Solution cum Scheme of Evaluation

IV/IV B.Tech (Regular) Degree Examination

14ME701 Industrial Engineering & Entrepreneurship Development

Mechanical Engineering

November, 2019

Prepared by
P.Umamaheswarrao
Assistant Professor
Department of Mechanical Engineering
Bapatla Engineering College
Bapatla-522102
Mob: 9440871256

1. **1Mx12 = 12M**

a) What is marketing?

Marketing is human activity directed at satisfying needs and wants through exchange process.

(or)

The performance of the business activities that direct the flow of goods and services from producer to consumer is known as marketing.

b) State the levels involved in management

1. Top level management.
2. Middle level management
3. Lower level management

c) Write the stages in product life cycle

Introduction, Growth, Maturity, Decline

d) Define work study

work study is a generic term for those techniques, particularly method study and work measurement, which are used in the examination of human work in all its contexts, and which lead systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed, in order to effect improvement.

e) State any two steps involved in time study

1) Obtaining and recording all information of job, operator, and surrounding conditions likely to affect the carrying of the work.
2) Recording the complete description of the method and breaking down the operation into elements.
3) Measuring with timing device and recording the time taken by the operator to perform each element of operation.

f) What is standard time?

Standard time = Normal time + allowances

g) Define double sampling

When a decision on acceptance or rejection of the lot is made on the basis of two samples is known as double sampling.

h) What is human resource management?

HRM can be defined as a process of procuring, developing and maintaining competent human resources in the organisation so that the goals of an organisation are achieved in an effective and efficient manner.

i) Write the methods of merit rating

1. Ranking method
2. Paired comparison method
3. Man to man comparison

4. Checklist plan
5. Scale plan

j) Define Plant Design

Includes items related directly to the complete plant, such as plant layout, general service facilities and plant location.

k) What is entrepreneurship?

Entrepreneurship is the process of creating something new, with value, by devoting the necessary time and effort, assuming the accompanying financial, psychic, and social risks, and receiving the resulting rewards of monetary and personal satisfaction and independence

l) Write any three functions of an entrepreneur

1. Manages business and takes decisions
2. Studies the market and selects the business
3. Makes a selection of plant size
4. selects plant site
5. Organizes sales and holds the customers

2. a) Discuss about Principles of scientific management 6M

Principles of scientific management:

1. Development of science for each element of work

Analyse the work scientifically, rather than using thumb rule. It means that an attempt is made to find out what is to be done by a particular worker, how he is to do it, what equipment will be necessary to do it. This information is provided to the worker so as to reduce wastage of time, material etc and improve the quality of work.

2. Scientific selection, placement and training of workers

This principle states that select the workers best suited to perform the specific tasks, and then train them within the industry in order to attain the objectives of the enterprise. This eliminates the possibility of misfits in the organization and ensures better working. Workers should also be trained from time to time to keep them informed of latest development in the techniques of production.

3. Division of labour (Separation of planning function from doing function)

Division of work in smaller tasks and separation of thinking element of job from doing element of the job. This is the principle of specialization. It is essential for efficiency in all

spheres of activities as well as in supervision work. To be more effective and efficient, Taylor, the founder of scientific management introduced functional organization, in which one foreman was made in charge for each function.

4. Standardization of methods, procedures, tools and equipment

Standardization helps in reducing time, labour and cost of production. The success of scientific management largely depends upon standardization of system, tools, equipments, and techniques of production.

5. Use of time and motion study

Taylor introduced time and motion study to determine standard work. Taylor undertook studies on fatigue incurred by the workers and the time necessary to complete the task.

Taylor suggested that for increasing production rate, the work of each person should be planned in advance and he shall be allotted a definite work to complete by a given time by using a predetermined method.

6. Differential wage system

Taylor's differential piece rate scheme provides an incentive for a worker to achieve high level of optimum output. It distinguishes the more productive workers from less productive workers and motivates them to produce more. Taylor believed that if labour is suitably rewarded and is satisfied with job, he will work whole heartedly to achieve the objectives of the enterprise.

7. Co-operation between labour and management

Scientific management also strives to get the thinking of management changed so as to make the management feel that mutual respect and co-operation between the workers and the management helps in providing proper and effective leadership. The labour starts thinking that it is their work and they must put their heart and soul in the work assigned to them. In fact the main job of scientific management is to revolutionize the mind of both workers and management for mutual benefit and also for the benefit of the enterprise.

8. Principle of management by exception

In order to make effective utilization of time of top managers, Taylor suggested that only major or significant deviations between the actual performance and standard performance should be brought to the notice of top management. Top management should pay more attention to those areas of work where standards and procedures could not be established and where there is a significant variation between standard performance and actual performance.

2. b) Explain about the functions of management? 6M

FUNCTIONS OF MANAGEMENT:

1. **Forecasting:**

Forecasting is a pre-requisite to planning. It determines estimate of future requirement of the business in regard to products and quantities for sale, materials, manpower, machines capacity for production or any other aspect of business activities.

Forecast are of two types i) short term forecast and ii) Long-term forecast. Forecast covering periods less than one year ahead are called short term forecasts and forecasts covering periods over 1 year to 15 years(beyond 15 years future is assumed to be uncertain) are termed as long term forecasts.

Short term forecasts are made for the purpose of materials control, loading and scheduling, and budgeting while long term forecasts are made for product diversification, sales and advertising, budgeting, financial planning and investment planning.

2. **Planning:**

Planning is determining (identifying and listing) activities to be performed in future in order to achieve desired goals. Planning, therefore, is forward looking. Planning is important because

1. It is done ahead of the job and therefore considered key activity for achieving goals
2. It involves making decisions today which will affect future
3. It provides the basis for other steps of the management process-organising, directing and controlling
4. It gives overall idea of the work that is to be done, in advance so that we don't forget anything and run at the last minute.
5. Planning develops manager's capacity to visualize and help foresee problems before they occur.

Planning involves three steps:

1. Listing of all the activities that need to be performed
2. Arranging activities in the sequence in which they need to be performed
3. Incorporating flexibility to meet contingencies

Planning embraces every activity (function) of management. In the absence of planning, there will be confusion, haphazard working and wastage of resources.

3. Organizing:

Organizing is the next phase to planning. Planning establishes objectives and draws a plan of the activities and organizing puts the plan into action.Organising is

1. Identification and classification of various activities necessary for Achievement of objectives (task identification)
2. Separation and grouping of activities(formation of departments)
3. Assigning people to those activities and providing physical factors of environment (resource allocation)

4. Delegation of authority to each individual charged with execution of each respective activity (delegation of authority)
5. Fixation of horizontal and vertical relationships between various positions

Organising facilitates smooth functioning of the organization, greater co-ordination of work performed by different subordinates, and effective channels of communication. Good organizing results in greater utilization of resources, clarity of responsibility and authority, reduced inter and intra departmental problems, effective decision making, and horizontal and vertical co-ordination of authority and information relationships.

4. Directing:

Directing is the process by which actual performance of the subordinates is guided towards attainment of the goals of the organization.

- Directing involves
- Guiding and helping subordinates in performing the job
- Giving instructions to the subordinates to do a job
- Supervising subordinates to ensure that job is carried out as per established plan
- Motivating them (subordinates) for better performance

Directing involves following four functions

1. Leadership
2. Communication
3. Motivation
4. Supervision

1. Leadership

Influencing subordinates and gaining their confidence and trust is critical for every manager. Subordinates must accept their bosses as leaders and latter must possess leadership qualities.

2. Communication

Managers need to give instructions and guide subordinates. Instructions to subordinates may be oral or written, but they must be clear and precise. Communication, therefore, therefore, plays an important role in getting things done through people.

3. Motivation

Motivation is inspiring people for better performance. Since, different people have different needs, every manager must carefully study the employees' needs and make sincere efforts to satisfy them by providing monetary and non-monetary rewards. Motivation, therefore, is important for directing subordinates.

4. Supervision

Supervision and directing are not separatable since a manager must supervise his subordinates to see that work is performed according to laid down plan

5. Staffing:

Management is getting things done through other people and as such staffing-the process of selecting, training, developing and placing of qualified people in the various jobs- is another important function of management. Staffing is a continuous process as people are required to fill newly created positions due to expansion of activity and to fill vacated positions on account of separation (resignations, death, termination, dismissal etc) of employees

6. Co-ordination:

Co-ordination is integrating or synchronizing the work performed by various individuals for attainment of company's objectives. Co-ordination, like communication, is required at every stage of the management process. The problems as well as importance of co-ordination increases with size of the organization. Co-ordination improves communication between different departments (sales, production, administration, finance etc) increases productivity and morale while lack of co-ordination between different departments can cause irreparable damage to the organization. Effective co-ordination involves

- Setting procedures and systems that co-ordinate the activities (e.g. production meetings, or review meetings)
- Reviewing jointly status of the activities with the departments involved
- Regulating communications to convey decisions taken at the review meetings wherever required.

