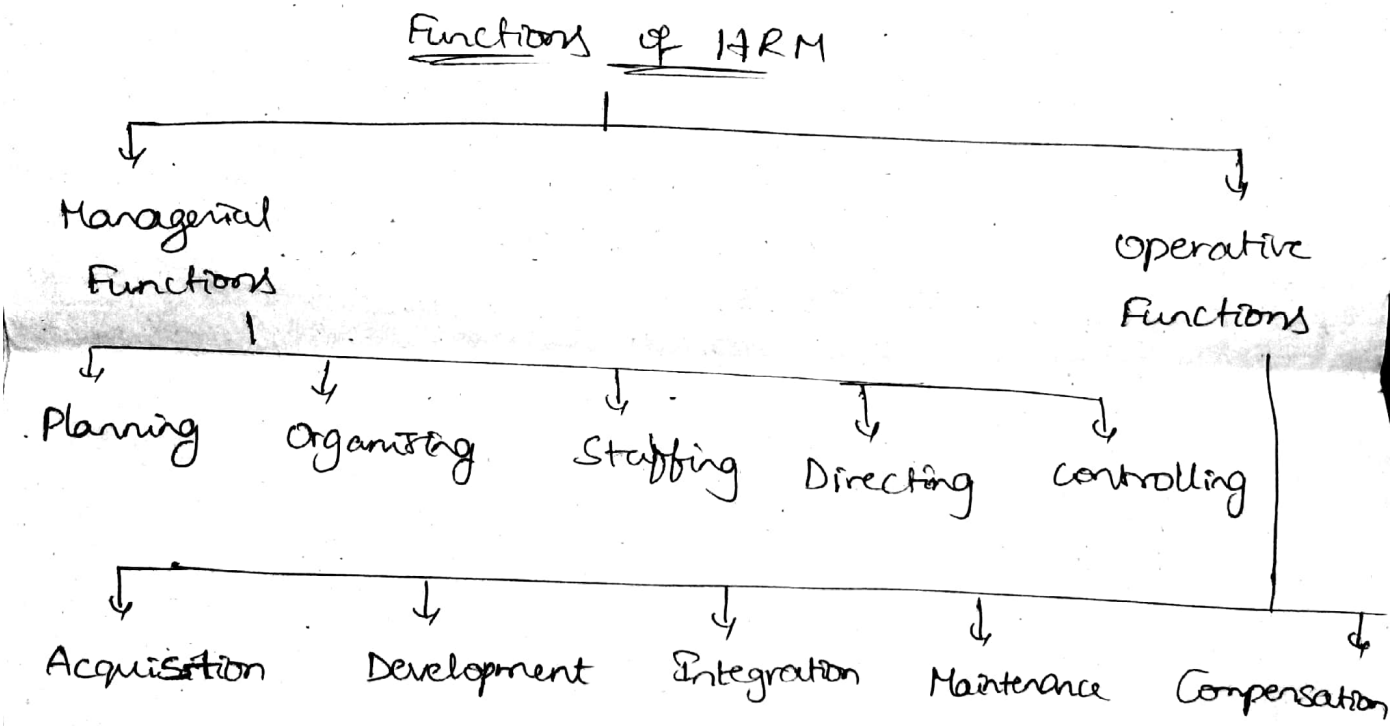
(3) To increase the job satisfaction and self-actualization of the personnel by encouraging them to realise their potential.

(4) To help maintain Ethical policies and behaviour inside and outside the Organisation.

(5) To Establish and maintain Cordial relations between Employees and management.

(6) To reconcile individual / group goals with Organizational goals.

* Functions of HRM



(1) Managerial Functions :-

(a) Planning
(b) Organising
(c) Staffing
(d) Directing
(e) controlling.

(a) Planning :- Planning is a predetermined course of action. It is Concerned with determining Organi-zational goals and formulating the policies and

Procedures for attaining those goals.

(b) Organising :- Organising is the method of achieving the planned task. It is the process of allocating the jobs in the direction of achieving goals. Organising includes the activities like allocation of tasks to the Sub-ordinates, Establishing depart-ments, delegation of authority, Establishing chan-nels of Communication, Co-ordination of work and ~~So on~~ So on.

(c) Staffing :- Staffing refers to filling the position in the Organisation with the right people.

(d) Directing :- The next step is the execution of the plan. In other words, It is the process of activating and co-ordinating the individual and group efforts in order to achieve the goals and objectives. It includes the activities like getting things done with Sub-ordinates, motivating the Sub-ordinates etc.

(e) Controlling :- Controlling is the process of checking the performance to confirm whether the activities are going according to the plans made. Controlling involves the activities like Setting performance standards, Checking and Verifying etc.

(2) Operative functions :- The operative functions are the functions related to particular department & section. Effectively performed operative functions of HRM ensure placing right people on the right jobs at the right times.

The operative functions include activities like,

(a) Acquisition
(b) Development
(c) Integration
(d) Maintenance
(e) Compensation

(a) Acquisition :— Acquisition involves acquiring right kind of people and placing them in right position in tune with Organizational requirements. It includes these activities,

* Job Analysis
* Human Resource planning
* Recruitment
* Selection
* Induction
* Transfer
* Promotion and Demotion

(b) Development :— Development is the process meant to improve the knowledge, skills, aptitudes and values of employees so that they can better contribute to their job. It includes the following activit

* Performance Appraisal
* Training
* Career planning and Career Development

(C) Integration :— Integration is the process of reco -nciling and reuniting the Organizational goals with its members.

It includes like,

* Motivation
* Job satisfaction
* Collective Bargaining
* Employee participation
* Discipline

(d) Maintenance ← Maintenance includes the activities like, * Organizational Health
* Human Resource Audit
* Human Resource Accounting

(e) Compensation ← Compensation includes the determination of wages and salaries matching with contribution made by the employees to achieve Organizational goals. It includes the activities,

* Job Evaluation
* wage and salary Administration
* Incentives
* Bonus
* Fringe Benefits

Personnel Management :-

Personnel Management is a process of managing people and Enabling them to contribute their best for the attainment of Organizational goals.

Definitions :- According to Flippo, "Personnel management is the planning, Organising, Compensation, Integration and maintenance of people for the purpose of contributing to Organisational, individual and societal goals."

According to Brech, "Personnel Management is that part which is primarily Concerned with human resource of Organization.

