GOVERNMENT OF TAMILNADU

DIRECTORATE OF TECHNICAL EDUCATION CHENNAI – 600 025

STATE PROJECT COORDINATION UNIT

Diploma in Mechanical Engineering

Course Code: 1020

M – Scheme

e-TEXTBOOK

on

INDUSTRIAL ENGINEERING AND MANAGEMENT

for

VI Semester Diploma Mechanical Engg. & Allied Courses

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M-SCHEME

(Implemented from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32061

Semester : VI

Subject Title : Industrial Engineering and Management

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	**Instructions**		**Examination**			
Industrial Engineering and Management	**Hours/ Week**	**Hours/ Semester**	**Marks**			**Duration**
	6	90	**Internal Assessment**	**Board Examination**	**Total**	3 Hours
			25	75	100	

Topics and Allocation of Hours:

UNIT NO.	**TOPIC**	**HOURS**
I	PLANT ENGINEERING AND PLANT SAFETY	17
II	WORK STUDY, METHOD STUDY AND WORK MEASUREMENT	17
III	PRODUCTION PLANNING AND QUALITY CONTROL	17
IV	PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIOAL BEHAVIOR:	16
V	FINANCIAL AND MATERIAL MANAGEMENT	16
	REVISION AND TEST	7
	TOTAL	**90**

RATIONALE:

In the Indian Economy, Industries and Enterprises always find prominent place. After globalization, the students should be trained not only in manufacturing processes but also in managing activities of industries. The knowledge about plant, safety, work study techniques, personnel management and financial management will definitely mould the students as managers to suit the industries.

OBJECTIVES:

- To study the different types of layout.
- To study the safety aspects and its impacts on an organization.
- To study different work measurement techniques.
- To study production planning and control and its functions.
- To study basic and modern management techniques.
- To study the staff selection procedure and training of them.
- To study capital and resources of capital.
- To study inventory control system.
- To study about organization and it's behavior.

INDUSTRIAL ENGINEERING AND MANAGEMENT

DETAILED SYLLABUS

Contents: Theory

UNIT	NAME OF THE TOPIC	HOURS
I	**PLANT ENGINEERING AND PLANT SAFETY**	**17**
	Plant Engineering : Plant – Selection of site of industry – Plant layout – Principles of a good layout – types – process, product and fixed position – techniques to improve layout – Principles of material handling equipment – Plant maintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance.	
	Plant Safety: Importance –accident-causes and cost of an accident-accident proneness-prevention of accidents-Industrial disputes-settlement of Industrial disputes-Collective bargaining, conciliation, Mediation, arbitration-Indian Factories Act 1948 and its provisions related to health, welfare and safety.	

II WORK STUDY, METHOD STUDY AND WORK MEASUREMENT 17

Work Study: Productivity – Standard of living – method of improving productivity

– Objectives – Importance of good working conditions.

Method Study: Definition – Objectives – Selection of a job for method study –Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart, Man machine chart, String diagram and flow diagram.

Work Measurement: Definition – Basic procedure in making a time study – Employees rating factor – Application of time allowances – Rest, Personal, Process, Special and Policy allowances – Calculation of standard time – Problems – Basic concept of production study – Techniques of work measurement-Ratio delay study, Synthesis from standard data, analytical estimating and Pre determined Motion Time System (PMTS).

III PRODUCTION PLANNING AND QUALITY CONTROL 17

Production Planning and Control: Introduction – Major functions of production planning and control – Pre planning – Methods of forecasting – Routing and scheduling – Dispatching and controlling – Concept of Critical Path Method (CPM)-Description only. Production – types-Mass production, batch production and job order production- Characteristics – Economic Batch Quantity (EBQ) – Principles of product and process planning – make or buy decision.

Quality Control: Definition – Objectives – Types of inspection – First piece, Floor and centralized inspection – Advantages and disadvantages. Quality control – Statistical quality control – Types of measurements – Method of variables – Method of attributes – Uses of X, R, p and c charts – Operating Characteristics curve (O.C curve) – Sampling inspection – single and double sampling plan – Concept of ISO 9001:2008 Quality Management System Registration Certification procedure – Benefits of ISO to the organization.

IV PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIOAL BEHAVIOR: **16**

Principles of Management: Definition of management – Administration - Organization – F.W. Taylor's and Henry Fayol's Principles of Management – Functions of Manager – Directing – Leadership -Styles of Leadership – Qualities of a good leader – Motivation – Positive and negative motivation --Modern management techniques- Just In Time – Total Quality Management (TQM) – Quality circle – Zero defect concept – 5S Concept- Management Information Systems – Strategic management – SWOT Analysis --Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) –Supply Chain Management (SCM) – Activity Based Management (ABM) – Global Perspective – Principles and brief describtion.

Personnel Management: Responsibility of human resource management – Selection procedure – Training of workers – Apprentice training – On the job training and vestibule school training – Job evaluation and merit rating – objectives and importance – wages and salary administration – Components of wages – Wage fixation – Type of wage payment – Halsey's 50% plan, Rowan's plan and Emerson's efficiency plan – Problems.

Organizational behavior: Definition – organization--Types of Organization – Line, Staff,Taylor's Pure functional types – Line and staff and committee type –Organizational Approaches, individual behavior—causes—Environmental effect—Behavior and Performance, Perception-organizational implications.

V FINANCIAL AND MATERIAL MANAGEMENT **16**

Financial Management: Fixed and working capital – Resources of capital – shares preference and equity shares – debentures – Type of debentures – Public deposits, Factory costing – direct cost – indirect cost – Factory overhead – Selling price of a product – Profit – Problems. Depreciation – Causes – Methods - Straight line, sinking fund and percentage on diminishing value method – Problems.

Material management: Objectives of good stock control system – ABC analysis of inventory – Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level-Economic order quantity problems – supply chain management – Introduction – Purchasing procedure – Store keeping – Bin card.

Text Books :

1) Industrial Engineering and Management, O.P. Khanna, Revised Edition Publications (P) Ltd – 2004, 67/4 Madras House, Daryaganj, New Delhi – 110002.
2) Engineering Economics and Management, T.R. Banga & S.C. Sharma, McGraw Hill Editiion. 2 – 2001, New Delhi.
3) Herald Koontz and Heinz Weihrich,'Essentials of Management',McGraw Hill Publishing Company,Singapore International Edition.Latest

Reference Books :

1) Management, A global perspective, Heinz Weihrich, Harold Koontz, 10th Edition, McGraw Hill International Edition.Latest.
2) Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.
3) S.Chandran,Organizational Behaviours,Vikas Publishing House Pvt. Ltd. Latest
4) M.Govindarajan and S.Natarajan,Principles of Management,Prentce Hall of India Pvt.Ltd.New Delhi.Latest.

UNIT-I

PLANT ENGINEERING AND PLANT SAFETY

PLANT ENGINEERING

Plant Engineering

1. **Plant**
   It is places where men, materials, money, equipment, machine are brought together for manufacturing.

2. **Plant Engineering**

   Deals with design, installation and improvement of plant with resources.

3. **Plant Location**
   Deciding a suitable location, area, and place for plant.

FACTORS CONSIDERED FOR THE SELECTION OF A SITE.

- Nearness top raw material.
- Land
- Transport facilities
- Availability of labour.
- Availability of fuel and power.
- Availability of water.
- Waste disposal.
- Financial and government concessions.
- Other factors

1. Nearness to raw material:

- To avoid transportation cost.
- Raw material is bulk and huge.
- E.g.: cement factory, sugar factory, iron and steel industry.

2. Land:

- Topography, area, cost, drainage.

- Earthquakes, floods.

3. Transport facilities

- Major amount is spending for transport.
- Suitable method of transport is selected where in roadways, railways and airways.
- Airport or port should be near the plant to avoid transport cost.

4. Availability of labour

- Labour should be available near plant.
- Labour cost should be reasonable.

5. Availability of fuel and power

- Need continuous power supply at reasonable rates.
- Steel industry ⟶ near coal fields. ⟶ No fuel cost.

6. Availability of water

- Water is the major concern for the industry.
- Water based industries like leather, paper, chemical industry and thermal power plant also.
- Location should be near the water.

7. Waste disposal

- Industrial waste should properly be disposed to avoid harmful effects to the environment.
- E.g.: Paper industry, chemical plant, leather industry.

8. Financial aids and government concessions

- Tax exemption.
- Site and building at low cost.
- Reduced electric charges
- Subsidence. (50% run by other parent company.)
- **Note: -** to avail these benefits plant should be located near backward areas.