Success of co-ordination depends on effectiveness of administrative controls (procedures and systems in the organization), dynamism of the leadership, and quality of informal relationships within the organization.

7. Controlling:

Controlling is the process of measuring current performance and taking action (if required) to ensure that pre-determined goals are accomplished. Controlling involves

- Setting performance standards
- Measuring actual performance
- Comparing actual performance against pre-set standards
- Identifying gaps in performances (actual and standard performance)
- Initiating corrective and preventing actions.

Planning and controlling are closely related. The objectives set in planning process provide the basis for controlling. And findings of controlling help future planning.

Controlling is a continuous process which monitors progress of the activities on continuous basis and initiates corrective action when performance is not in conformity with the pre-determined plan.

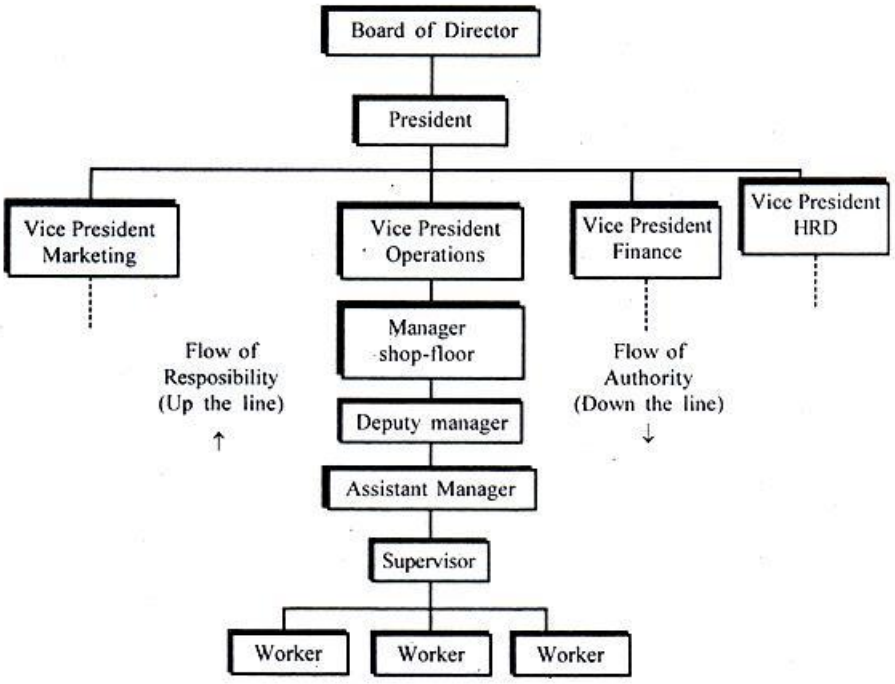
8. Decision making:

Decision making is selecting the best course of action among the available alternatives. Decision making is required in every step of management i.e. planning, organizing, directing and controlling.

Decision making entails identifying the problem, finding out the different possible solutions, selecting the best course of action and implementing the selected alternative.

3. a) Write about different types of organization structures
Line organization **3M**

This is the oldest and most conventional type of relationship, which is also called as **scalar or military type**. This is simple and represents a military organization, where relationships are based on relative rank, authority and responsibility rather than the activity or operations that an individual performs. Immediate supervisor is the boss. Authority flows downwards while responsibility flows upwards. The relationships are more at vertical levels. No service or support units are possible in an ideal line-type structure. The principle of unit of command is strictly followed.



Advantages of Line organisation Structure

1. Simplicity: Line Organisation structure is easy to understand and follow by superiors and subordinates. It is simple and clear as regards authority and accountability.
2. Prompt decisions: Line Organisation facilitates prompt decision-making at all levels as the authority given is clear and complete.
3. Discipline: It brings discipline in the Organisation due to unity of command, delegation of authority and direct accountability.

4. Economical: Line Organisation is economical as experts are not appointed.
5. Attraction to talented persons: Line Organisation brings out talented workers and develops in them quality of leadership. It offers opportunities of self-development to employees.
6. Quick communication, high efficiency, flexibility and high employee morale are some more advantages of line Organisation structure.

Limitations of Line organisation Structure

1. Heavy burden on line executives: The line executives are given too many duties and responsibilities. Even the quality of the decisions of executives may suffer due to heavy burden of duties and responsibilities.
2. Non-availability of services of experts: There is absence of skilled experts in line organisation. Expert assistance is not available promptly when needed by line executives.
3. Favoritism: There is wide scope for favoritism and nepotism in the line organisation. Leadership of departmental executive is autocratic due to heavy concentration of powers. He may favour some employees at the cost of others.
4. Too much dependence on limited executives: In the line organisation, all powers are concentrated in the hands of a few executives. Naturally, the success and stability of the entire organisation depends on their personal skill, initiative and interest. Special difficulties arise when one executive is to be transferred/replaced/promoted.
5. Rigidity: There is rigidity in the working of line organisation.
6. Delays in communication, limited freedom to employees and unsuitability to modern large business units are some more demerits of line organisation.

LINE AND STAFF ORGANIZATION STRUCTURE 3M

Staff authority is used to support the line authority. Line authorities are more involved in the core activities of the business. They have little time to analyze all information for many decisions. They do not have expertise in all technical areas. Staffs are specialists, who help line authority in discharging their duties. For example, a production manager (a line authority) does not have enough time and experience to handle labor relation problems. Staffs (who are specialists) help them in doing so.

Line and staff organizations have both line and staff executives. Line executives are assisted by staff specialists in R & D, planning, distribution, quality, legal, audit, public relations, etc. The job of staff is mainly advisory and guidance. Line executives maintain the supervisory power and control over the execution of work.

Characteristics of Line and Staff organisation

1. Planning and execution: There are two aspects of administration in this organisation, viz., planning and execution.
2. Combining line and staff: Planning function is entrusted to staff specialists who are 'thinkers' while execution function is given to line executives who are 'doers'. The staff is supportive to line.
3. Role of authority: The line managers have authority to take decisions as they are concerned with actual production. The staff officers lack such authority.

4. Guidance from staff: The staff provides guidance and advice to line executives when asked for. Moreover, line executives may or may not act as per the guidance offered.
5. Exercising control: The staff manager has authority over subordinates working in his department.
6. Scope for specialization: There is wide scope for specialization in this organisation as planning work is given to staff and execution work is given to line executives.
7. Possibility of conflicts: Conflicts between line and staff executives are quite common in this organisation but can be minimized through special measures.
8. Suitability: Line and staff organisation structure is suitable to large-scale business activities.