Nature of Personnel Management :-

(1) Managing people.
(2) Concerned with Employees
(3) Helping Employees
(4) Universal Application.

(1) **Managing people :-** It is Concerned with managing people at work. It does not manage only Organized or unOrganized workers in the Organization, but Everyone working in the enterprise.

(2) **Concerned with Employees :-** It deals with Employees both as individuals as well as in groups. The aim is to motivate people for getting best results from them.

(3) Helping Employees :- The employees are helped to develop their talent fully by providing them appropriate opportunities. This will given them job satisfaction and may improve their performance at work.

(4) Universal Application :- It may be used every - where and in every type of organization. It is equally useful in a government, semi-government, non-profit organizations.

Objectives of Personnel Management :-

(1) To procure right type of people for right jobs.

(2) To train and develop human resources.

(3) To Establish good working relationships.

(4) To ensure satisfaction of the needs of the employees.

(5) Desirable working relationship between employer and employees.

Functions of personnel Management :-

(1) Managerial Functions

(2) Operative Functions.

Functions of Personnel Management

Managerial Functions

(1) Planning
(2) Organizing
(3) Directing
(4) Controlling

operative Functions

(1) Procurement of Employees
(2) Development
(3) Remuneration
(4) Working conditions
(5) Coordination
(6) Maintenance of personnel.

Difference between Human Resource Management and Industrial Relations:-

HRM	Industrial Relations
(1) HRM involves two parties i.e., Employee and Employer.	(1) Industrial relations involves four parties i.e, Employees, Employer, trade unions and government.
(2) In HRM, grievance and disciplinary procedures are used for solving the Employer, Employee issues.	(2) Collective bargaining and different types/forms of industrial conflicts are used for solving the problems.
(3) The individual Employee has an Easy access over its Superior.	(3) The individual Employee can directly contact the top level management
(4) Formulations of objectives, policies, procedure and Programs of human resources and implement them.	(4) The implementation of HRM policies results in IR (Industrial Relations).

Industrial Relations :-

Industrial relations refers to the relation -ship between the Employers and the Employees in an Organization. Human relations in industry refers to the develop a sense of responsibility in the workers.

Industrial relations are regulated by laws & by agreement between the trade unions and the Employers.

Definition :-

According to Dale Yoder, The term "Indust -rial relations" has been described as relationship between Employers and Employees & among Employees and their Organization that characterizes & grows out of employment.

Scope and Aspects of Industrial Relations :-

(1) Development of healthy labour - management relations.

(2) Maintenance of industrial peace and avoidance of industrial strikes.

(3) Development of Industrial Democracy

(1) **Development of healthy labour - management relations :-** Existence of strong, well Organized, democratic and responsible trade unions in the industry. These Enhances job security of

Employees, helps in increase workers participation in decision making.

(2) Maintenance of Industrial peace :- To Establish industrial peace ~~with~~ the following privileges are to be followed.

(a) Machinery for the prevention and settlement of Industrial disputes i.e,

* legislative and administrative Enactment.
  (i) Trade Union Act
  (ii) The dispute Act
  (iii) The Industrial Employment Act
* Works Committee and joint management Cancil.
* Boards of conciliation.
* Labour Courts, Industrial Tribunals

(b) Government should have the power to refer the dispute to adjudication.

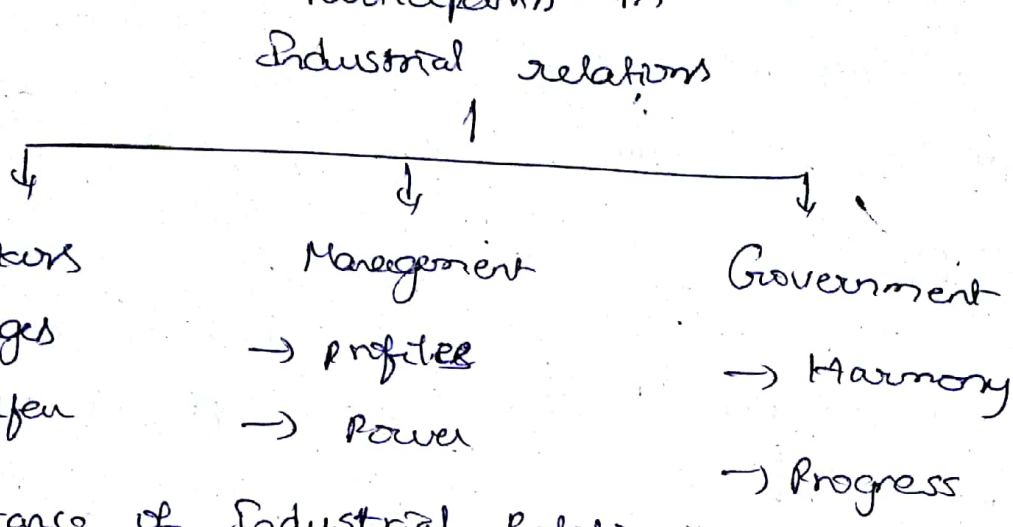
(c) Government Enjoys the power to maintain Status.

(3) Development of Industrial Democracy :-

Industrial democracy is that the labour should receive the right to be associated with the running of the industry.

* Establishment of joint management.
* Recognition of human rights in industry.
* Increase in labour productivity.
* Material and Social Environment.

Participants in Industrial Relations :-



Importance of Industrial Relations :-

(1) To avoid industrial conflicts and develop harmonious relation.

(2) To raise productivity to a higher level.

(3) To Establish and maintain Industrial democracy based on labour partnership.

(4) To bring down strikes, lockouts by providing better and reasonable wages and improve living conditions.

(5) To bring out government control over loss making units.

Difference between Personnel Management and Human Resource Management :-

Personnel Management	HRM
(1) Personnel management is the management of people employed.	(1) HRM is the management of employees skills, knowledge, abilities, talents, aptitude, creative abilities etc.

(2) Employee in personnel management is viewed as a commodity.	(2) Employee in HRM is considered as a resource.
(3) It consist Traditional approach.	(3) It consist modern approach.
(4) Personnel management is a daily routine administrative function.	(4) HRM is a developmental process of the workforce over long period.
(5) Personnel function is only auxiliary.	(5) HRM is a strategic management function.
(6) It consist Transactional Role.	(6) It consist Transformational Role.
(7) Personnel management belives that job satisfaction will lead to improved performance.	(7) HRM approves that good performance will lead to high morale and satisfaction of Employees.