9. Other factors

- Political and social environment.
- Availability of hospitals, schools, banks, markets and post office.
- Housing facilities.
- Security (safe).
- Recreational facilities (cinema, amusement park).
- Future expansion.

PLANT LAYOUT

Various arrangements of men, machine, and materials within the plant area.

Objectives of good plant layout

- Material handling and transportation should be minimum.
- Raw materials and semi finished goods should move from one place to another.(Eliminate bottle necks and congestion.)
- Suitable place should be allocated for every production centre.
- Movement of the workers should be minimum.
- No stoppage of work due to non arrival of semi finished goods.
- It should be flexible to accommodate changes in product design.
- It should be flexible for future expansion.
- It should occupy all 3 dimensions of the room.(x,y,z axis)
- Should lead to less production time and reduced capital cost.

PRINCIPLE OF GOOD PLANT LAYOUT.

- Principle of integration.
- Principle of minimum movement and handling.
- Principle of material flow.
- Principle of cubic space utilization.
- Principle of safe environment.

- Principles of flexibility

1. Principle of Integration:

All the production units like workers, machinery and material should be integrated (allotting) and arranged in a good logical manner.

2. Principle of Minimum Material Movement and Handling:

- Material should be moved in bulk amount.
- Movement of workers and material should be minimum.

3. Principle of Material Flow

- Output (finished goods) at various work centers should be balanced.
- Avoid bottlenecks, congestion and back tracking.

4. Principles of Cubic Space Utilization

- Use x, y, z direction to occupy floor space and upto ceiling.
- Use boxes for stocking material.
- Use overhead handling (cranes) to save space.

5. Principles of Safe Environment

- Safety of workplace like ventilation, noise, fumes, dust, odors (smell) hazards.
- Safety in Environment increases workers efficiency.

6. Principle of Flexibility

- For future expansion of production.
- Design change.

Advantages of good plant layout

- Reduced material handling.
- Improved resources (**MMM**) utility.
- Improved productivity.
- Reduced production time.
- Improved working condition.
- Better supervision (monitor)

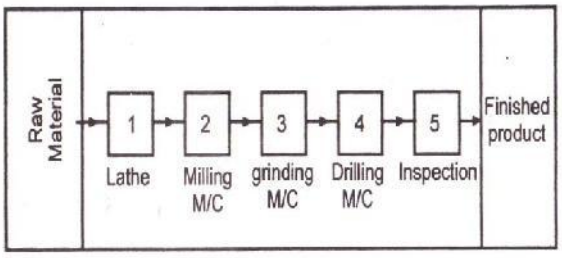
- Reduced accidents.
- Reduced fatigue.

TYPES OF LAYOUT:

- Product layout or line layout.
- Process or functional layout.
- Fixed position layout or constant position layout.

1. Product layout or line layout.

- This layout is suitable for mass production.
- This layout is also called as line layout.
- In this layout the machines are arranged as per the sequence of operation (arranged in a single line.)
- The production will run by the arrangement of machines.
- **E.g.:- 1. Automobile assembly**
  2. Manufacturing of cam shaft.
  3. Bolt, Nut and Washer.



PRODUCT LAYOUT

Advantages.

- Less material handling.
- Less production time.
- Production can easily be controlled.
- Less accident.
- Less skilled workers are needed.

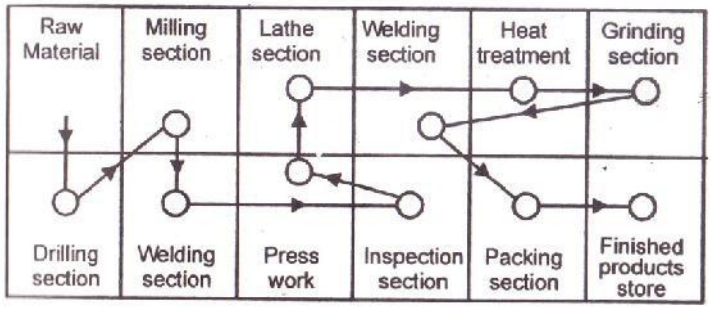
Disadvantages.

- More investment in machines.

- Less flexible.(For variety design)
- If one machine breakdown then the total production will be stopped.
- Less utility of machines.
- Manufacturing cost will be more when volume of production is less.

2. Process Layout Or Functional Layout.

- This layout is suitable for batch production, or job order production.
- This layout is also called as functional layout.
- In this layout, group of machines are kept in one place.
- Variety of batch type production will be done at different work centers.
- **E.g.: 1. Leather work.**
  2. Sheet metal work.
  3. Moulds
  4. Maintenance stops.



PROCESS LAYOUT

Advantages

- Layout is flexible.(Variety of products can be done.)
- Utilization of machine is more.
- Less investment on machines.
- Production will not be affected even if one machine breaks down.

Disadvantages

- Material handling is more.
- More skilled workers are required.
- Production time is high.
- Requires more floor space.
- Less safety.

3. Fixed position layout

- This layout is also called as constant position layout.
- This layout is suitable for unit production.
- In this layout the major component of the product are kept in a fixed position.
- All the resources (men, machine, and material) are brought to this place to complete the job.
- **E.g.:** **1. Ship building**
  2. Aircraft assembly
  3. Boiler fabrication.
  4. Dam construction.
  5. Bridge construction.

Advantages.

- Material movement is reduced.
- Flexible to change the product.
- More workers can be employed from start to finish.

Disadvantages.

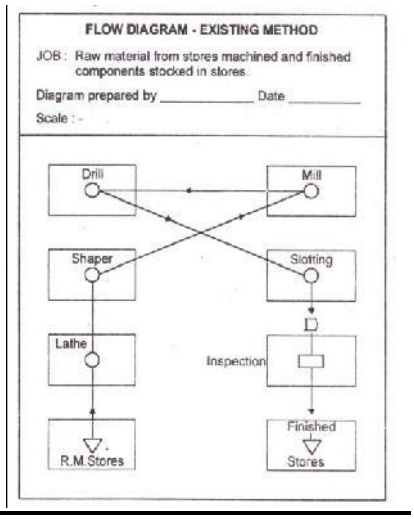
- Work is costly.
- High skilled workers are needed.
- Supervision is difficult.

TECHNIQUES TO IMPROVING PLANT LAYOUT.

- Flow diagram
- String diagram
- Templates
- Models

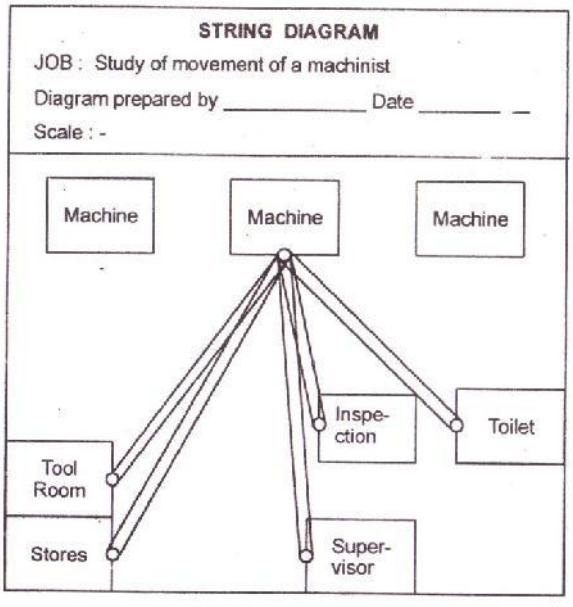
Flow diagram

- It shows the path of movement of the materials.
- By studying the flow diagram the unwanted material movement, back tracking and congestion is found out.



String diagram

- String diagram shows the movement of the worker.
- It shows the total distance travelled by the worker.
- By analyzing string diagram the unwanted movement of the worker is found out.

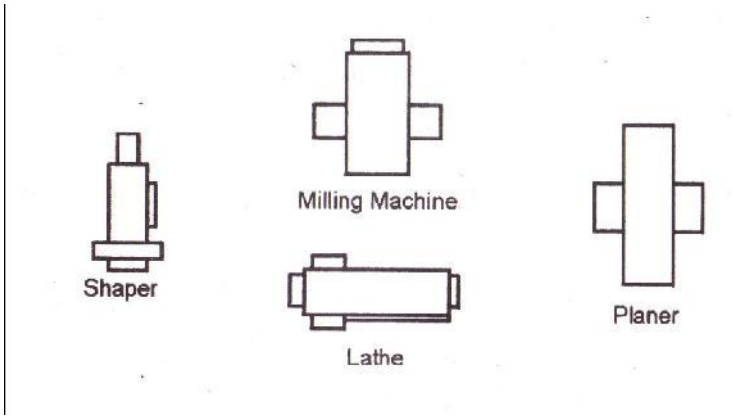


Templates

- Templates are 2 dimensional pieces made of cardboard or plastics.
- Templates are made to scales (1:50)
- Templates show the floor area, machine, trolley, trucks and equipments.
- In templates the outline plan of the shop floor is drawn in a drawing sheet.
- Templates are used for easily identifying the machines.