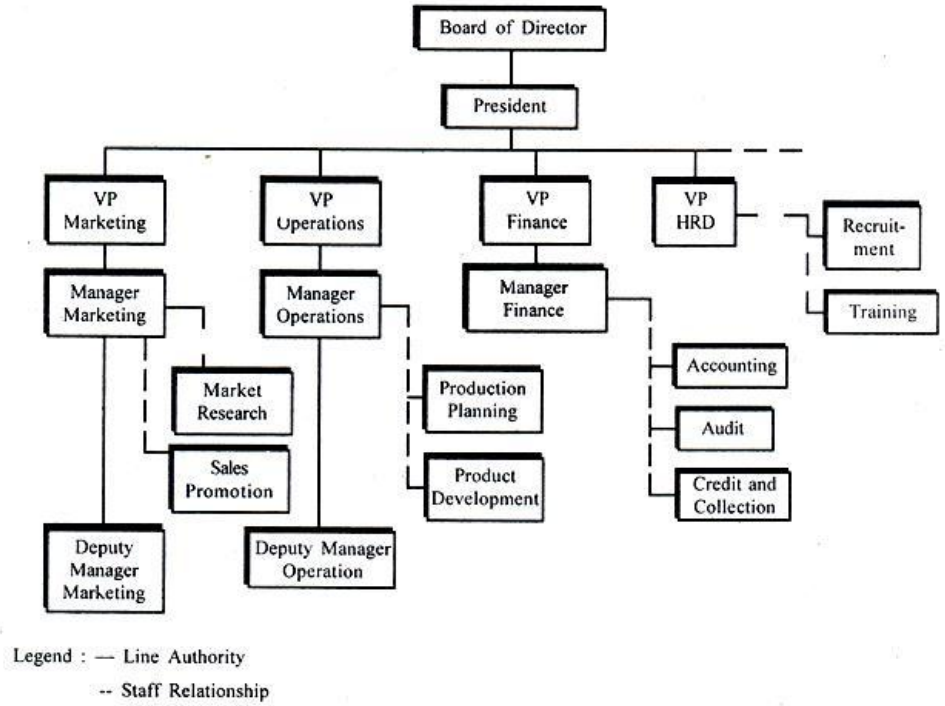
Merits of Line and Staff organisation

1. Less burden on executives: Line executives get the assistance of staff specialists.This reduces the burden of tine executives. This raises overall efficiency and facilitates the growth and expansion of an enterprise.
2. Services of experts available: The benefits of services of experts are provided to line managers. Highly qualified experts are appointed and they offer guidance to line executives.
3. Sound decision-making: Line and staff organisation facilitates sound management decisions because of the services of experts and specialists. The decisions are also taken in a democratic method i.e. in consultation with the experts.
4. Limited tension on line managers: The pressure of work of line bosses is brought down as they are concerned only with production management.
5. Benefits of specialization: There is division of work and specialization in this organisation. Naturally, the benefits of division of work and specialization are easily available.
6. Training opportunities to employees: Better opportunities of advancement are provided to workers. The scope for learning and training for promotions are available.

Demerits of Line and Staff organisation

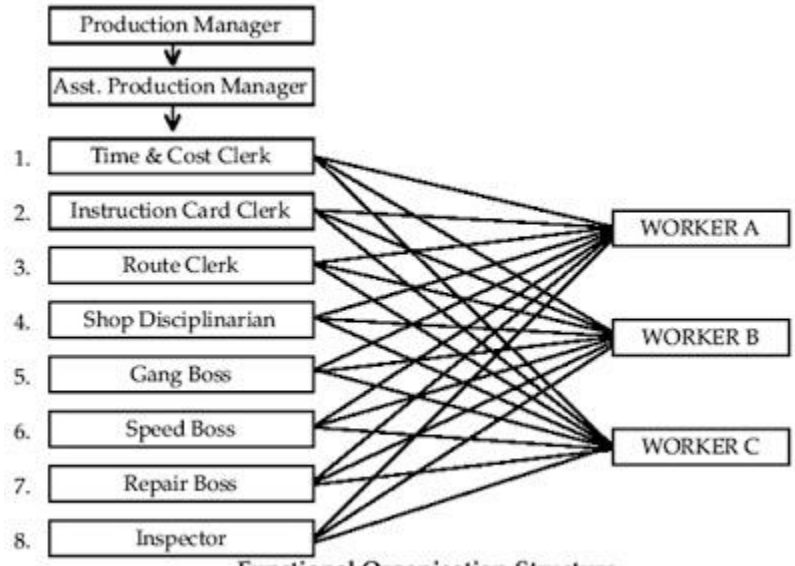
1. Delay in decision-making: The process of decision-making is delayed, as line executives have to consult staff experts before finalizing the decisions. The decisions of line managers are likely to be delayed due to this lengthy procedure.
2. Buck passing among executives: The line bosses are concerned with actual execution of work. However, they depend on staff experts for guidance. If something goes wrong, the attempt is made to pass on the blame by one party to the other. Thus, there is shifting of responsibility or buck-passing.
3. Conflicts between line and staff executives: In this organisation, quarrels and conflicts between line managers and staff specialists are quite common. The line managers are generally not interested in the advice offered by experts. Secondly, specialists feel that the line bosses lack knowledge of new ideas. Such conflicts lead to bitterness.
4. Costly organisation: Line and staff organisation is a costly organisation as the line executives are supported by highly paid staff executives who are experts. All this adds to the overhead expenses and the cost of production increases.

5. Complicated operation: This organisation is too complicated in actual operation because of dual authority, division of functions and too much dependence on staff. The unity of command principle is violated.
6. Internal discipline is affected adversely: The internal discipline is likely to be affected adversely due to decentralisation and division of loyalty of subordinates.



(OR)

Functional Organisation **3M**



Functional Organisation Structure

Foremen at Planning Level (Planning Dept.)

1. Time and Cost Clerk: He is concerned with preparing standard time for the completion of certain piece of work and compiling the cost of that work.
2. Instruction Card Clerk: He lays down the exact method of doing the work. He specifies the tools to be used for conducting the production and also gives other instructions on the instruction cards prepared by him.
3. Route Clerk: The route clerk lays down the exact route through which each and every piece of work should move through various stages till completion. He decides the production schedule and the sequence of steps by which the production process is to move.
4. Shop Disciplinarian: He is concerned with the discipline, insubordination, violation of rules of discipline and absenteeism. All cases relating to these matters will be managed by the shop disciplinarian.

Foremen At Shop Floor Level (Shop Floor)

1. Gang Boss: He assembles and sets up various machines; and tools for a particular piece of work. He is in-charge of assembling line of production.
2. Speed Boss: He is concerned with the speeding of machines used for production. He keeps proper speed of the machines and see that workers complete the production work as per the schedule time.
3. Repair Boss: The repair boss looks after the proper maintenance of machines, tools and equipments required during the production process.
4. Inspector: The inspector controls quality of the products by keeping adequate check/control when the production work is in progress.

Merits of Functional Organisation Structure

1. Facilitates specialization: Functional organisation structure facilitates division of work and specialization. Each boss has specialized knowledge of his functional area. He is in a better position to guide and help the workers.
2. Benefits of large-scale operations: Functional organisation offers the benefit of economy of large-scale operation. In this organisation, one administrative unit manufactures all products. The available machinery, equipment and facilities are used fully for large-scale production.
3. Facilitates effective coordination: Functional organisation facilitates effective coordination within the function. This is possible as one boss is in-charge of a particular function and he looks after all activities, which come within that function.
4. Operational flexibility: Functional organisation possesses operational flexibility. Necessary changes can be introduced easily to suit the needs of the situation without any adverse effect on the efficiency.
5. Ensures effective supervision: Functional organisation facilitates effective supervision by the functional heads and foremen. Due to specialization, they concentrate on the specific functional area and also keep effective supervision on their subordinates.

Demerits of Functional Organisation Structure

1. Absence of unity of command: Unity of command is absent in the functional organisation as each worker gets orders and instructions from several bosses.
2. Fixing responsibility is difficult: In functional organisation, responsibility is difficult to fix on a specific person. This is because the responsibility itself is divided among many.
3. Unsuitable to non-manufacturing activities: Functional organisation can be introduced in the case of manufacturing activities. However, its application to non-manufacturing activities such as marketing, etc. has not been successful.
4. Costly: Functional organisation is costly, as more specialists are required to be appointed.
5. Creates confusion among workers: Functional organisation is based on specialization as function is taken as a base for dividing the work. The authority is overlapping the responsibility is divided. This confuses workers.
6. Conflicts among foremen, delays in decision-making and limited discipline within the departments are some more demerits of functional organisation.

3. b) Describe briefly different channels of distribution

CHANNELS OF DISTRIBUTION 2M

A channel of distribution or trade channel is the path or route along which goods move from producers to ultimate consumers. It is a distribution network through which a producer puts his products in the hands of actual users. A trade or marketing channel consists of the producer, consumers or users and the various middlemen who intervene between the two. The channel serves as a connecting link between the producer and consumers. By bridging the gap between the point of production and the point of consumption, a channel creates time, place and possession utilities. A channel of distribution represents three types of flows:

a. Goods flow from producer to consumers;

b. Cash flow from consumers to producer as payment for goods; and

c. Marketing information flows in both directions, from producers to consumers in the form of information on new products, new uses of existing products, etc. The flow of information from consumers to producers is the feedback of the wants, suggestions, complaints, etc.

KINDS OF DISTRIBUTION CHANNELS 4M

Every small-scale entrepreneur requires a channel that can distribute his product to the right customers at the right time and at the right cost. It consists of all the middlemen which participate in the distribution of goods and which serve as a link between the manufacturer and the consumer.

1. Manufacturer to Customer: This is also known as direct selling because no Middlemen are involved. A producer may sell directly through his own retail stores, for example, Bata. This is

the simplest and the shortest channel. It is fast and economical. Small producers and producers of perishable commodities also sell directly to the local consumers. Big firms adopt direct selling in order to cut distribution cost and because they have sufficient facilities to sell directly to the consumers. The producer or the entrepreneur himself performs all the marketing activities.