Job Evaluation :-

Job Evaluation refers to a systematic way of determining the value or worth of a job in relation to other jobs in an Organization.

It tries to make a systematic Comparison between jobs to assess their relative worth for the purpose of Establishing a rational pay Structure.

Job Evaluation begins with job analysis and Ends at the point of determination of worth of a job.

Importance of Job Evaluation :-

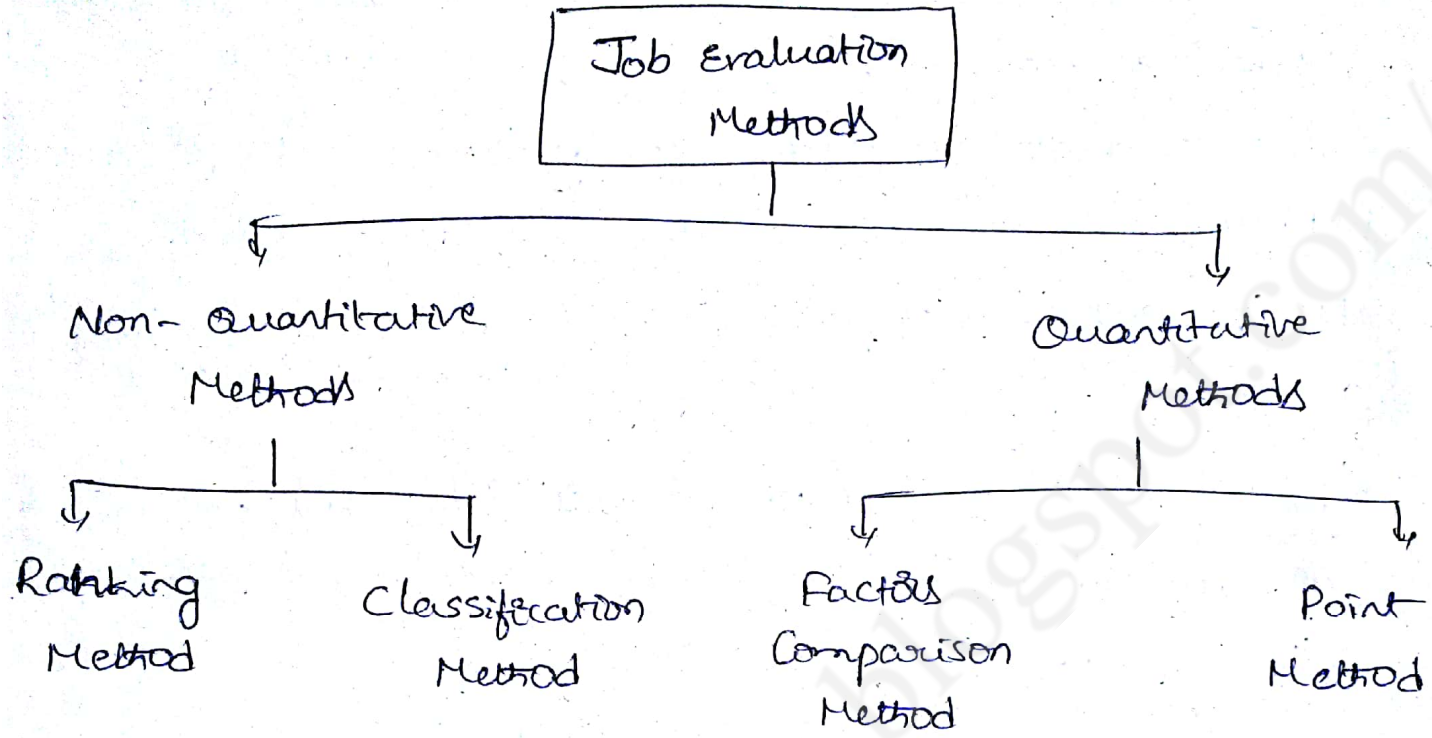
(1) It helps to rate the job.
(2) Job Evaluation helps to determine pay structure.
(3) It helps in bringing harmonious relation between labour and management.
(4) It helps to minimize the cost of recruitment and selection.
(5) It helps to differ job other than skills
(6) It helps to determine the requirement of training and development.

Features of Job Evaluation :-

(1) It Tries to assess job, not people.
(2) Basis of Job Evaluation is job analysis.
(3) Standards of Job Evaluation is relative, not absolute

(4) It carried on by groups not individuals.

Methods of Job evaluation :- (Types)



(1) Non-quantitative Methods :-

(a) Ranking Method :-

→ As per this method, jobs are arranged from highest to lowest, in order of their values & merit to the organisation.

→ Jobs can also be arranged according to the relative difficulty in performing them.

→ The job at the top has the highest value and job at the lowest has the lowest value.

→ Jobs are arranged in each department and then department ranking are combined to develop an organisation ranking.

Advantages :-

(1) Simple to understand and practice.

(2) Best suited for small Organisation.

(3) It is less time consuming.

(4) It does not involve Expenses.

Disadvantages :-

(1) Ranks are highly subjective in nature.

(2) Rankings are difficult to develop in large, Complex Organisation.

(3) It is an unscientific method of Evaluating the jobs.

(b) Classification Method :-

→ The job classification method sometimes called as "Grade - Description Method" consists of sorting all the jobs being Evaluated into grades or classes which have been decided in advance and arranged in order of importance.

As per this method, a predetermined group of jobs are assigned to their classification.

Class	Rank	Employees
Class 1	Executives	Office manager, Deputy office manager, Office Superintendent etc.
Class 2	Skilled workers	Purchasing Assistant, Cashier, Receipts clerk etc.

Class 3	Semi skilled workers	Stenotypists, Machine-operators etc.
Class 4	Less skilled workers	Daftaris, file clerks, office boys etc.

Advantages :-

(1) It is relatively easy to install the method.

(2) Grading of new jobs becomes easy.

(3) Employees can easily understand the system.

Disadvantages :-

(1) This may not be useful for large organizations.

(2) It is difficult to grade the complex jobs in an organization.

(3) It is time consuming unmanageable.