Advantages

- They are cheap.
- Technical people can easily understand the arrangement.
- Duplicate copies can be made.



Disadvantages

- Non-technical people cannot understand easily.
- Overhead facilities (top) cannot be visualised.

Models

- These are the 3 dimensional scale models of equipments or machines.
- Models are made of wood or plastics.
- Models are improving a layout used in templates.
- Most helpful to plan for the overhead (top) material handling equipments like cranes, hoists etc.

Advantages

- Even lay man can easily understand.
- Easily explained to the management.
- Can operate on overhead devices.
- Easily shifted or altered.

Disadvantages

- Expensive.
- It is not easily carried to flames.

MATERIAL HANDLING.

- Transfer the raw material, semi finished goods and finished goods from one machine to another or one place to another place through equipment.
- Total cost of the production is nearly 20% to 60% is invested in material handling.
- Nearly 40 % of accidents occur due to the bad methods of material handling.

PRINCIPLES OF MATERIAL HANDLING.

- Try to eliminate the material handling wherever it is possible.
- Minimise the distance moved by adopting suitable routes.
- Use gravity principle wherever it is possible, it saves fuel and power.
- Arrange sequence of operations for smooth flow of material and uni directional.
- Avoid backtracking and duplicate handling.
- Use bulk containers for transporting small components.
- Design containers properly to avoid rehandling.
- Use mechanical devices instead of manual labour. (saves time)
- Select proper material handling equipment, right equipment for right job.
- Deliver the material closer to the point of use.
- Locate the work centers near the stores-reduces material handling.
- Avoid wasteful movement of material handling equipment.
- Select multipurpose handling to reduce investment.
- Use operation research (OR) technique for optimum utilization of handling equipment.
- Use standardized equipment for spare availability.
- Give proper training to operators for M.H.E.
- Proper maintenance done for M.H.E.
- Give importance to safety.

Factors considered for selection of equipment

1. **Material to be moved**
    - Size of material, shape, weight, nature.(Geometrical properties.)
2. **Path of travel**
    - Horizontal- Vertical- Combined.
    - Fixed path-Variable path.
3. **Type of Building**
    - Floor capacity – ceiling height - column spacing- door size
4. **Handling capacity:**
    - Load to be moved, frequency of movement.(time)
5. **Type of production activity:**
    - Mass production - Conveyors.
    - Batch production - Truck
    - Job order production - Cranes.
6. **Cost of M.H.E.**
7. **Operating costs**
8. **Expected life of the equipment.**
9. **Maintenance for M.H.E.**

Equipments:

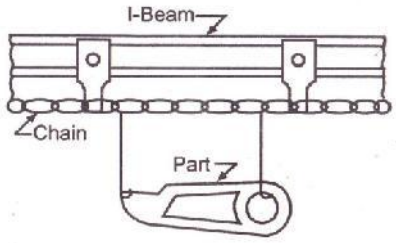
1. Fixed path equipment - Conveyors, mono-rails, chutes, overhead cranes
2. Variable path equipment-Truck, Forklift, mobile cranes, industrial tractors.

1. Conveyors:

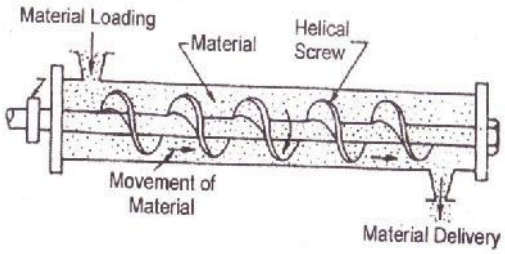
Conveyors are a device which moves material in either vertical or horizontal direction between two fixed paths.

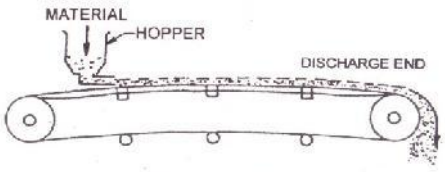
Types of conveyors:

1. Belt conveyors.
2. Roller conveyors.
3. Bucket conveyors.
4. Chain conveyors.
5. Screw conveyors.

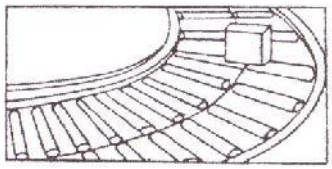


CHAIN CONVEYORS



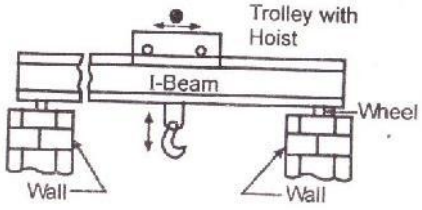


BELT CONVEYOR



2. Cranes:

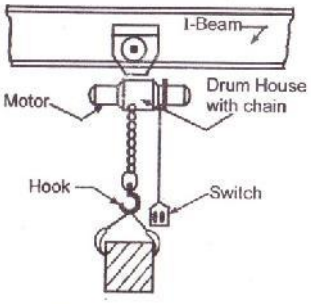
- Used for lifting bulky items and packages.(Bridge crane, Jib crane)



BRIDGE CRANE

3. Hoists

- Fitted with cranes with help of pulley and chain.



CRANE AND HOIST

CHAIN PULLEY

4. Trucks

- Operated manually or by power in horizontal path.
- Plant form truck, Fork truck, container truck.

PLANT MAINTENANCE:

Maintenance

It is a process of keeping the machine and the equipment in good working condition to increase the machine efficiency and life.

Disadvantage of poor maintenance

- Machines may be damaged.
- Poor maintained machine will produce poor quality of products.
- Production time increases due to idleness of breakdown machine.
- More wastage of material.
- Poor maintenance causes accidents and life of machine will be reduced.

Advantages of good maintenance:

- Machine life is increased.
- Production will be done as per schedule.
- Products will be delivered to customer in time.
- Produce good quality of products.
- No idle time of men and machine.

MAINTENANCE PRACTICES:

- Breakdown maintenance
- Preventive maintenance
- Scheduled maintenance.

1. Breakdown maintenance:

- In this method the machine is allowed to run without maintenance.
- Maintenance is done only the machine gets repair and is set right.
- Next maintenance is done only when the machine breaks down again.
- Suitable for small scale industries.

Causes of breakdown

- Failure to replace worn out parts.
- Neglecting lubrication.
- Neglecting cooling system.
- Violating towards minor repairs.

Disadvantages of breakdown maintenance:

- Production will be delayed.
- Leads quick maintenance- leads poor quality maintenance.
- Plant depreciates very quickly.
- Life of plant is reduced.
- Increases cost due to overtime payment.
- Direct loss of profit.
- Increased accidents.
- More wastage of material.

2. Preventive maintenance:

Principle: "Prevention is better than cure."

Objectives:

- To reduce the possibility of unanticipated (sudden) breakdown.
- To retain the value of equipments.
- To maintain optimum (maximum) productivity.
- Ti maintains accuracy of machines.
- Safety to workers.

Procedure

1. Maintaining machine records

- Type of equipment and description
- Name of manufacturer.
- Cost and date of purchase.
- Cost and date of planned repairs.
- Date and reasons of breakdown.
- List of spares and their code numbers.

2. Preparing inspection check list:

- Components to be inspected on regular intervals and listed by daily/weekly/monthly.

Date :		Observer :	Study No :	
Number of observations : 150			Total	Percentage
Machine running		𝍸 𝍸	120	80.0
Machine idle	Repairs	𝍸	3	2.0
	Supplies	𝍸 𝍸 ||	12	8.0
	Personal	𝍸 |	6	4.0
	Idle	𝍸 |||	9	6.0

d) Water, air and fuel lines.

e) Key equipments and machines.

f) Single shift two or for 24 hrs daily.

g) Age, condition and value of equipment.

h) Safety and health requirement.

i) Dirt, fume, friction, fatigue, stress, corrosion and wear etc.