2. Manufacturer to Retailer to Customer: This is one stage distribution channel having one middleman, i.e., retailer. In this channel, the producer sells to big retailers like departmental stores and chain stores who in turn sell to customer. This channel is very popular in the distribution of consumer durables such as refrigerators, T V sets, washing machines, typewriters, etc. This channel of distribution is very popular these days because of emergence of departmental stores, super markets and other big retail stores. The retailers purchase in large quantities from the producer and perform certain marketing activities in order to sell the product to the ultimate consumers.

3**. Manufacturer to Wholesaler to Retailer to Customer:** This is the traditional channel of distribution. There are two middlemen in this channel of distribution, namely, wholesaler and retailer. This channel is most suitable for the products with widely scattered market. It is used in the distribution of consumer products like groceries, drugs, cosmetics, etc. It is quite suitable for small scale producers whose product line is narrow and who require the expert services and promotional support of wholesalers.

4. a) What is productivity? Explain how to measure productivity?

Productivity **2M**

Productivity defined as the ratio of output produced to the input resources utilized in the production.

KINDS OF PRODUCTIVITY MEASUREMENT: **4M**

Productivity is an effective tool of judging how a system is performing over a period of time. It is important to measure it quantitatively and the following techniques are used to measure the productivity.

1. **MATERIAL PRODUCTIVITY:**

   There are many industries in which the cost of raw material is in appreciable proportion of cost of finished product. Under such conditions, the productivity of materials becomes a key factor in economic production.

   $$\text{Material productivity} = \frac{\text{output}}{\text{Material input}}$$

   Raw material productivity can be improved by:

   1. Changes in product design
   2. Proper training and motivation of workers
   3. Better material planning and control
   4. Waste reduction and scrap control
   5. Search for alternative cheaper materials

2. LABOUR PRODUCTIVITY:

$$\text{Labour or human productivity} = \frac{\text{output}}{\text{Human input}}$$

Output and labour can also be measured in terms of their money value

$$\text{Thus labour productivity} = \frac{\text{Total revenue from production}}{\text{Expenditure on labour}}$$

Labour productivity can be improved by:

1. Providing training to workers to utilize best methods of production.
2. Selection of product design and process of manufacture so as to ensure most economic use of labour
3. Constant motivation of workers by financial and non financial incentives
4. By boosting the morale of employees
5. Improving working conditions in the plant

3. CAPITAL PRODUCTIVITY:

$$\text{Capital productivity} = \frac{\text{Turnover}}{\text{Capital input}}$$

It can be improved by:

1. by careful make or buy decisions
2. Better utilization of capital resources like land, building and machines
3. by adopting modern manufacturing techniques, like flexible manufacturing system, Improved techniques of maintenance and proper plant layout.

4. MACHINE PRODUCTIVITY:

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

Machine productivity can be increased by:

1. Preventive maintenance
2. Utilization of proper machining parameters like speed, feed etc
3. Use of requisite skilled and properly trained labour
4. Method study

5. ENERGY PRODUCTIVITY:

Energy productivity = output

Energy input

4. b) Explain the objectives of Method study

OBJECTIVES OF METHOD STUDY: 6M

1. The improvement of processes and procedures
2. The improvement of factory, shop and work place layout and the design of plant and equipment
3. Economy in human effort and reduction of unnecessary fatigue
4. Improvement in the use of materials, machines and manpower.
5. The development of better physical working environment
6. To find the best way of doing a job
7. To standardize the best method
8. To train the individual worker in its practice as per standardized method
9. Reduction of waste and scrap, improvement in quality
10. Effective material handling
11. Improvement in the flow of production and processes

5. a) Describe the different techniques of work measurement

TIME STUDY 3M

Time study is used to determine the time required by a qualified and well-trained person working at a normal pace to do a specified task. It should be noted that, whereas motion study is largely design, time study involves measurement. Time study is used to measure work. The result of time study is the time that a person suited to the job and fully trained in the specified method will need to perform the job if he or she works at a normal or standard tempo. This time is called the standard time for the operation.

TIME STUDY EQUIPMENT:

The equipment needed for time study work consists of a timing device and observation board.The devices most commonly used for measuring work are

1. Stop watch or electronic timer
2. Motion picture camera (with constant –speed motor drive or with a micro chronometer in the picture to indicate time)
3. Electronic data collector and computer

DECIMAL STOP WATCHES AND ELECTRONIC TIMERS:

The stop watch and the electronic timer are the most widely used timing devices for time study. The electronic timer, which performs the same function as the stop watch, is some times referred

to as an electronic stop watch. The electronic data collector and the computer provide an entirely different system for making time studies.

The decimal-minute stop watch has the dial divided into 100 equal spaces, each of which represents 0.01 minute, the hand making one complete revolution per minute. A smaller dial on the watch is divided into 30 spaces, each of which represents 1 minute, the hand making one complete revolution in 30 minutes. The hands of the watch are controlled by the side A and the winding stem B. The starting and stopping of the watch are controlled by the slide. It is possible to stop the hand at any point and then start it again from that position. Pressure on the top of the stem B returns the hand to zero, but it starts off immediately upon releasing the stem. The hand may be held at zero either by holding the stem down or by pushing the slide A away from the stem.

The decimal-hour stop watch is like the decimal-minute watch in design and operation, but it has the dial divided into 100 spaces, each of which represents 0.0001 hour, the hand making 100 revolutions per hour. The small dial on the watch is divided into 30 spaces, each of which represents 0.01 hour, the hand making 3⅓ revolutions per hour. The principal advantage of this watch is that the readings are made directly in fractions of an hour, which is the common unit of time measurement in industry. The chief disadvantage of the decimal-hour watch is that it is more difficult to handle four decimal places than two decimal places. This is particularly true in recording stop-watch data on the observation sheet. The split-second stop watch is not recommended and is seldom used for this work.

WORK SAMPLING **3M**

Work sampling was first used by L.H.C.Tippet in the British textile industry, and it was introduced into this country under the name of "ratio delay" in 1940.Work sampling is a fact-finding tool. In many cases, needed information about men or machines can be obtained in less time and at lower cost by this method than by other means.

Work sampling has three main uses:

1.activity and delay sampling- to measure the activities and delays of workers or machines –for example, to determine the percentage of the day that a person is working and the percentage that he or she is not working

2. Performance sampling- to measure working time and non working time of a person on a manual task, and to establish a performance index or performance level for the person during his or her working time.

3. Work measurement-Under certain circumstances, to measure a manual task, that is, to establish a time standard for an operation.

Work sampling is based on the law of probability. A sample taken at random from a large group tends to have the same pattern of distribution as the large group or universe. If the sample is large enough, the characteristics of the sample will differ but little from the characteristics of the group. Sample is the term used for this small number, and population or universe is the term used for large group. Obtaining and analyzing only a part of the universe is known as sampling.

PROCEDURE:

The work sampling procedure can be divided into the following three phases:

a) preparing for work sampling
   i) statement of the main objective of the study
   ii) obtain the approval of the supervisor of the department in which work sampling is to be performed
   iii) Establish quantitative measure of activity
   iv) Selection of training of personnel
   v) Making a detail plan for taking observations
b) performing work sampling
   i) Describing and classifying the elements to be studied in details
   ii) Design the observation form
   iii) Determine the number of days or shifts required for the study
   iv) Develop properly randomized times of observations
   v) Observing activity and recording data
   vi) Summarizing the data at the end of each day
c) Evaluating and presenting results of work sampling
   i) Evaluate the validity and reliability of data
   ii) Presenting and analyzing data
   iii) Planning for future studies

5. b) What is performance rating? Explain the different methods of performance rating 6M

Performance rating is the step in the work measurement in which the analyst observes the worker's performance and records a value representing that performance relative to the analyst's concept of standard performance.

1. **Skill and effort rating:**

   Around 1916 Charles E.Bedaux introduced the Bedaux system of wage payment and labor control in this country. His plan was based on time study and his time standards were expressed in points or "Bs". A point or B was simply another name for what we now call a standard minute. His time study procedure included the rating of the operator's skill and effort and the use of a standard table of fatigue allowances.Bedaux used 60 points equal to standard performance. In another words, an operator working at a normal pace was expected to produce 60 Bs per hour, and it was expected that the average incentive pace would be around 70 to 85 points per hour.

   Before Bedaux, performance rating had been done mainly by selecting stop-watch readings from the time study data. Thus, if the operator was judged to be working at a fast tempo, a watch reading considerably above average would be selected as the

representative time for the element; if the operator was judged to be working at a slow tempo, then a watch reading below average would be selected. The bedaux system was a definite improvement over this informal method of rating operator performance.