(2) Quantitative Methods :-

(a) Factors Comparison Method :-

* Under this method, instead of ranking Complete jobs, each job is ranked according to a series of factors. These factors include mental effort, physical effort, skill needed, responsibility, working conditions etc.

* Pay will be assigned in this method by comparing the weights of factors required for each job.

* wages are assigned to the job in comparison to its ranking on each job factor.

Advantages:-

(1) This results in accurate Evaluation of the job.
(2) It utilizes few factors and thereby reduces overlapping.
(3) Evaluation of new jobs becomes Easy.

disadvantages:-

(1) It is a very expensive process to install.
(2) It is difficult to understand and to Explain to the Employees as it is Complicated.

(b) Point Method:- The point rating method is most commonly used in industries. It uses rating scales to measure a specific job characteristics or factors which are common in many jobs. The factors may be the educational qualifications, experience, responsibility etc.

Each of these factors are assigned a certain number of points on the basis of relative worth, as compared to other factors. The total of such points Establishes the point value of the job.

Advantages:-

(1) It is effective and more reliable.
(2) It is easy to understand.
(3) Once the scales are developed, they can be used for a long time.
(4) Jobs can be easily placed in distinct categories.

Disadvantages :-

(1) A lot of expenditure is required for the development and installation of the system.

(2) It is a time-consuming and difficult task.

(3) It is difficult to determine the factor levels within factors and assign values to them.

Merit Rating :-

Merit rating is the process of determining the relative merit of the person on a given job. The performance of an individual is constantly evaluated in an organization for the purpose of promotion, demotion, separation, rewarding and transfer etc.

Objectives of Merit Rating :-

(1) To recognize and reward the employees by determining their worthiness.

(2) Evaluating the performance regularly in order to decide the promotion, transfer or demotion.

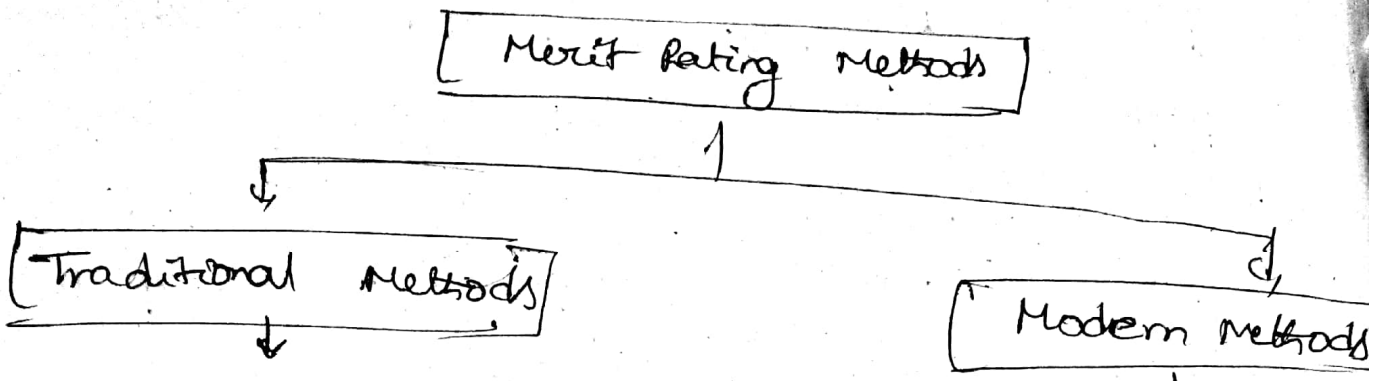
(3) Identification of training needs.

(4) To Enhance the Creativity in individuals.

(5) To guide the employees who lack in their performance.

(6) To judge whether the employee is suitable for the given task.

Merit Rating Methods :—



(1) Straight Ranking Method
(2) Paired Comparison Method
(3) Man to man Comparison Method
(4) Grading Method
(5) Graphic Scale Method
(6) Check list Method
(7) Selection of Critical incident
(8) Descriptive Evaluation Method
(9) Group appraisal Method
(10) Interview Method.

(1) 360° Appraisal Method
(2) Behaviorally anchored rating Scales
(3) Management By Objectives (MBO)
(4) Assessment Centers

(I) Traditional Methods :—

(1) Straight Ranking Method :— In the Straight ranking method, the rater ranks the Employee in order of their merit with the best on the top and poorest Employee at the bottom of the ranking table. This method is best suited where the number of Employees are less.

(2) Paired Comparison Method :— As the name

indicates Each person is compared with other person in pairs. Each Employee is paired with other Employees working on similar type of jobs, the result of these decisions are tabulated and a rank is allotted from the number of times Each person is considered to be Superior.

(3) Man to man Comparison Method :- It is Commonly called "Factor Comparison Method". Under this method, certain factors such as leadership, initiative, dependability, reliability etc., are selected. Thereafter a five point master scale is designed to each factor by the raters. The five point scale would be excellent, good, satisfactory, average and poor and the weightage could be 5, 4, 3, 2 and 1, respectively.

The individual weightage of each factor are added upto judge the relative merit of each Employee.

(4) Grading Method :- In this method, the actual performance of each Employee is compared with the grades Established and the person is allocated to the grade which best describes his performance. The grades may be such as : Excellent, Very good, average, poor, Very poor etc.

(5) Graphic Scale Method :- In this method there are two types of factors.

(a) Employee characteristics

(b) Employee Contributions

Each of these factors will have three to five degrees. The indications are recorded and rest is similar to person to person Comparison method.

(6). Check List Method :- In this technique the Supervisors are provided with printed form Containing descriptive questions about the perform-ance of workers. The Supervisor has to answer in yes or no. After putting answers to these questions the form are sent to personnel depar-ment where final rating is done.

Various questions in the form may be weighted Equally & certain questions may be given more weightage than others.

The check list may contains such questions :-

(1) Is the employee hard working ? (Yes/No)

(2) Is he regular on the work ? (Yes/No)

(3) Does he obey instructions well ? (Yes/No)

(7) Selection of critical incident :- This method measures worker's performance in terms of certain Events & incidents that occur in the course of work. The assumption in this method is that

the performance of an Employee / worker on the happening of Critical incidents determines his failure or success.

(8) Descriptive Evaluation Method :- In this method, the rater prepares a consolidated report describing the performance of the Employee on the job. The report reflects the personality, behaviour, quantity and quality of work performed by the Employee. The report is prepared by rater purely by observation.