3. Inspection as per check list and corrective action:

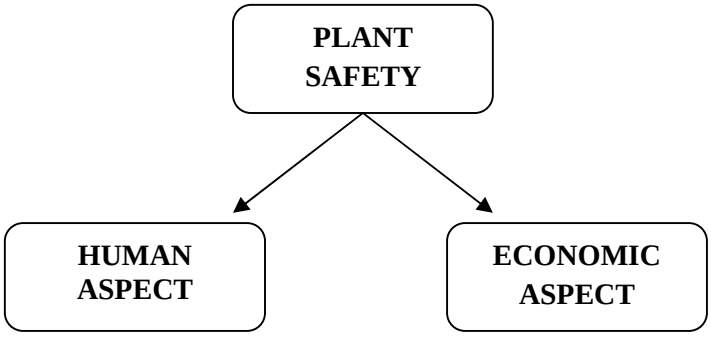
- Routine UP-KEEP- adjustment of guide plates, lubrication and cleaning.
- Periodic inspection – visual inspection overhauls, scheduled replacements etc.
- This maintenance will be done without disturbance to the production.
- Cost of the maintenance is high on preventive maintenance (Record, inspection, spare parts)

Advantages of preventive maintenance:

- Reduced breakdown.
- Safety to workers.
- Reduced production cost.
- Equipment life is increased.
- Better product quality.

UNIT-I

PLANT SAFETY



1. **Human aspect:**
   - Loss of human parts.
   - Suffering to family members.
   - Less security

2. **Economic aspect:**

   - Loss of money to management
   - Unwanted addition to production cost
   - Production loss

COST OF ACCIDENTS

1. Direct costs
2. In direct costs

DIRECT COSTS	INDIRECT COSTS
i) Payment of compensation	i) wage paid to injured person
ii) Medical expenses	ii) wage paid to employees who stop production.
iii) First aid expenses	
iv) Cost of training a new workers	iii) wages to management staff.
v) Loss due to waste of raw material	iv) wages to foreman

Indirect Cost- Cost Due To Spoilage of Material

i. Loss of profit
ii. Legal expenses
iii. Cost of training a new worker
iv. Cost due to the loss of m/c time

Causes of accidents may calculate by the following categories:

88% -Accident are caused by human.

10% -Accident are caused by mechanical failures.

02% -Accidents are due to nature.

These are the causes grouped into:

1. Unsafe conditions –work place
2. Unsafe Acts –By workers
3. Environmental factors –nature
4. Personal factors –character of worker

1. UNSAFE CONDITIONS:

- Improperly guarded equipment
- Poor designed equipment
- Inadequate (Insufficient) safety devices
- Hazardous works place
- Bad layout
- Unsafe storage, congestion and over loading
- Improper material Handling
- Bad plant location.
- Improper ventilation and air circulation
- Improper lighting
- Poor housing keeping
- Improper maintenance of machines and equipment
- Defective raw materials
- Dangerous type of job (crane work)

- Poor exhaust to deliver fumes and dust.

  30% - Accidents occur in material handling equipments like cranes, trucks, trolleys etc.

2. UNSAFE ACTS:

- Operating without authority
- Failure to use protective devices
- Operating the m/c s at unsafe speeds
- Removing guarded and disconnected the devices
- Using unsafe equipments
- Operating a defective m/c
- Cleaning, oiling, repairing (or) adjusting the rotating parts.
- Testing, abusing (or) quarrelling with co-workers.
- Failure to follow safety instruction.

3. ENVIRONMENTAL FACTORS:

i. Atmospheric condition:

- Excessive heat (or) excessive cold may indirectly cause accidents.
  a. High temperature –quick fatigue occur.
  b. Low temperature –May affects human parts.

ii. Hours of work – time of work rest time:

- Mostly accidents happen in night shifts.
- No continuous duty in night shifts.
- Without rest time accidents may happen.
- Noise, bad odour, flash of light may also lead accident.

4. **HUMAN FACTORS:**

i. Individual factors –	Age, experience, health, mental ability.
ii. Psychological factors –	Attitude towards works, interest, habits.
iii .Personality factors –	Emotional stability, intellectual level, presence of mind.
Iv. Sociological –	Family problems, social status, home environment.

ACCIDENT PRONENESS

The People who meet with accident often even they try to avoid they are called the accident proneness people.

Various Causes of accident proneness are listed below:

- Emotional instability
- Physical instability.
- Visual disability.
- Wrong attitude.
- Hostility towards management.
- Family problems

Planning for accident prevention:

1. Layout of work place.
2. Access to work place.
3. Machinery.
4. Flow if material through shop
5. Storage of materials

Safety activities:

- Framing company's accident prevention policy.
- Advising the management on safety.
- Guiding shop people on safety.
- Investigating accidents.
- Keep accident records and statistics.

- Safety drills and training.
- Identify accident Hazards.
- Examine plant safety.
- Conducting safety seminars, exhibition.
- Conducting safety committee meetings.

ACTIVITIES AROUSE SAFETY CONSCIOUSNESS AMONG WORKERS:

1. Safety propaganda –

   Posters, films, exhibition, contest, seminar, training program.

2. Safety committee –

   Supervisors and worker analyses accidents.

3. Safety Training –

   Use of protective device, precaution, First aid.

4. Other activities –

   Safety slogans, safety instructions, warning signals.

INDUSTRIAL DISPUTES:

In industries, Disputes or differences may arrive between employer and employee (or) between employees (clash of personalities).

Various Causes of industrial disputes are:

1. Psychological causes

2. Managerial causes

3. Employment conditions.

4. Working conditions.

5. Wages and other benefits.

6. Legal causes.

1. Psychological causes:

- Authoritarian leadership
- Strict discipline
- Demand for recognition of workers
- Clash of personalities.

2. Managerial causes:

- Non recognition of trade union.
- Unfair conditions and practices.
- Compelling workers not to join in trade union.

3. Employment conditions:

- Environmental conditions
- Unsafe plant
- Bad condition of m/c's.
- Frequent change in products.

4. Working conditions:

- Poor ventilation
- Poor temperature control
- Improper exhaust.
- Poor lightning.

5. Wages and other benefits:

- Insufficient wages.
- Unknown deflect in wages
- Poor allowances.

6. Legal causes:

- Violating on labour laws, factory acts.
- Violation of agreements.

SETTLEMENT OF INDUSTRIAL DISPUTES:

1. Collective Bargaining
2. Conciliation
3. Mediation
4. Arbitration

1. Collective Bargaining:

Step 1- Process of settlement of dispute between employee and employee.

Step 2- Representative from management and representative from trade union should present.

Step 3- disputes arises the representation from management and from trade unions negotiate with each other.

Step 4- Dispute regarding overtime (OT), bonus, leave rules, hours of work, condition of employment, compensation to injuries, retrenchment, dismissals, etc.

Example for collective bargaining:

i) Trade union quote- 30% but management may offer only 15%.

ii) Trade union may come down to 25% and management may go up to 20%.

Essential conditions for the success of collective bargaining:

- Flexible attitude of both parties.
- Knowledge about the dispute.
- Should be a recognized trade union.
- Should be mutual good will and faith.

If the dispute gets fails the trade union should give notice to management regards strike (or) management will give notice for lock out.

2. Conciliation:

- It is a process by which discussion between employees and employer take place in the presence of conciliator(Third party)
- Conciliator is a government officer.

- He will analyze the problems and sends report to the government if the dispute again fails.

3. Mediation:

- Third party attempts to mediate between employee and employer.
- MLA (or) MP or public figure.

4. Arbitration:

- Arbitrator may be fixed by the parties (or) by government.
- He listens about the dispute and gives his judgment.
- If the judgment is not satisfied by the union (or) management the dispute may move to courts.

5. Labour courts and Industrial tribunals.

- Government will appoint a retired High court judge.
- The court hears the parties and gives its final judgments.
- This is binding on both parties.
- No appeal after the judgment of court order.

INDUSTRIAL LEGISLATIONS:

- Laws connected with working conditions
- Laws connected with wages, welfare etc
- Laws related to workers association.
- Laws related to social insurance.

THE FACTORIES ACT, 1948 REGARDING HEALTH, SAFETY AND WELFARE

- The main provisions of factories act 1948 regarding health.
- The main provision of factories act 1948 regarding safety.
- The main provisions of factories act 1948 regarding welfare.