2. **Westing house system of rating:**

A four-factor system for rating operator performance was developed at Westinghouse and originally published in 1927.These four factors are i)skill ii) effort iii) conditions, and iv) consistency. A scale of numerical values for each factor was supplied in fig. and the selected time obtained from time study was normalized or leveled by applying the sum of the ratings of the four factors.

For example, if the selected time for an operation was 0.50 minute and if the ratings were as follows:

Excellent skill, B2	+ 0.08
Good effort, C2	+ 0.02
Good condition, C	+ 0.02
Good consistency, C	+ 0.01

Total	+ 0.13

Then the normal time for this operation would be 0.565 minute (0.50X1.13 = 0.565)

3. **Synthetic rating:**

Synthetic rating is the name given to a method of evaluating an operator's speed from predetermined time values. The procedure is to make a time study in the usual manner, and then compare the actual time for as many elements as possible with predetermined time values for the same elements. A ratio can be established between the predetermined time value for the element and the actual time value for that element. This ratio is the performance index or rating factor for the operator in so far as that one element is concerned. The formula for computing the performance rating factor is

$$R = \frac{P}{A}$$

Where R = performance rating factor

P = predetermined time for the element, expressed in minutes

A = average actual time value (selected time) for the same element

The selected times for elements 1 and 3 were 0.12 and 0.17 minute, respectively. The time values for these two elements as determined from a table of predetermined time values were 0.13 and 0.19 minute, respectively. In the first case the rating factor was 108 percent (0.13/0.12 X 100 = 108%), and in the second case it was 112 percent (0.19/0.17X100 = 112%).The average rating factor was the average of 108 and 112, or

110 percent. The average rating factor was then applied to all elements in this study. The rating factor, of course, is applied only to manually controlled elements.

4. **Objective rating:**
   Another method of rating performance has been given the name objective rating. First, the operators speed is rated against a single standard pace which is independent of job difficulty. The observer merely rates speed of movement or rate of activity, paying no attention to the job itself. After the pace rating is made, an allowance or a secondary adjustment is added to the pace rating to take care of the job difficulty. Job difficulty is divided into six classes, and a table or categories are 1. Amount of body used 2. Foot pedals 3. Bimanual ness 4. Eye-hand coordination 5.Handling requirements 6.weight

   EXAMPLE:

   If the selected time for an element is 0.26 minute, the pace rating is 95 percent, and if the sum of all secondary adjustments amounts to 20 percent, then the normal time will be 0.297 minute (0.26X0.95X1.20)

5. **Performance rating**
   By far the most widely used system of rating in this country is that of rating a single factor –operator speed, pace, or tempo. This system is called performance rating. The rating factor may be expressed in percentage, in points per hour, or in other units. Here we shall use the percentage system, with normal performance equal to 100 percent.

6. a) Explain about attribute control charts with examples 6M

Attributes control charts plot quality characteristics that are not numerical (for example, the number of defective units, or the number of scratches on a painted panel).

It is sometimes necessary to simply classify each unit as either conforming or not conforming when a numerical measurement of a quality characteristic is not possible. In other cases, it is convenient to count the number of nonconformities rather than the number of nonconforming units. A unit may have a number of nonconformities without classing the unit as nonconforming. For example, a scratch on a painted panel may be nonconformity but only if several such scratches exist would the entire panel be classed as a nonconforming unit.

- **P chart**
  A p-chart is a type of control chart used to monitor the proportion of nonconforming units when measuring subgroups at regular intervals from a process.
- **C chart**
  A c-chart is a type of control chart used to monitor the total number of nonconformities when measuring subgroups at regular intervals from a process.

Control Charts for Attributes:

The $\bar{X}$ and R control charts are applicable for quality characteristics which are measured directly, i.e., for variables. There are instances in industrial practice where direct measurements are not required or possible.

Under such circumstances, the inspection results are based on the classification of products as being defective or not defective, acceptable as good or bad accordingly as that product confirms or fails to confirm the specified specification.

In manufacturing, sometime it is required to control burns, cracks, voids, dents, scratches, missing and wrong components, rust etc. Here, we inspect products only as good or bad but not how much good or how much bad. Furthermore, there are many quality characteristics that come under the category of measurable variables but direct measurement is not taken for rea-sons of economy.

These products are inspected with GO and NOT GO gauges. Again under this type also, our aim is to tell that whether product confirms or does not confirm to the specified values. Quality characteristics expressed in this way are known as attributes.

The various control charts for attributes are explained as under:

1. Attribute Charts for Defective Items: (P-Chart):

This is the control chart for percent defectives or for fraction defectives. This is used when-ever the quality characteristics are expressed as the number of units confirming or not confirm-ing to the specified specifications either by visual inspection or by 'GO' and 'NOT GO' gauges.

The Centre Line Value:

It is denoted by $\bar{P}$ (P bar) and may be defined as the ratio between the total number of defective (non-conforming) products observed in all the samples combined and the total number of products inspected. For example, 15 products are found to be defective in a sample of 200, then 15/200 is the value of $\bar{P}$.

Fraction and Percent Defectives:

The fraction defective value is represented in a deci-mal as proportion of defectives out of one product, while percent defective is the fraction defective value expressed as percentage. As in the above example, fraction defective of 15/200 = 0.075, and percent defective will be 0.075 x 100 = 7.5%.

Standard Deviation:

The standard deviation for fraction defective denoted by σ P is calculated by the formula.

$$\sigma P = \sqrt{\frac{\bar{P}(1-\bar{P})}{n}}$$

Where n = sample size and $\bar{P}$ = fraction defective.

Trial Control Limits:

So $$UCL_p = \bar{\bar{P}} + 3\sigma P_. = \bar{\bar{P}} + 3\sqrt{\frac{\bar{\bar{P}}(1-\bar{\bar{P}})}{n}}$$

Similarly, $$LCL_p = \bar{\bar{P}} - 3\sqrt{\frac{\bar{\bar{P}}(1-\bar{\bar{P}})}{n}}$$

Just as the control limits for the X and R-charts are obtained as + 3σ values above the average. The two control limits, upper and lower for this chart are also calculated by simply adding or subtracting 3σ values from centre line value. These trial limits are computed to determine whether a process is in statistical control or not.

Mostly the control limits are obtained on the basis of about 20-25 samples to pick up the problem and standard deviation from the samples is calculated for further production control

The table shows that successive lots of spindle are coming out of the machine. The spindles are subject to inspection for burrs. The spindles are inspected in samples of 100 each.

Presence of a single or more burrs discriminates the value to be as defective. Compute and construct the chart.

Sample No.	*Sample Size*	*Defectives*	*Percentage*
1	100	1	1
2	100	1	1
3	100	2	2
4	100	1	1
5	100	1	1
6	100	0	0
7	100	1	1
8	100	0	0
9	100	1	1
10	100	2	2
11	100	3	3
12	100	2	2
13	100	1	1
14	100	2	2
15	100	0	0
16	100	2	2
17	100	7	7
18	100	1	1
19	100	2	2
20	100	0	0

Computation and Construction:

Here the maximum percent defective is 7% and the total number of samples inspected is 20. On graph paper, make abscissa for samples number 1, 2, 3, up to 20. Make ordinate as percent defective so as to accommodate 7%. Next go on marking various points as shown by the table as sample number vs. percent defective.

Draw three firm horizontal lines, one each for central line value, upper limit and lower limit after obtaining by calculations.

Estimated fraction defective

$$\bar{P} = \frac{\text{Sum of defective values}}{\text{Total number of products inspected}}$$

$$= \frac{30}{20 \times 100} = 0.015$$

Percent defective of $\bar{P} = 100\ \bar{P} = 100 \times 0.015 = 1.5\%$

Standard deviation $= \sigma P = \sqrt{\frac{\bar{P}(1-\bar{P})}{n}}$

$$= \sqrt{\frac{0.015(1-0.015)}{100}} = 0.0121$$

Then, upper control limit $= \bar{P} + 3\,\sigma P$

$\therefore$ $UCL_P = 0.015 + 3 \times 0.0121 = 0.0513$

Lower control limit $= \bar{P} - 3\,\sigma P = 0.015 - 3 \times 0.0121 = 0.015 - 0.0363$

$=$ – ve value, but –ve value is not possible

Therefore, $LCL_P = 0$.