(9) Group Appraisal Method :- In this method, the rating is made by a group of Supervisors who sit together and Evaluate the performance of the Employee.

(10) Interview Method :- In this method, instead of directly interacting with Employees, the Experts from personnel department interview the Concerned Supervisor to obtain all the information about each Employee and also ask them about the possible methods of improving performance of Employees.

II Modern Methods :-

(1) 360° Appraisal Method :- It is a method where an Employee is appraised by all the parties around him i.e, his superiors, subordinates, peers, customers, clients and by himself.

(2) Behaviourally Anchored Rating Scales :- (BARS)

It can be used as a substitute for traditional methods of performance appraisal.

BARS method involves the following steps.

(i) Identify critical incident / Events.

(ii) Group the identified incidents into various performance clusters.

(iii) Reassign the actual critical Events.

(iv) Rate the incident

(v) Create a subset of incidents for Each Cluster.

(3) Management by objective (MBO) :- Managment by objective method was developed by peter Drucker and it is also known as appraisal by results or Evaluation by outcomes method. It is the process wherein objectives to be attained are set by both superiors and subordinates together and proper direction is laid down to achieve such objectives.

(4) Assessment Center :- In this method, Superiors are asked to come together at one particular place called as assessment center and undertake various activities which are similar to the activities they take-up in their job.

Usually, assessment center method is used to decide whether an Employee is to be promoted/demoted.

Difference between Job Evaluation and Merit Rating

Job Evaluation	Merit Rating
(1) It is a technique by which different jobs of an enterprise are Evaluated.	(1) Merit Rating is the process by which the ability, efficiency and potentiality of an Employee are Evaluated.
(2) This process is started after the appointment of an Employees.	(2) This process of Merit Rating is started before the appointment of Employees.
(3) It is related with the relative study of different jobs.	(3) It is related with relative study of different Employees.
(4) In the process of job Evaluation, the performance of an Employee is Evaluated by Comparing it with the performance of another Employees of Equal rank and status.	(4) In the process of Merit Rating, the ability, Efficiency and the potentiality of an Employee are Evaluated.
(5) In the process of job Evaluation, the remuneration of an Employee is determined.	(5) In the process of Merit Rating, the remuneration of an Employee is determined on the basis of his efficiency, ability and potential

Wage incentive plans :-

Wage incentive refers to performance linked compensation paid to improve motivation and Productivity. It is the monetary inducements offered to employees to make them perform beyond the acceptance standards.

According to Human and Nickerson define it in simple terms as "all the plans that provide Extra pay for Extra performance in addition to regular wages for a job."

Objectives of wage incentive plans :-

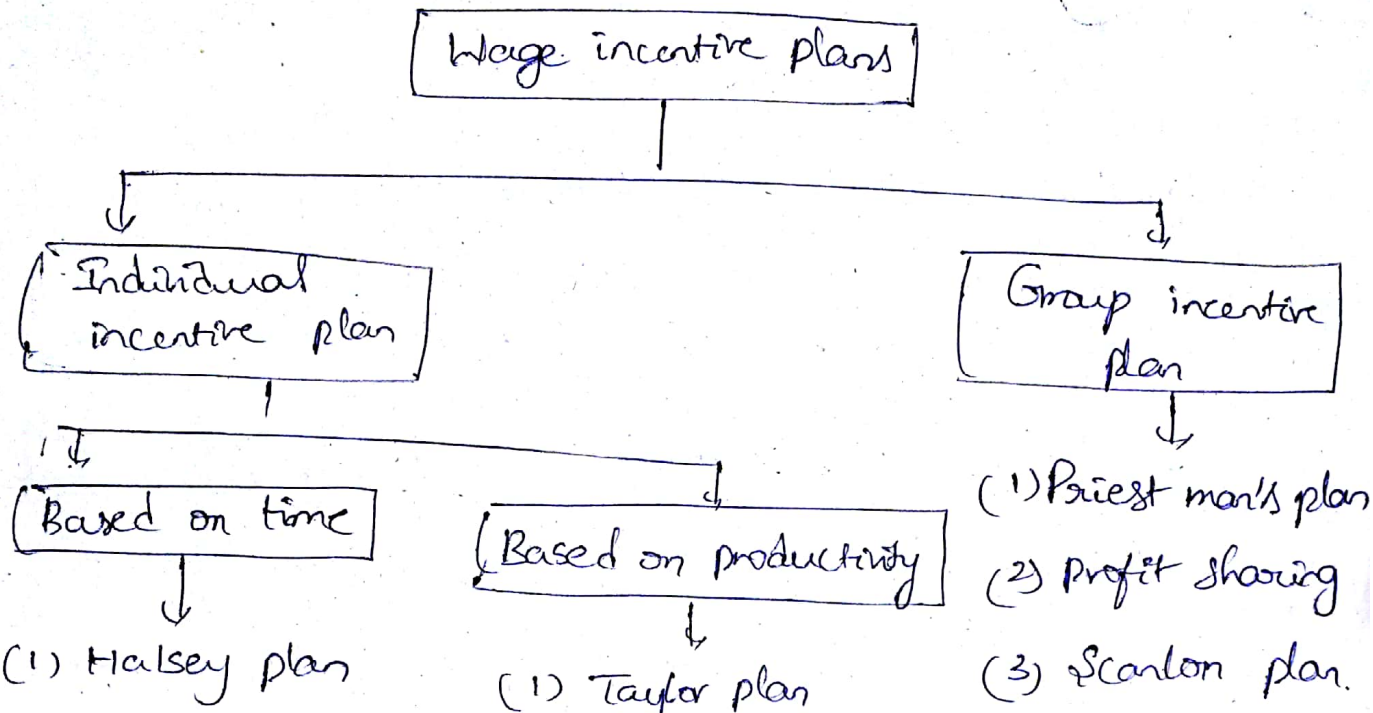
(1) To use wage incentives as a useful tool for securing a better utilisation of manpower, better Productivety & scheduling and performance control, and a more Effective personel policy.

(2) To improve the profit of a firm through a reduction in the unit costs of labour and materials or both.

(3) To increase a worker's Earning without dragging the firm into a higher wage rate structure regardless of productivity.