FACTORIES ACT 1948 REGARDING HEALTH:

1. **Cleanliness**
   i. Remove dust and diet daily, floor should be clean and wash in week.
2. **Wastes and effluents**
   i. Proper disposal of waste and effluents.
3. **Ventilation and temperature**
   i. Sufficient ventilation for fresh air.
   ii. Suitable temp maintained.
4. **Humidification-**
   i. artificial humidification is done within limits
   ii. Prinking water is used for humidification.
5. **Dust and fumes**
   i. Accumulation of dust and fumes shall be prevented.
6. **Overcrowding**
   i. Minimum 4.2 cu.m of space need for each worker.
7. **Hazard gases**
   i. Always wear suitable respiratory devices.
   ii. Should cautious in closed tanks.
8. **Excessive weight:-**
   i. Avoid young person to over loading work.
   ii. Careful in lifting (or) moving heavy load.
9. **Lighting**
   i. Sufficient and suitable lighting to work place
10. **Drinking water**
    i. Drinking water should be at least 6 m away from toilets.
    ii. More than 250 workers a water cooler should provided.

11.Latrines and urinals:

i. Toilets must be cleaned periodically. Proper lighted and ventilation.

12.Spittoons:-

i. Separate spittoons will provided
ii. Not to spit in all place otherwise fine of max. Rs 5/- will be offered.

FACTORIES ACT 1946 REGARDING SAFETY:

1. **Fencing of machinery**
   - i. Moving parts of prime moves, fly wheel, etc
   - ii. Projection of lathe
   - iii. Electric generator parts.
2. **Work on or near machinery in motion-**
   - i. No young worker shall permit on dangerous machines.
   - ii. Trained adult only permitted.
3. **Employment of young person of dangerous machines .**
   - i. Give sufficient training.
   - ii. Under proper supervision.
4. **Hosts and lifts-**
   - i. Good mechanical construction, sufficient strength.
   - ii. Maintenance and periodically examined
5. **Lifting machines, chains, and popes**
   - i. Maintenance and periodically examined
6. **Pressure plants**
   - i. Maintain working pressure and not to exceed the safe limit.
7. **Excessive weights.**
   - i. Restricted to lift ((or) carry excessive loads leads to accidents.
8. **Protection of eyes**
   - i. Suitable goggles and shield is provided in welding, x ray works.
9. **Precautions against fire**
   - i. Fire alarms should provided
   - ii. Fire extinguishers should provided
   - iii. Windows, exhausts should provided
10. **Precautions against dangerous fumes**
    - i. No persons except trained persons should not allowed to any chamber, tank, pit etc. Which present dangerous fumes

FACTORIES ACT 1948 REGARDING WELFARE:

1. **Washing facilities**
    i. Cleaning and washing facilities separate for men and women workers.
2. **Facilities for sitting**
    i. Continuous standing workers will provide for rest time for sitting.
3. **First aid**
    i. For 150 workers first aid box to be provide.
    ii. More than 500 workers , shall have dispensary.
4. **Canteens**
    i. For more than 250 workers shall have canteen.
5. **Rest Room and lunch room**
    i. For more than 150 workers shall have an suitable clean ventilated rest room and lunch room.
6. **Working hours**
    i. 48 hours per week employee can be work.
7. **Child labour**
    i. Under 17 years young people will be treated as child labour . So they cannot be placed for work.

UNIT II

WORK STUDY, METHOD STUDY AND WORK MEASUREMENT

Work Study

It is a generic term for the techniques of method study and work measurement. It is used to examine the human work.

Production	Productivity
Process of converting raw material in to finished products.	Ratio of output product to the input resources utilized Productivity =output/input

Productivity and Resources of Production

(1) Productivity of land.
(2) Productivity of men.
(3) Productivity of machine.

Standard of living

(1) Food
(2) Clothing
(3) Housing
(4) Health
(5) Security
(6) Education

METHOD OF IMPROVING PRODUCTIVITY

(1) Improving working conditions

- Light
- Ventilation
- Temperature
- Noise

- Humidity
- Safety
- Health

(2) Improving working methods

- Adopt method study.
- It simplifies the method of works.
- Economical methods will develop.

(3) Reduction of Non Productive time

- Non productive time will reduce (or) Remove by work measurement technique.
- Utility of men, machine is increased.
- Productivity will increase.

(4) Proper motivation

- It increases productivity
- Incentives, Bonus, awards, promotion.

(5) Proper maintenance of machine tools

- Maintenance increases life of m\c and efficiency.
- Better utility of equipment and m\c.

(6) Proper production planning and control

- Proper PPC reduced Non-Production time.
- Increases productivity.

(7) Proper material control

- It avoids overstocking and shortage of raw materials.
- Over stocking is increases cost of production.
- Shortage of material lead to idleness of men and m\c.

(8) Training of workers

- Proper training improves skill of labour.
- Wastage of materials will reduce.
- Increases productivity.

(9) Standardization

- Standardization of Dimensions (shape, size qualifier) of product.
- Standardization of product leads to mass production.
- In mass production more components can be done.

(10) Modernization of Plant and Equipment

- Out dated (or) out of model m/c and equipment should replace and adopt modern m/c.
- Modern m/c will have higher capacity and productivity.

(11) Product Research and Development

- In R&D section defective design will be identified.
- Continuous development of products and defects will be reduced.

(12) Improving plant layout:

- By method study the layout is improved, material handling is reduced.

(13) Safety

- Accidents lead to loss of time. Safety increases production.

Importance of Work Study

(1) By method study:

a) Working condition is improved.
b) Work content is reduced.
c) Worker's efficiency is increase.
d) Plant layout is improved.

(2) By work measurements:

a) Ineffective time is reduced
b) Production time is standardized.

Importance of working conditions

1) Lighting and Ventilation.
2) Temperature and Humidity.
3) Safety and Healthy.
4) Layout and Housekeeping.
5) Noise and Vibration.
6) Ergonomics.

1. **Lighting and Ventilation:**

   a) **Lighting**

      (i) Proper lighting improves productivity.

      (ii) Improves lighting will cause headache, visual fatigue.

      (iii) Use Anti-gales fluorescent light.

   b) **Ventilation:**

      - Free and fresh supply of air.
      - Recommended 50 cubic meters/hour of minimum air flow.
      - Fumes, dust and smokes should be driven out by exhaust fans.

      Main functions of ventilation are

      i. Dispersal of atmospheric contaminations

      ii. Dispersal of heat generated by men and machines.

      iii. Maintaining of correct level of oxygen, carbon dioxide and carbon monoxide.

2. **Temperature and Humidity:**
   - High temperature and humidity in the shop floor will cause fatigue to workers.

- In deep mines, textile mills and sugar mills ventilation will be poor and humidity will be high. (This will causes damages)
- Proper humidity will be maintained.
- Air temperature normally 20 to 22°C for physical (light) work and 14°C to 16°C for heavy work in standing position.

3. **Safety and Health**
   - Provide environment safety and free from accidents.
   - Layout should designed safe with safely handling methods.
   - Use protective devices for protecting face, eyes, lungs, and other parts of body.
   - Provide work place clean against the infection and occupational disease.

4. **Layout and Housekeeping**
   - Sufficient window area - atleast 20% of floor area.
   - Ceiling Height – atleast 3 meters.
   - Air flow – 10 cubic m.
   - Floor area (single worker) – min 2 sq.m.
   - Traffic aisles used of material handling.
   - Floor – Nonslip, Non dust forming.

5. **Noise and Vibration**

   Noise: Unwanted sound to which a individual is exposed by m\c.The effects of Noise are:
   - Disturbs concentration causes annoyance (irritation).
   - Disturbs speech communication.
   - Hearing losses.
   - Increases fatigue and BP.

Normally human ear can receive only 90 dB of sound (Noise).

Noise level can be controlled by

- Replacing noisy machines and equipment.
- Dynamic 9equally) balancing rotating parts.
- Use rubber and plastic for arrest noise.
- Use ear plugs (ear protection device).
- Use brick walls.

Vibration

It is created by rotating components of machines during machining.

Causes of Vibration

- Loss of muscle problem.
- Nervous problem.
- Less of sense.

Remedies

- Control m/c speed
- Balance of rotating parts.
- Rest breakers usage.
- Provide bush.

6. Ergonomics

It is defined as human engineering which studies the relationship between man and his working environment.

i. Designing the workplace to fit the requirement of worker.
ii. Designs the equipment, m\c's and controls t reduce physical and mental strain to workers.
iii. Providing a good environment for working.

Designing the work place controls like.

i) Control knobs ii) Wheels iii) Levers iv) Arm rest v) Foot rest

The above mention controls will be designed to the favor of workers to reduce fatigue and strain.