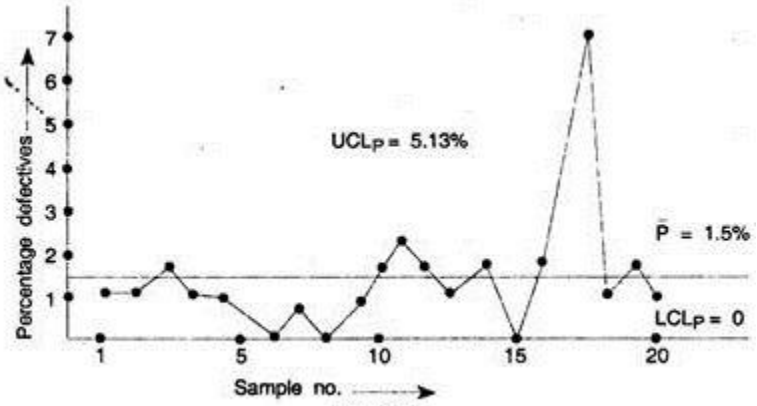


Fig. 63.5.

(OR)

Attribute Charts for Number of Defects per Unit: (C-Chart):

This is a method of plotting attribute characteristics. In this case, the sample taken is a single unit, such as length, breadth and area or a fixed time etc. In some cases it is required to find the number of defects per unit rather than the percent defective.

For example take a case in which a large number of small components form a large unit, say a car or transistor. The transistor set may have defect at various points. In this case, it seems natural to count the number of defects per set, rather than to determine all points at which the unit is defective.
This attempt to use P-charts to locate all the points at which transistor is defective seems to be wrong, impossible to some extent and impracticable approach to the problems. Such a condition warrants the necessity for the use of a C-chart.

Examples of C-Chart:
The distribution of the variables in C-chart very closely follows the Poisson's distribution.

The examples given below show some of representative types of defects, following Poisson's distribution where C-chart technique can be effectively applied:
(i) Number of blemishes per 100 square metres.
(ii) Typing mistakes on the part of a typist.
(iii) Number of spots on a distempered wall.
(iv) Air gap between two meshing parts of a joint.
(v) Welding defects in a truss.
(vi) Unweaven points on a piece of a textile cloth.
(vii) Leakage in water tight joints of radiator.
(i) The Average Number of Defects:
It is denoted by $\bar{C}$ (C bar) and is the ratio between the total number of defects found in all samples and the total number of samples inspected.
(ii) Standard Deviation:
The sigma of standard deviation for number of defects per unit production is calculated from the formula $\sigma c = \sqrt{\bar{C}}$
Trial Control Limits:
The control limits can be calculated as $\pm 3\sigma c$ from the central line value C.

i.e., $UCL_c = \bar{C} + 3\sqrt{\bar{C}}$

$LCL_c = \bar{C} - 3\sqrt{\bar{C}}$

Example 5:
The following table shows the number of defects on the surface of bus bodies in a bus depot, on 21 Sept. 2013.

Dated	*Body No.*	*No. of defects*
21/5/2014	1	2
	2	2
	3	4
	4	7
	5	5
	6	6
	7	7
	8	14
	9	2
	10	9
	11	3
	12	0
	13	5
	14	1
	1	3
	16	10
	17	4
	18	3
	19	12
	20	6
Total	20	110

Computation:

(i) Compute the average number of defects $\overline{C} = 110/20 = 5.5$.

(ii) Compute the trial control limits, $UCL_c = 5.5 + 3\sqrt{5.5} = 12.54$

$LCL_c = 5.5 - 3\sqrt{5.5} = -1.74 = 0$, as -ve defects are not possible.

Construction:

1. Mark abscissa as the body number to a suitable scale (1 to 20).
2. Mark ordinate as number of defects say upto 15. Looking to the table, the maximum number of 14 defects are in body No. 8.
3. Mark various points for the body number and the number of defects in that body.
4. Join all the 20 points with straight lines and also draw one line each for average control line value, upper control limit and lower control limit, i.e. 5.5, 12.54 and 0 respectively.

Interpretation:

As shown in the chart, one point No. 8 having 14 defects fall outside the upper control limit. The data relate to the production on 21/5/2014. then $\overline{C}$ value requires recalculation which will be 100 + 14/19 = 5.03. The value 5.03 will be the standard value of $\overline{C}$ for next day's production. Consequently the control limits are also revised if it decided to apply the data in next day's production, i.e., 22/5/2014.

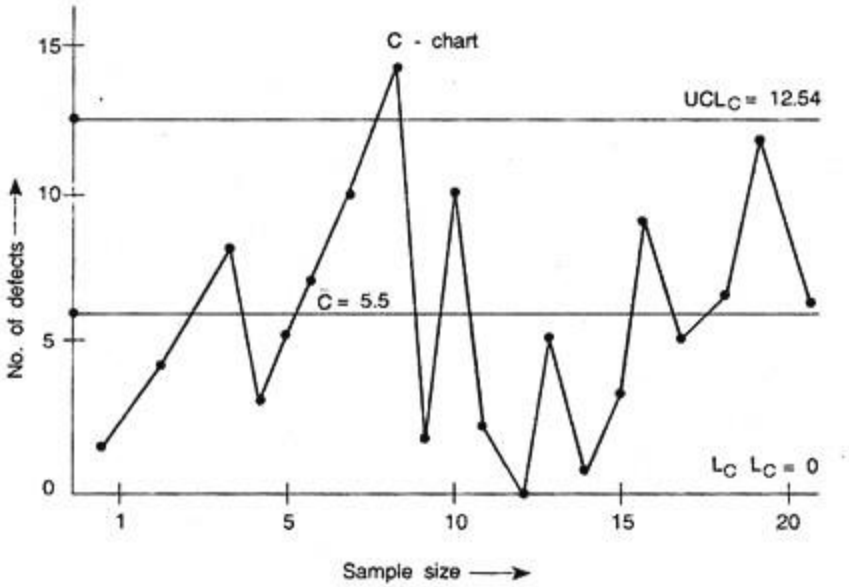
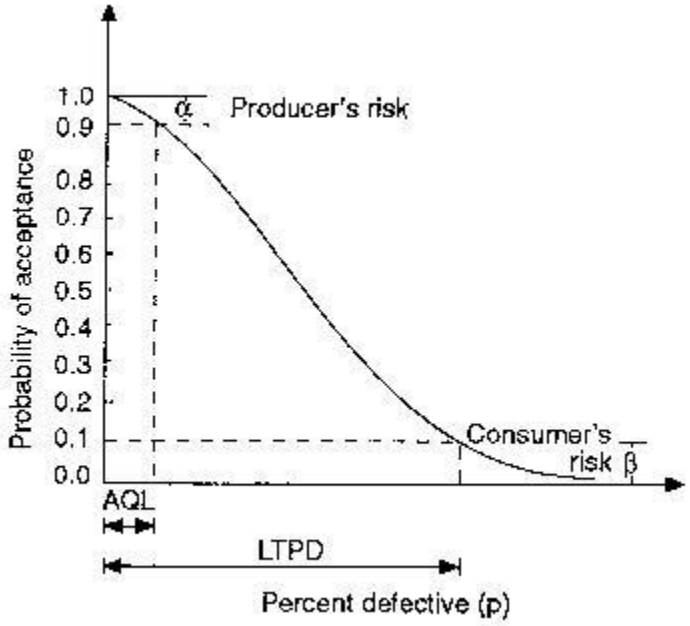


Fig. 63.6.

6. b) Describe the acceptance sampling in detail **6M**

Acceptance sampling is an inspection procedure used to determine whether to accept or reject a specific quantity of material



The concepts of the two types of risk are well explained using an operating characteristic- curve. This curve will provide a basis for selecting alternate sample plans. For a given value of sample size (n), acceptance number (C), the O.C. curve is shown in Fig.

In the above figure, percent defective is shown on x-axis. The probability of accepting the lot for a given percent defective is shown on y-axis. The value for percent defective indicates the quality level of the lot inspected. AQL means acceptable quality level. LTPD means lot tolerance percent defectives. These represent quality levels of the lot submitted for inspection. If the quality level of the lot inspected is at AQL or less than AQL, then the customers are satisfied with the quality of the lot. The corresponding probability of acceptance is called $1 - \alpha$. On the other hand, if the quality level is more than or equal to LTPD, the quality of the lot is considered to be inferior from consumer's view point. The corresponding probability of acceptance of the lot is called β. The quality level in between AQL and LTPD is called indifferent zone.

So, we require α, β, AQL and LTPD to design a sample plan. Based on these, one can determine n and C for the implementation purpose of the plan

Advantages of Acceptance Sampling:

(i) The method is applicable in those industries where there is mass production and the industries follow a set production procedure.