(4) To avoid additional capital investment for the Expansions of production capacity.

Types of wage incentive plans :-



(A) Individual incentive plan :- It may either be time based or production based.

(i) The time based individual incentive plans are :

(1) Halsey plan
(2) Rowan plan
(3) Emerson plan
(4) Bedeaux plan

(1) Halsey plans :- under Halsey plan minimum wages are guaranteed to every worker. A standard time is fixed for the workers. If the workers finish the work before standard time they are given bonus. But no penalty if they fails to do that.

The total wage of the worker is given by the following formula.

Total wages (W) = $T \times R + (P/100)(S-T) \times R$

Where,

T = Actual time taken to complete the job.

R = Rate in hours

S = Standard time.

P = Bonus

(2) Rowan plan :- The Rowan plan is very much similar to the Halsey plan. Firstly, it gurantees a minimum base wage. Secondly, the output standards are based upon the past records of Production. Lastly, the bonus is given on the time saved.

The workers wage is given by the following formula,

$$W = R \times T + \left(\frac{S-T}{S}\right) \times R \times T$$

where,

R = wage rate in hours

T = Actual time taken to complete the alloted task.

S = Standard time or allowed time.

(3) Emerson plan :- The Emerson's Efficiency plan also provides a guaranteed base wage to the worker. A worker with 67% - 100% efficiency

can Earn ~~increase~~ incentive from 0 to 20%. If the efficiency of worker is 100%. then for every 1% increase in output, there is 1% increase in incentive of worker.

(4) Bedeaux plan :- This plan is developed by Charles E. Bedeaux in 1911. Here the minimum time wage is guaranteed to all workers. The workers who complete the job within a rate than the stand ard time are paid at the normal time rate.

worker who complete the job in less than the standard time are paid bonus, generally 75% of the wage for the time saved and 25% to the foreman.

$$W = S \times R + 75\% \text{ of } R(S-T)$$

Where,

S = standard time

R = Rate in hours

T = Actual time taken to complete the job.

(ii) Based on productivity :-

(1) Taylor plan :- This system was introduced by Taylor, the father of scientific management. The main characteristics of this system are that two rate of wage one lower and one higher are fixed.

A lower rate for those workers who are not able to attain the standard output with in the standard time; and a higher rate for those who are in a position to produce the standard output with in or less than the standard time.

Advantages :-

(1) Provides incentives to efficient worker.

(2) Inefficient worker is penalized.

(3) This system is simple and easy to implement.

disadvantages :-

(1) Minimum wage is not assured.

(2) There are chances that quality of work may suffer.

(3) This system is not liked by below average workers, as they do not get any incentive.

(2) Merrick's plan :- To overcome the limitations of Taylor's differential piece rate system, Merrick suggested a modified plan in which, three-piece rates are applied for workers with different levels of performance.

These are :

(a) Workers producing less than 83% of the standard output are paid at basic rate.

(b) Workers producing between 83% and 100% of standard output will be paid 110% of basic piece rate.

(c) Those producing more than 100% of the standard

output will be paid 120% of basic piece rate.

Advantages:-

(a) Efficient workers are rewarded handsomely.

(b) Minimum wages are guaranteed.

disadvantages:-

(a) There is wide gap in slabs of differential wage rate.

(b) Over emphasis on high production rate.

(3) Gantt's plan:- In gantt incentive plan, workers get a guaranteed wage.

* If a worker does not complete the job within standard time i.e. he takes more time than the standard time, he will not receive any bonus but he is given wages for the time taken by him.

* If a worker completes the job within standard time (100% efficiency), he is given wages for the standard time and bonus of 20% of wages earned.

* If the worker completes the job in less than the standard time, wages are paid according to piece rate.

Advantages:-

(a) Minimum wages are guaranteed.

(b) It is simple to understand.

(c) Efficient workers can earn more money.

Disadvantages :-

(a) Emphasis on over speed or high production rate.

(B) Group Incentive plans :- under this method group bonus is given instead of individual bonus. The bonus is distributed among all the Employees of the Organization on the different basis which are as follows.

(a) Priestman's plan :- under this method Bonus is increased in proportion to increase in output.

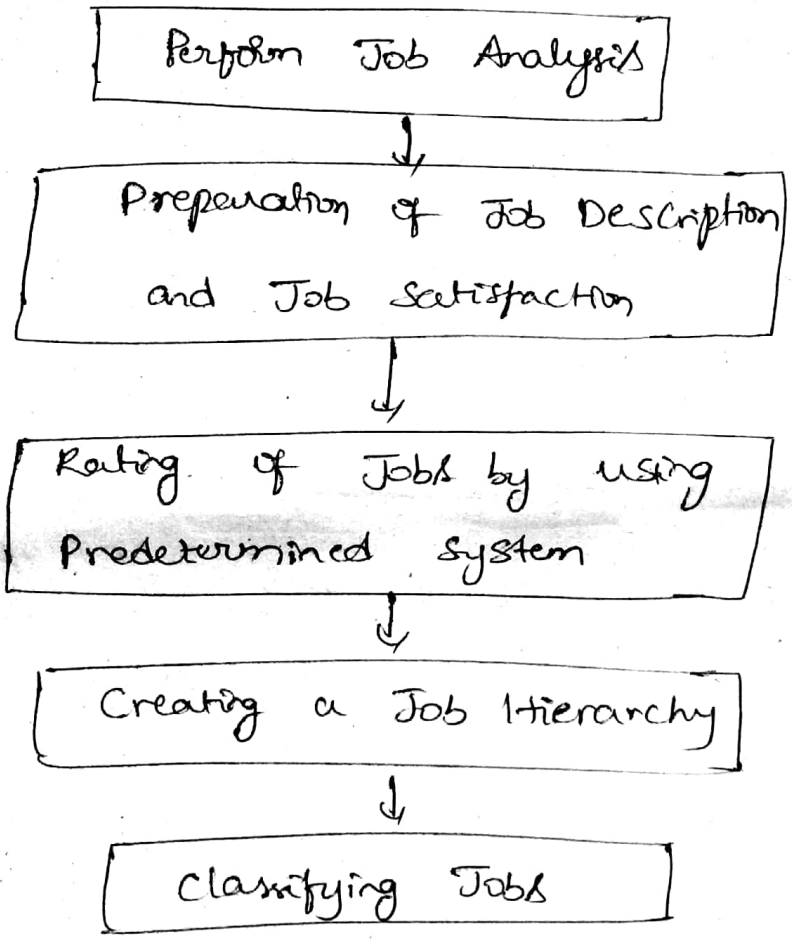
$$\frac{\text{Increased production}}{\text{Standard production}} \times 100$$

(b) Profit Sharing method :- under this method increased profit is shared among the workers and management as agreed between both the parties.