CHAPTER II

Method Study

It is a technique of systematic Recording and critical Examination of Existing and proposed ways of doing work and develops cases and Economical method.

Objectives of method study

1. Improvement of working conditions
2. Improvement of plant layout and work place layout
3. Reducing Human effort and fatigue
4. Reduce material Handling
5. Improvement of process and Procedure
6. Improvement of Design.
7. Improvement in utility of Resources. (MMM)
8. Standardization of method.
9. Improvement of safety standard
10. Improvement of Previous method style.

Procedure to conduct method study

1. Select:

a. Economical factors
b. Human factors
c. Technical factors

a) Economical factors

-Operations having bottlenecks

-Operations done repetitively

-Operations have more amounts on manual work

-Operations for long material handling.

b) Human factors

-Fear of unemployment

-Fear of reduction in wages

-Fear of Increased work load

-Prestige may lost for supervisor

c) Technical factors:

-Technical details of job should be available (Tools)

-M/C should support the new method study. (Capacity)

Example:

A word study man feels that the machine tool may use HSS but the M/C capacity does not permit. This Technical factor should consider.

2) Record:

-Previous methods details are recorded;

-Done by direct observations.

-Symbols should be used for the activities like operation, Inspection etc.

3) Examine

Critical Examination is done by Questioning technique.

1. Purpose - Why it is done?

   What is done?

   What should be done?

2. Place - Where is to done?

   Where it is done?

3. Sequence - When it is done?
4. Person - Who is doing?

   Who should it is done?

5. Means - How it is done?

   How should it be done?

- By questioning Unwonted activities can be eliminated.

4. Develop

- The answer to the above mention Questions to develop the better method.

1) Purpose - What should be done?
2) Place - Where should be done?
3) Sequence - When should be done?
4) Person - Who should do it?
5) Means - How should be done?

Example: A window cover letter.

5. Define

- Once a complete study of job it is Necessary to get approval from management before install.

- The work study man should submit Report management which contains

a) Brief description of old method
b) Brief description of New method
c) Reasons for change
d) Adv. And limitations of New method
e) Materials, labour and over heads.
f) Tools and Equipment required in new methods.
g) Cost for installing new method.

Written Standard Practice

- Records about improved method for References.
- Used to explain new method to management, foreman and operators.
- It gives details of change in layout of m/c and workplace.
- Used to training of workers.
- Word tools (Jig, fixtures,sp.tools)
- Operation conditions.

6) Install

- Install is very difficult stage.
- Should satisfy both management and trade union.

a) Gaining acceptance of the change by supervisor.
b) Getting approval of management
c) Gaining acceptance of change by trade union and workers.
d) Giving training to operators in new method.
e) To be satisfactorily Execute the method.
f) Re-arrangement of layout
g) Training and rehearsal.

7) **Maintain**

- Workers can slip back to the old method it should be monitored.
- Periodical review is made.
- Difference between New written standard Practice and actual Practice is found out.

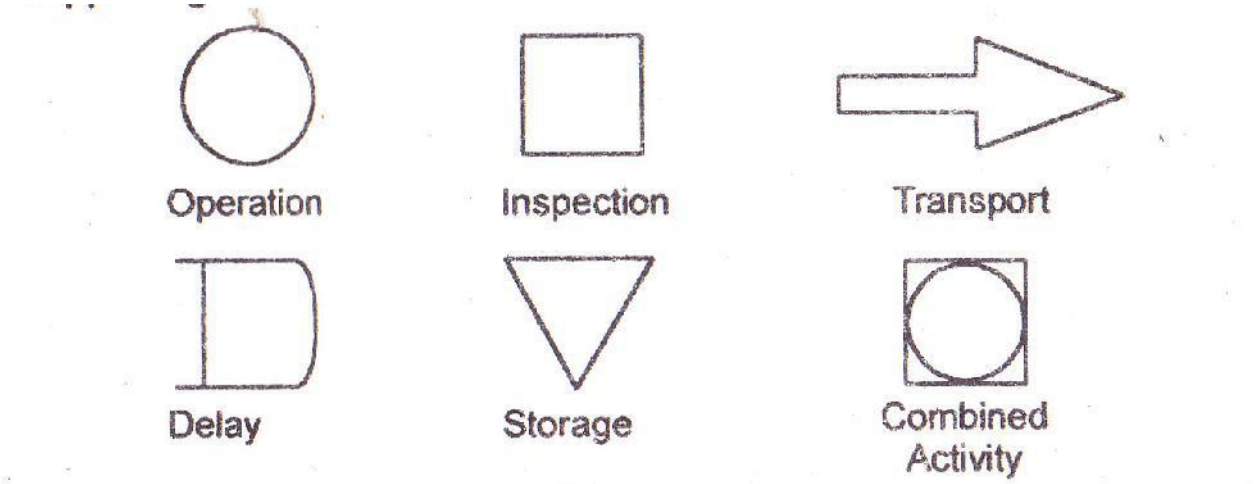
CHARTS AND DIAGRAM USED IN METHOD STUDY

1) Operation Process chart (or) outline Process chart
2) Flow process chart
   - Material type
   - Operator type (or) man type
   - Equipment type
3) Two handed Process chart

   (Or)

   Left hand – Right hand chart
4) Multiple activity chart
5) Flow diagram
6) String diagram

PROCESS CHART SYMBOLS



1) Operation

- A large circle indicates the operation
- An operation is changing physical (or) chemical characteristics of object

Ex: Reducing diameter in a lathe

2) Inspection

- A square indicates inspection
- Inspection is checking object quality, quantity.

Ex: Counting numbers of product produced

3) Transport

- An arrow indicates Transport
- Refers Movement of object (or) Equipment from one place to another.

Ex: 1. Moving material by a trolley.

2. Operator going to store for material.

4) Delay (or) Temporary storage

- A large capital indicates delay.

- Also called as temporary storage

Ex: Operator waiting to get tool in store room

5) **Permanent storage**

- An Equilateral triangle standing on its vertex represents storage.

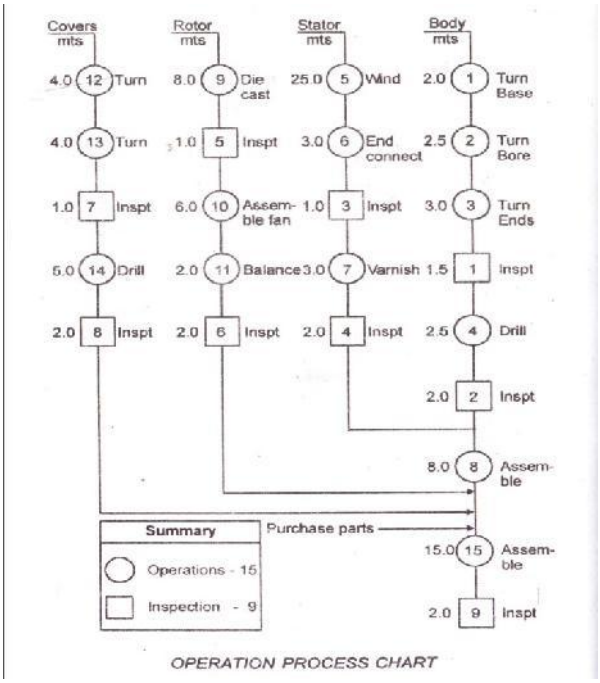
Ex: Raw material in the store room.

6) Combined activity

- Square with circle shows combined activity.
- Two9 activities takes Place at the same time by operator

Ex: Reading and recording a Pressure gauge.

OPERATION PROCESS CHART



Steps followed in OPC

1) Write the title at the top of chart
2) Begin the chart from the right side top comer.

3) Mention the main component at the right Extreme.
4) Mention the sequence of operations and inspections by their symbols connect them by vertical flow lines.
5) Record the activities to the Right Side of symbols.
6) Note down the time for each activity to the left side of symbol.
7) Put Number in serial order for all operations. Start from right side top.
8) Similarly put in serial order for all inspections.
9) Continue Numbering till the Entry of second component.

10) Continue the Numbering from the Starting of Next component. Show the Entry of purchased parts by horizontal lines.