(ii) The method is economical and easy to understand.

(iii) Causes less fatigue boredom.

(iv) Computation work involved is comparatively very small.

(v) The people involved in inspection can be easily imparted training.

(vi) Products of destructive nature during inspection can be easily inspected by sampling.

(vii) Due to quick inspection process, scheduling and delivery times are improved.

Limitations of Acceptance Sampling:

(i) It does not give 100% assurance for the confirmation of specifications so there is always some likelihood/risk of drawing wrong inference about the quality of the batch/lot.

(ii) Success of the system is dependent on, sampling randomness, quality characteristics to be tested, batch size and criteria of acceptance of lot.

7. a) Write and Explain the different types of job evaluation methods 6M

Methods of job evaluation:

a) Non-quantitative methods
   1. Ranking method
   2. Classification method

b) Quantitative methods
   1. Factor comparison method
   2. The point rating method

1. Ranking method

This is the easiest and simplest method of job evaluation. In this method the jobs are ranked from the most important one to the least important. Each departmental head arranges the jobs in their department in the order of importance. The individual

departments pass on their ranking to a central committee who groups the jobs into grades/classes.

While ranking, following points are considered:

1. Amount of work involved
2. Supervision needed
3. Extent of responsibility required
4. Difficulties involved in the work
5. Monotony of work
6. Working conditions required
7. Knowledge and experience needed

2. Classification method

In this method jobs are classified or graded in groups or levels of equal skill, difficulty, responsibility, importance and other requirements. It may be production job, a sales job or an office job, each job family can be broken into a number of grades. For example, production jobs may be classified into five grades, namely grade 1 to grade 5. Grade 1 involves simple tasks requiring less skill, precision and accuracy while grade 5 involves skilled, precise and highly accurate work.

The job evaluation by job classification involves following major steps:

1. Deciding the number of grades(five, six etc)
2. Writing grade level descriptions
3. Identifying/listing of the jobs to be evaluated
4. Preparing job descriptions
5. Comparing job descriptions with grade level descriptions and assigning jobs to grades

3. Factor comparison method

In this method detailed analysis of the jobs is carried out by employing following five main factors:

1. Skill
2. Mental effort
3. Physical effort
4. Responsibilities
5. Working conditions

The various steps involved in the factor comparison method are:

1. Identify a few key jobs in the organization which can be described accurately and assumed to be correctly paid
2. Analyse the key jobs for each of the five factors mentioned above
3. The salary paid for each key job is amongst the factors in proportion to their importance in the job
4. This provides a money rating scale for each of the factors

5. Each of the remaining jobs is evaluated for each of the factors on its money rating scale of the key jobs. The monetary value of the job is obtained by adding up the individual money values assigned to the job for each of the factors depending upon their importance in the job.

		Factors				
Key job	Salary	Skill	Mental effort	Physical effort	Responsibility	Working conditions
J1	1300	240	100	200	600	160
J2	1640	500	100	600	200	240
J3	2160	400	750	140	800	120
J4	2500	540	380	900	320	360
J5	3200	800	400	200	1100	700
X	Job to be evaluated	200	160	240	500	300

4. Point method

The point system a widely used method is based on dividing the jobs into a number of factors which in turn are further subdivided into grades or degrees. Certain points (weightage) is assigned to each grade.(for example, effort is one of the factors which may be subdivided in two grades-physical and mental) when such points for all the factors are added they indicate the importance of the job in the organization. The points or weightage assigned to each factor will vary from industry to industry. Point method involves the following major steps:

a) Decide the type of jobs to be evaluated
b) Select and define job factors which may vary from five to ten.

A few job factors commonly selected are as given below

1. Skill
   a) Education and training
   b) Experience
   c) Judgement and initiative
2. Effort
   a) Physical
   b) Mental
3. Responsibility towards
   a) Materials or product
   b) Equipment or process
   c) Safety of others
   d) Work of others
4. Working conditions
   a) Exposure to hazards

b) Dust, smoke, fumes and noise
c) High temperature
d) Glares and harmful radiations

While selecting the factors it should be noted that:

1. The factors selected must be rateable. For example, education is a rateable factor as it can be specified in varying degrees such as middle school, trade certificate, graduation, postgraduation etc
2. The number of factors should be as few as possible
3. Only important factors should be selected factors which are present to the same degree in all jobs should not be selected
4. Each factor should measure only one aspect of the job

Select and define grades or degrees to each factor. For example, education and training may have the following factors:

1. Diploma in engineering with no training
2. Diploma in engineering with 2 years apprentice training
3. Diploma in engineering with 2 years training in machine shop and certificate course in computer applications
4. Diploma in engineering A.M.I.E and 2 years experience

7. b) What is job description? Explain it briefly 6M

Job Description is an important document, which is basically descriptive in nature and contains a statement of job Analysis. It provides both organizational information's (like location in structure, authority etc) and functional information (what the work is).
It gives information about the scope of job activities, major responsibilities and positioning of the job in the organization. This information gives the worker, analyst, and supervisor with a clear idea of what the worker must do to meet the demand of the job.

Who can better describe the characteristics of good job description?

Earnest Dale has developed the following hints for writing a good job description: -

1) The job description should indicate the scope and nature of the work including all-important relationships.

2) The job description should be clear regarding the work of the position, duties etc.

3) More specific words should be selected to show:-

a) The kind of work

b) The degree of complexity

c) The degree of skill required

d) The extent to which problems are standardized

e) The extent of worker's responsibility for each phase of the work

So friends we can conclude by saying that Job description provide the information about the type of job and not jobholders

USES OF JOB DESCRIPTION:

There are several uses of job description, like

• Preliminary drafts can be used as a basis for productive group discussion, particularly if the process starts at the executive level.
• It helps in the development of job specification.
• It acts as a too during the orientation of new employees, to learn duties & responsibilities. It can act as a basic document used in developing performance standards.

8. a) What are the factors affecting Entrepreneurship 6M

1. Great need for achievement
2. Urge for independence
3. Urge for power
4. Family Background
5. Flexibility
6. Creative and Innovative spirit
7. Fluency
8. Decision making capacity

Explanation of above factors is required

8. b) Write the qualities and characteristics required to become an entrepreneurs? 6M

- Self-confident
- Able to make decisions
- Determined
- Independent
- Energetic
- Able to lead
- Resourceful
- Versatile
- Achievement-oriented
- Able to take calculated risks
- Responsive to criticism
- Profit-oriented
- Initiative-taker
- Perceptive
- Flexible
- Responsive to change
- Eager to learn
- Responsible
- Competitive

- Optimistic
- patience
- Goal-oriented
- Efficient

9. a) What is product design? Explain its process in detail 6M

Product design describes the process of imagining, creating, and iterating products that solve users' problems or address specific needs in a given market.
The key to successful product design is an understanding of the end-user customer, the person for whom the product is being created. Product designers attempt to solve real problems for real people by using both empathy and knowledge of their prospective customers' habits, behaviors, frustrations, needs, and wants.

1. Idea Generation:
The design process begins with understanding the customers and their needs. Ideas for new products can come from a variety of sources both within and outside the firm. Internal sources include employees, research and development, market research sales force and reverse engineering.
The external sources include customers, legislation, environment, technology and strategic position of the organisation. Competitors are also the source of ideas for new products or services. Perceptual maps, bench marking and reverse engineering can help companies learn from their competitors.

2. Screening Ideas:
The purpose of screening ideas is to eliminate those ideas that do not appear to have high potential and so avoid the costs incurred at subsequent stages. Using group of people, proposals would be supported by graphics, models and an outline specification and judged against a set of criteria such as necessity to the firms survival, role in filling out an existing product/service, degree of overlap with existing products and services, utilizing existing processes and capabilities, impact on overall sales and profits of the company.
To have a better evaluation of ideas, each of the dimensions of the ideas is scored on a 0-10 scale and each dimension is attached weights as per these dimensions. The resulting aggregate score helps in deciding which idea to progress and which idea should be dropped.

3. Feasibility Study:
Initial screening of the ideas is designed to stop the ideas, which are unsuitable for further considerations. Feasibility study consists of a market analysis, an economic analysis, and technical and strategic analysis.