(c) Scanlon plan :- under this method bonus is paid in proportion to the production 1-1. bonus if 1% increase in production.

Steps / procedure of Job Evaluation :-

To develop a standardized procedure for determining the relative worth of different jobs and to develop an equitable wage differential plan, the following five steps need to be adopted.



Step 1 :- Job Analysis

Job analysis is the process of studying and collecting information relating to the operations and responsibilities of a specific job. The immediate products of this analysis are job descriptions and job specifications.

step2 :-

(i) Preparing a Job Description :- The data collected from the previous step is used to prepare a job description statement consisting of the job contents in terms of functions, duties, responsibilities, operations etc. The employee is required to perform the duties, responsibilities and functions listed in the job description.

(ii) Developing a job specification :- This step involves conversion of job description statement into job specification statement. Job specification specifies the personal attributes of the employee like knowledge, skills, qualities, abilities etc. which are required to perform the job.

Step-3 :- Rating the jobs by using a predetermined system : After the job description and job specification is completed, a committee of managers and supervisors need to finalize relative worth of different jobs using various Evaluation procedures. The most commonly used method is the 'point factor system'.

The point factor system uses work related criteria for Evaluateding the relative work value of each job. Such work related criteria are known as Compensable factors.

Step-4:- Establishment of job Hierarchy

Based on job description, job specification and Job rating, listing of jobs need to be done. Job hierarchy is created based on the importance of job i.e., the most important jobs are placed at the top most level of hierarchy followed by the less importance jobs.

Based on the job rating, a job hierarchy is prepared to be starting in the descending order (ie.,) the ~~most~~ job having the maximum points would have to come first and the job with the minimum points, would come to last.

Step-5:- Classifying jobs :- To make the entire job design process a simple task after rating, grades are assigned to all jobs. This helps to reduce the job hierarchy to manageable levels.

Trade Unions :-

A Trade Union is a Combination of persons whether temporary or permanent, Primarily for the purpose of regulating the relations between workers and Employers or between workers for imposing restrictive Conditions on the Conduct of any trade or business and includes the federations of two or more trade unions as per sec. 2(6) Trade unions Act, 1926.

"A Trade Union is an organisation of workers, acting collectively, who seek to protect and promote their mutual interests through collective bargaining.

Objectives :-

(1) Ensure Security of workers
(2) Obtain better Economic Returns
(3) Secure power to Influence Management.
(4) Secure power to Influence Government.

(1) Ensure Security of workers :- This involves continued Employment of workers, prevent retrenchment, lay off or lock-outs. Restrict application of "fire" or discharge.

(2) Obtain better Economic Returns :- This involves

wages hike at periodic intervals, bonus at higher rate, other admissible allowances, subsidized canteen and transport facilities.

(3) Secure power to Influence Management :-

This involves worker's participation in management decision making, role of union in policy decision affecting workers, and staff members.

(4) Secure power to Influence Government

This involves influence on government to pass labour legislation which improves working conditions, safety, welfare, security and retirement benefits of workers and their dependents, seek redressal of grievances as and when needed.

Functions of a Trade Union :-

(1) To secure fair wages to workers.

(2) To safeguard security of tenure and improve conditions of service.

(3) To Enlarge opportunities for promotion and training.

(4) To improve working and living conditions.

(5) To provide for educational, cultural and recreational facilities.

(6) To promote identity of interests of workers with their industry.

(7) To offer responsive co-operation in improving levels of production and productivity, discipline and high standards of quality.

(8) To promote individual and ~~collective~~ Collective welfare.

UNIT- VI

Value Analysis & Project Management

Value Analysis :-

Value analysis developed as a cost reduction technique in U.S.A in 1947. The credit for it goes to Larry D. Miles who was working at General Electric company and who, subsequently became the president of SAVE (Society of American value Engineers) also.

Value analysis is a systematic and critical assessment of all the cost elements of a product & services for decreasing or removing the unnecessary costs. It is regarded as a cost reduction tool. The main objective of value analysis is to decrease the cost by increasing the product value.

In value analysis, value refers to the relationship which exists between function and cost. It is represented as,

$$\text{Value} = \frac{\text{Function}}{\text{Cost}}$$

Objectives (Need, Advantages)

(1) To improve the company's competitive position.

(2) To provide better value to a product/service.

(3) To ensure that every element of cost

labour
Material
Suppliers and service

Contribute equally to the function of the product.

(4) To eliminate unnecessary cost.

Application of value Analysis:-

(1) Capital goods — plant, Equipment, machinery, tools etc.

(2) Raw and Semi - processed material, including fuel.

(3) Materials handling and transportation costs.

(4) purchased parts, Components, Sub-assemblies etc.

(5) Maintenance, repairs, and operational items.

(6) Packing materials and packaging

(7) Printing & Sationary items.

(8) power, water supply, air, steam & other utilities.

Types of values :-

(1) Cost value
(2) Use value
(3) Esteem value
(4) Exchange value

(1) **Cost value** :- It is the cost of manufacturing a product & component.