2. **FLOW PROCESS CHART – OPERATER TYPE**

FLOW PROCESS CHART - OPERATOR TYPE

Chart No. : 001 Date :
Job : TYPING A LETTER Charted by .....
Chart begins : Steno in her seat Chart ends-putting the typed letter in the tray
Method : present / proposed

Sl. No.	Description of the activities	Distance	Time Sec.	Symbols	Remarks
1.	Steno in her seat	–	–		
2.	Hears the bell	–	3		
3.	Goes to manager's room	6m	10		
4.	Takes down dictation	–	120		
5.	Returns to her seat	6m	10		
6.	Prepares type writer	–	15		
7.	Types the letter	–	150		
8.	Checks the matter	–	40		
9.	Goes to manager's room	6m	10		
10.	Waits till the manager signs	–	20		
11.	Returns to her seat	6m	10		
12.	Types envelope	–	20		
13.	Puts the letter inside envelope	–	5		
14.	Puts the envelope in despatch tray	–	5		

General guide lines for making a flow Process chart

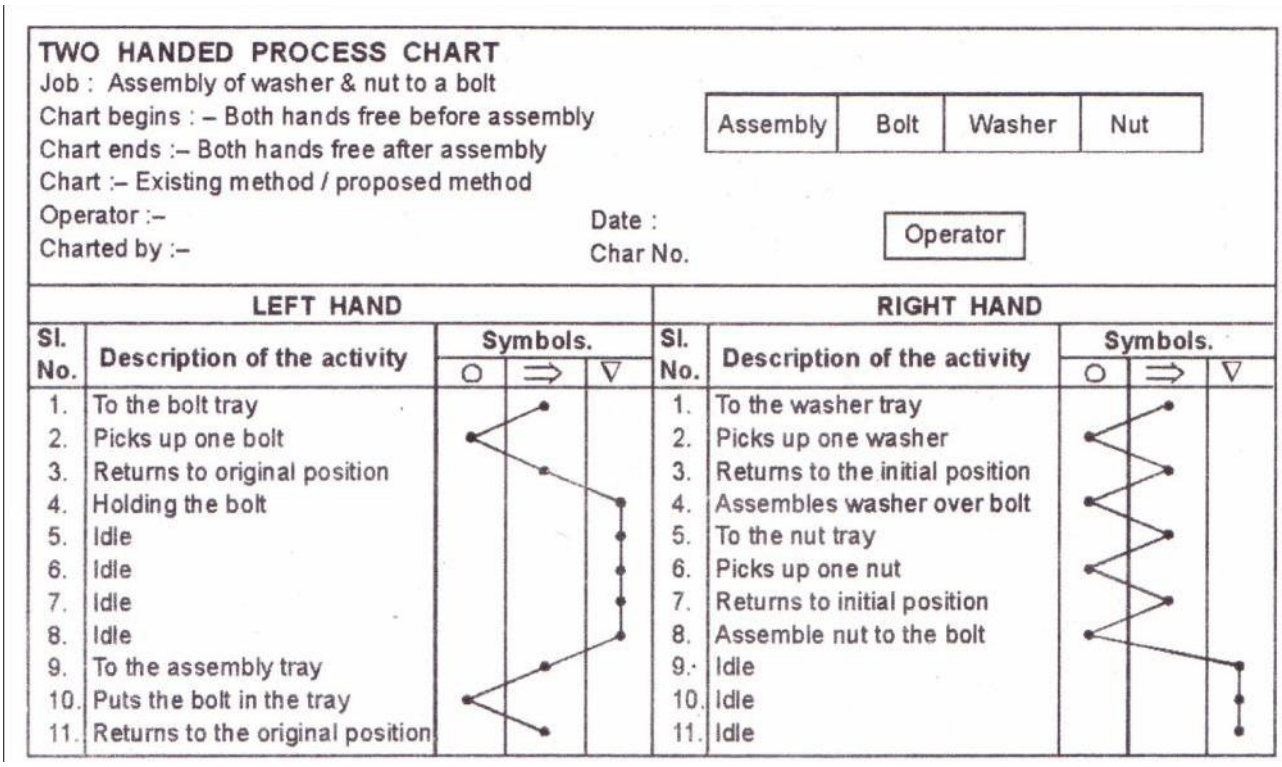
1) Details Must be obtained by direct observation (Not by memory based)
2) Record all the facts correctly.
3) No assumptions should be made.

4) Make it easy for Future References.

Charts should have the following details

- Name of Product, Material (or) Equipment that is observed
- Starting Point and Ending Point.
- Location where the activities takes Place.
- Chart Reference Number, sheet number, total Number of sheet.
- Key to the symbols must mention.

3. Two Handed Process Chart (Or) Right Hand Left Hand Chart



TWO HANDED PROCESS CHART

Job : Assembly of washer & nut to a bolt
Chart begins : – Both hands free before assembly
Chart ends :– Both hands free after assembly
Chart :– Existing method / proposed method
Operator :–
Charted by :–

Date :
Char No.

Assembly	Bolt	Washer	Nut

Operator

LEFT HAND					RIGHT HAND				
Sl. No.	Description of the activity	Symbols. ○	⇒	▽	Sl. No.	Description of the activity	Symbols. ○	⇒	▽
1.	To the bolt tray				1.	To the washer tray			
2.	Picks up one bolt				2.	Picks up one washer			
3.	Returns to original position				3.	Returns to the initial position			
4.	Holding the bolt				4.	Assembles washer over bolt			
5.	Idle				5.	To the nut tray			
6.	Idle				6.	Picks up one nut			
7.	Idle				7.	Returns to initial position			
8.	Idle				8.	Assemble nut to the bolt			
9.	To the assembly tray				9.	Idle			
10.	Puts the bolt in the tray				10.	Idle			
11.	Returns to the original position				11.	Idle			

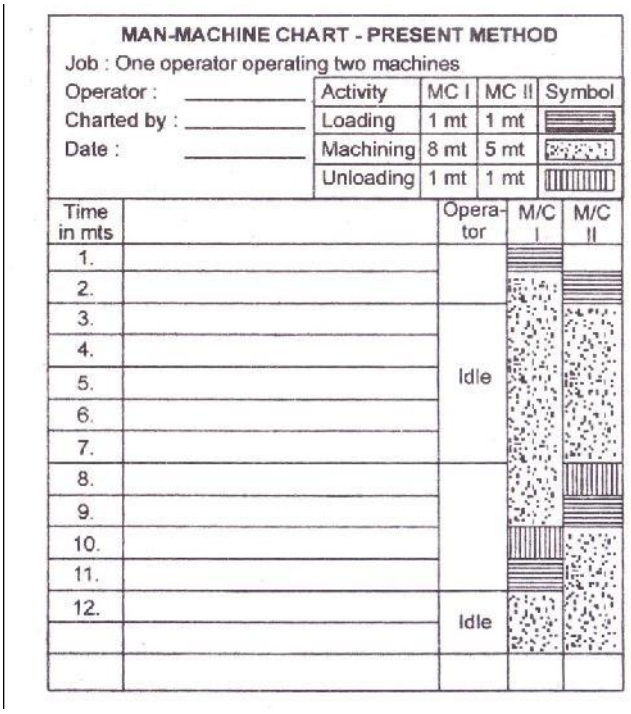
General guidelines for preparing two handed Process chart (THIPC)

1. Provide all information about the job in the chart.
2. Study the operation cycle a few times before starting record.
3. Record one hand at a time.
4. First record the activities of the hand which starts the work first.

5. Do not combine the different activities (like operation, transport)

4. Man – machine chart

- Man machine is a chart which the activities of more than one worker (or) m/c is recorded.
- It is also known as multiple activity charts.
- Activities of workers (or) m/c are recorder in separate vertical columns with horizontal time scale.
- The chart shows the idle time of worker (or) m/c during Process



MAN-MACHINE CHART - PRESENT METHOD

Job : One operator operating two machines

Operator : _____
Charted by : _____
Date : _____

Activity	MC I	MC II	Symbol
Loading	1 mt	1 mt	
Machining	8 mt	5 mt	
Unloading	1 mt	1 mt	

Time in mts		Opera-tor	M/C I	M/C II
1.				
2.				
3.				
4.				
5.		Idle		
6.				
7.				
8.				
9.				
10.				
11.				
12.		Idle		

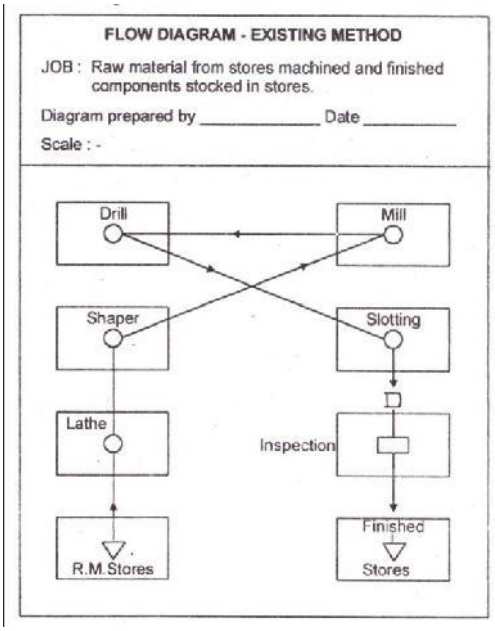
- Multiple activity charts is very useful in planning team work in Production.
- By using this chart we can find he Exact Number of workers needed for job.
- Time was Noted by using stop watch and High accuracy is not Needed

5. Flow diagram

Flow diagrams are used for the following Purpose.