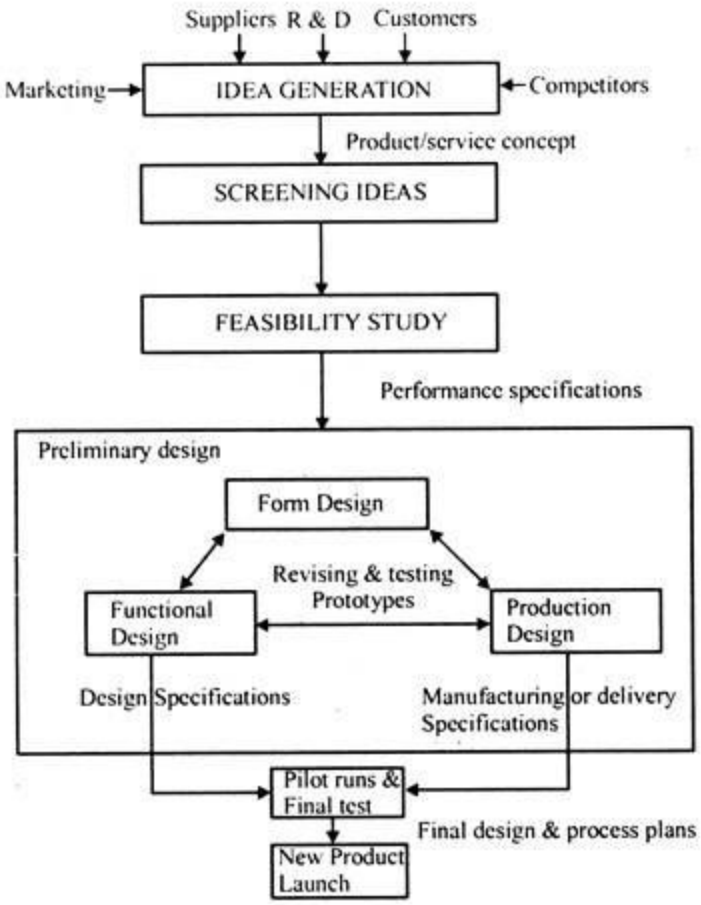


Fig. 2.5. The Design Process

Marketing takes the ideas that are generated and the customer needs that are identified from the first stage of the design process and develops alternative product concepts. The market analysis through customer analysis and market survey assesses whether there is an enough demand for the proposed product to invest in developing further.

If the sufficient demand exists, then there is an economic analysis that aims at establishing the production and development costs and compares them with estimated sales volume. The profit potential of the product can be studied using quantitative techniques such as cost benefit analysis, decision theory, net present value (NPV) or internal rate of return (IRR).

The risk analysis is also carried out. Finally, technical and strategic analysis is concerned with technical viability of the product with respect to technology, process of manufacture, availability of materials etc. Performance specifications are written for product concepts that pass the feasibility study and are approved for development. The details of feasibility are given in fig. 2.6.

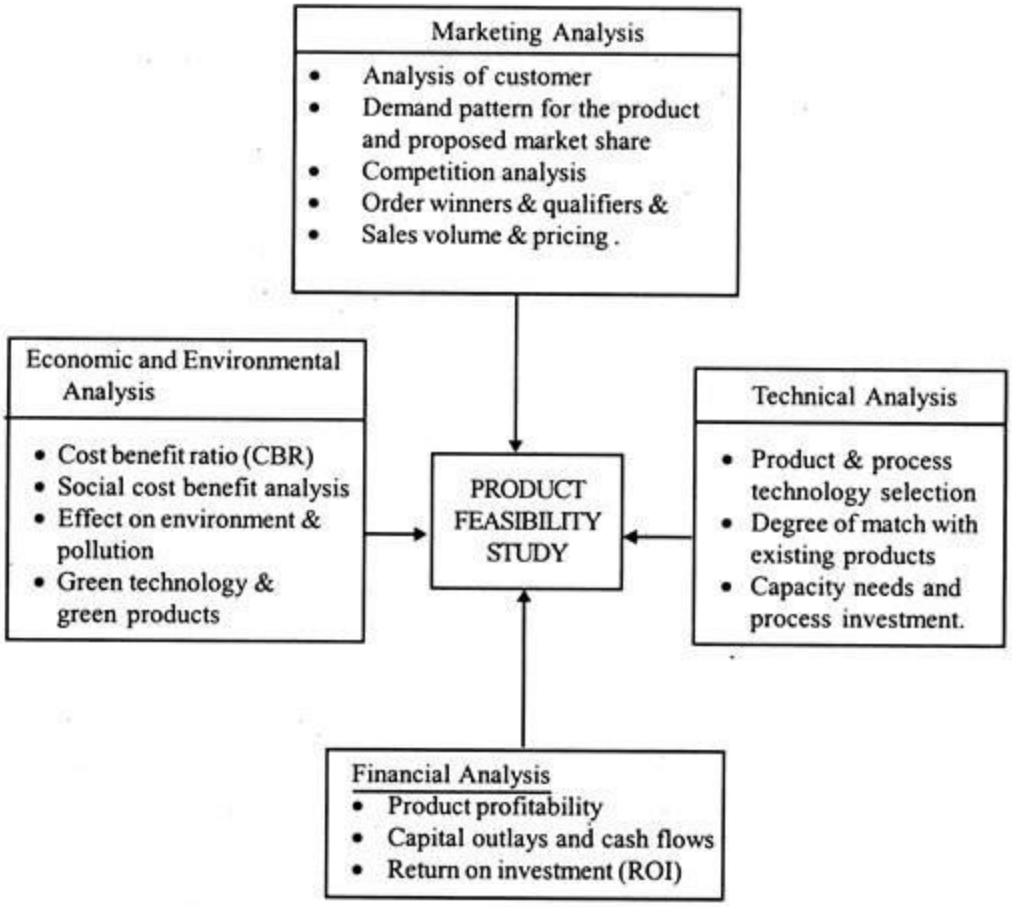


Fig. 2.6. Feasibility Study

4. Preliminary Design:

Design engineers take general performance specifications and translate them in to technical specifications. The process of preliminary design involves building a prototype, testing the prototype, revising the design, retesting and so on until a viable design is determined. Design incorporates both form and function.

Form design refers to the physical appearance of a product, its shape, size, color, styling etc. Aesthetics aspects such as image, market appeal, special identification, finish etc. will also form a part of the form design.

Production design is concerned with how the product will be made. Design, which are difficult to make result in poor quality products. During the design stage itself the manufacturing aspects should be considered. The production design or design for production include simplification, standardization and modularity.

Design simplification attempts to reduce the number of parts, subassemblies and options into a product. Standardization refers to use of commonly available and interchangeable parts and subassemblies. Modular design consist of combining standardized building blocks or modules in a variety of ways to create a unique finished product. Modular design is common in electronics and automobile industry.

5. Pilot Runs and Testing:

In the preliminary design stage, prototypes are built and tested after several iterations, pilot run of the manufacturing process is conducted. Adjustments are made as needed before finalizing the design. Apart from continuously testing the product for performance, market testing is also carried out to check the acceptability of the product in the defined market and customer group. This helps to know in advance, whether customer will accept and buy this product on launching in the market. Thus, test marketing is a powerful tool.

Final Design and Process Plans:
The final design consists of detailed drawings and specifications for the new product. The accompanying process plans are workable instructions for manufacture including necessary equipment's and tooling, component sources job descriptions, work instructions and Programmes for computer-assisted machines.

6. New Product Launch:
Launching a new product or service involves ramp up production. The process has been refined and debugged, but it has yet to operate at a sustained level of production. In ramp up, production starts at a relatively low level of volume as the organization develops confidence in its abilities to execute production consistently and marketing's abilities to sell the product, the volume increases. Launching the new product or service involves co-coordinating the supply chain and rolling out marketing plans. Marketing and production will work in a co-coordinated way during this phase.

9. b) Explain about the finance for enterprises 6M

Finance for the enterprises:
Finance is the main input for any enterprise. The entrepreneur requires capital to begin with and also needs financial assistance at every stage of the project. Project finance is needed for both short term as well as long term as follows:

Short-term finance:

When the funds are required for a period of less than one year. These are usually utilized for meeting the working capital requirements. Main sources for short term finance are bank borrowings, trade credit and customer advances.

Medium-term finance:

When the requirement period is from one year to five years, the finance is regarded as a medium-term finance. This type of finance is generally needed for permanent working capital to be used for small expansions, modifications and replacements. The sources of this type of finance are raised by issue of shares and debentures plus borrowings from banks and other financial institutions.

Long-term finance:

When the requirement period is more than 5 years the finance are regarded as long term finance. These are used for procurement of fixed assets. The important sources of long term finance are issue of shares and debentures plus loan from banks and other financial institutions.