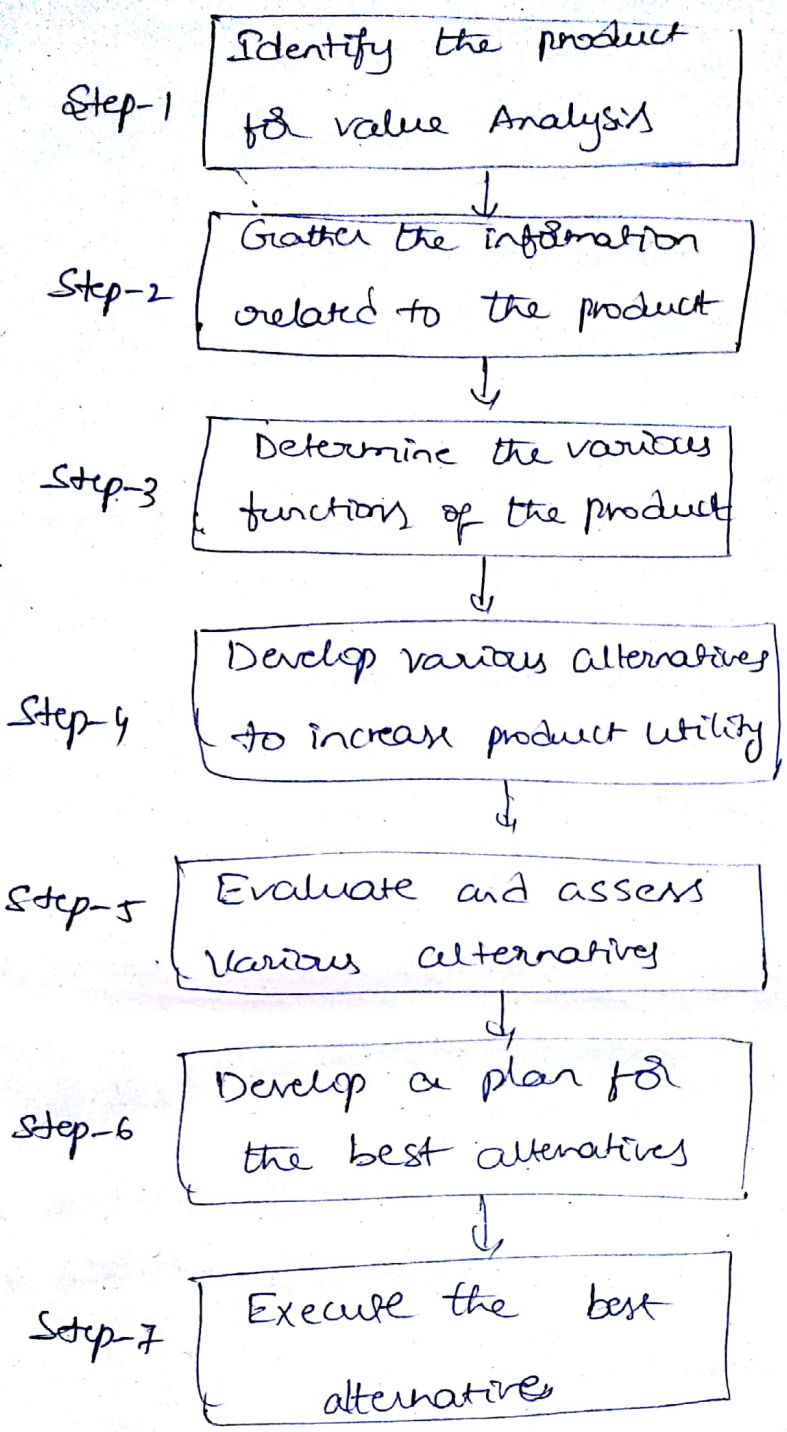
(2) **Use value** :- It may also be called functional value. It considers the work done, functions performed & services rendered by a product.

(3) **Esteem Value** :- It involves the qualities and appearance of a product which attracts persons and creates in them a desire to process the product.

(4) **Exchange value** :- A product is said to process Exchange value of the same can be exchanged for something else.

** Value Analysis or value Engineering process :-

Value analysis is a cost reduction technique which aims at developing the ideas that reduces the cost of the product & increases the product utility.



Value Engineering :—

It is a systematic method to improve the value of goods or products and service by using an examination of function.

Value engineering is a powerful methodology for solving problems and reducing costs while maintaining & improving performance and quality requirements.

Benefits / Advantages

(1) Improving quality management
(2) Improving resource Efficiency.
(3) Simplifying procedures.
(4) Minimising paper work.
(5) lowering Staff cost.
(6) Increasing procedural Efficiency.
(7) optimizing Construction Expenditures.

* Enterprise Resource planning :- (ERP)

ERP provides Combined business ~~Softwa~~ Software modules which acts as a base and supports the functional units of an Enterprise.

ERP can be defined as "an integrated Suit of application Software modules, which provide operational, managerial and strategic information for an Enterprise, so that an Enterprise can improve the standards of quality, productiveness and Efficiency to withstand the Competition

Scope of ERP :- Following are the areas which are covered by ERP

(1) Finance → Financial Accounting
(2) logistics → material management, planning
(3) Human Resource → Personnel management, Training & development
(4) work flow → assignment of tasks
allot work

(4) Finance

ERP Modules:- ERP software consists of many modules, which are usually the functional areas of an Organization.

(1) Financial System
(2) Human Resource System
(3) Marketing system
(4) Manufacturing System
(5) Material management System
(6) plant maintenance System
(7) Sales and distribution System
(8) Quality management System.

ERP Advantages:-

(1) Create integration among supply chain, production and administrative process.
(2) It develops similarity of databases.
(3) It can implement improved, reengineered "best processes."
(4) It helps to increase communication and collaboration among business units and sites.
(5) It has a software database which is off-the-shelf coding.

ERP Disadvantages:-

(1) It is very expensive and costly to purchase and customize.

(2) Implementation of ERP in a company needs major modifications in company and in processes.

(3) It is very complicated, so it is difficult for many companies to adjust to it.

(4) It involves an ongoing process of implementat -ion which never comes to an end.

Functions of ERP :-

(1) Customer Services
(2) Manufacturing
(3) Financial.

Supply chain Management :-

Supply chain is a group of network Existing between different individuals both in service and manufacturing organizations, although the complexity of chain may vary from industry to industry and from firm to firm.

A supply chain is a network of facilities and distribution options that are engaged in the procurement of raw materials, transforma -tion of these materials into intermediate and finished products and finally distributing them among the ultimate customers.

Objectives of SCM :-

(1) Reducing Uncertainty
(2) Reducing lead Times
(3) Eliminating Non-value added activities.
(4) Achieving process Quality.
(5) Manages Demand
(6) Focusing on 'A' category.
(7) Maintaining Multiple Supply chains.
(8) Improving performance Measures
(9) Taking Initiative at an industry level.
(10) Competing on service

Importance of SCM

(1) Gaining Competitive Advantage.
(2) Adds value to the products.
(3) Builds Relationship
(4) Helps in Integrating the process.
(5) Helps in Achieving Economies of Scale.