1. To remove unwanted material Movement

2. To remove back tracking
3. To avoid traffic congestion.
4. To improve Plant layout.

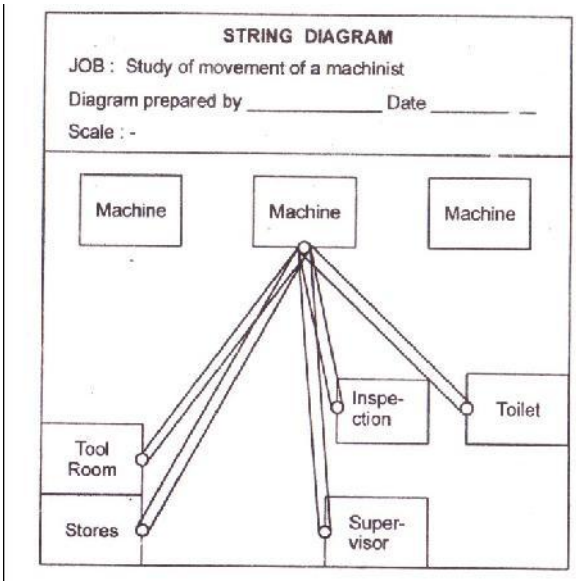


Procedure for Flow Diagram

i. Heading and description of the process should be given at top of diagram
ii. Information like shop Name, location, Name of Person drawing the diagram also noted.
iii. Path of material movement is shown by a flow line.
iv. Direction of movement is shown in small arrows along the flow lines.
v. Activities should represented by the symbols on flow lines.
vi. Different colours are used for Each Path.

6. String diagram

- String diagram is used to find the movement of workers.
- When the path is repeated (or) many it is not possible in flow diagram, so string diagram is used.
- In string diagram drawing sheet, Pins, and various coloured thread (or) string is used to find the Movement of workers.



Construction Procedure in string diagram

i. Draw the layout of shop to scale in a drawing sheet.
ii. Mark the various work centers like machines, stores, work bench in the diagram
iii. Fix the Pin in the drawing sheet at work centers.
iv. Tie (fix) one end of colored string to the work centre from the Movement starts.
v. Follow the path of worker and fix the thread at different Movement of Place.

CHAPTER-III

WORK MEASUREMENT

Work measurement is a technique to establish the time required for the qualified works to carry out a specified job at a defined level of performance.

OBJECTIVES OF WORK MEASUREMENT

- To reduce (or) eliminate non – productive time.
- To fix the standard time for doing a job.
- To develop standard data for the future reference.
- To improve methods.

USES OF WORK MEASUREMENT

- To compare the efficiency of alternate methods.
- For wage incentives schemes.
- For cost estimation.
- It helps to plan the work load of man and machines.
- It helps to determine the requirement of man and machine.
- It helps in better production control.
- It helps to fix the delivery date to the customer.

TECHNIQUES OF WORK MEASUREMENT

1. Stop watch time study
2. Production study
3. Work sampling (or) ratio delay study
4. Synthesis from standard data
5. Analytical estimating
6. Predetermined motion time system

1. STOP WATCH TIME STUDY

In stop watch study a stop watch is used to find the time.

Procedure following in stop watch time study:-

1. Selecting the job
2. Recording the specifications
3. Breaking operation into elements
4. Examining each element
5. Measuring using stop watch
6. Assessing the rating factor
7. Calculating the basic time
8. Determining the allowances
9. Compiling the standard time

1. SELECTION OF JOB

- A new job, new component (or) new operation
- When new time standard is required
- To check the previous standard time
- When cost of operation is find high
- Before introducing an incentive scheme
- When two methods to be compared.

2. RECORD

- About product name, product number, specification
- About machine, equipment and tool
- About working conditions, temperature, humidity, lighting, etc.
- About operator name, experience, age (for rating factor)

3. BREAKING DOWN OPERATION INTO ELEMENT

- Element operation is divided into a number of elements
- This is done for easy observation and accurate measurement
- The element are grouped as constant element, variable element, occasional element, man element m/c elements

4. EXAMINE EACH ELEMENT

- Examine whether the element are effective (or) wasteful

- Examine whether the element are done in correct method

5. MEASURING USING A STOP WATCH

- Time taken for each element is measured by using stop watch
- Two methods of measuring:-

i. fly back method(or) snap back method
ii. cumulative method (or) continuous method

6. ASSESS THE RATING FACTOR

- Rating is the measure of efficiency of a workers.
- Operator's rating is found out by comparing his speed of work with std performance.
- Rating factor of an operator is decided by work study man.

Rating scale

60	to	80	- Slow
75	to	100	- Average
100	to	133	- Above average

7. CALCULATE THE BASIC TIME

Basic time = observed time *operator rating / std rating (100)

BT = OT*OR/SR

8. DETERMINE THE ALLOWANCES

- Allowance like toilet, drinking water, rest time.
- Some extra time is added to basic time.
- This extra time is allowance

BREAKING A JOB INTO ELEMENTS

Reason for breakdown job into elements

1) To separate productive time and non-productive time
2) To fix the rating factor accurately
3) To determine fatigue allowance accurately
4) To prepare detailed work specification
5) To fix std time for repetitive elements (loading, unloading)

CLASSIFICATION OF ELEMENTS

1) REPETITIVE ELEMENTS:-
   This element which occurs every work cycle of the job

   Ex: loading the m/c, locating job in fixture

2) CONSTANT ELEMENT:-
   It is an element for which the basic time rematches constant whenever is performed

   Ex: m/c on/off

3) VARIABLE ELEMENT:-
   It is an element for which the time varies depending on the characteristics of the product.

   Ex: dimension of product

4) OCCASIONAL ELEMENT:-
   It is an element which does occurs in every work cycle of the job.

   Ex: grinding the tool, re-setting tool

5) FORIGN ELEMENT:-
   It is an element which is not a part of job.

Ex: cleaning the job, chip removal

6) MANUAL ELEMENT:-
   Element performed by worker.

   Ex: cleaning m/c

7) MACHINE ELEMENT
   Element automatically performed by a power driven m/c

   Ex: automatic feed mechanism

GENERAL RULES TO BE FOLLOWED IN BREAKING DOWN OPERATION INTO ELEMENTS

- Element should have proper beginning and ending
- Shortest element that can be timed using stopwatch is 0.04mt
- Separately note main element and machine element
- Separate constant element and variable element
- Separate occasional and foreign element

MEASURING TIME WITH A STOP WATCH

1) Fly back (or) snap back method
2) Continuous (or) cumulative method

1. FLY BACK METHOD

- In this method stop watch is started at the beginning of first element
- At the end of element the reading is noted in study sheet
- At the same time the stop watch is reset to zero
- Each element is noted by resetting zero this time is called observed time

2. CONTINOUS METHOD

- In this method the stop watch is started at the beginning of first element

- The watch runs continuously till the end of the last element.
- The time for each element is calculated by successive subtraction (cumulative).
- This time is observed time

3. RATING FACTOR

RATING:-
It is the assessment of the rate of working of the operator by work study man.

STANDARD PERFORMANCE:-
Rate of output which a qualified worker will give on an average

BENCH MARK FOR STANDARD RATING:-

- Value of bench mark standard
- Universally accepted

RATING SCALE:-

- 60-80 SCALE
- 75-100 SCALE
- 100-133 SCALE

CALCULATION OF BASIC TIME

Basic time = observed rating/ standard rating

ALLOWANCE

- The workers cannot work continuously without break
- Some extra time is added to the basic time (for break)
- This extra time is known as allowance

EXTRA TIME IS GIVEN FOR

Personal factor, nature of works other factor, tool breakage, communication with supervisor.

VARIOUS TYPES OF ALLOWANCES

1) Rest and personal allowance
2) Process allowance
3) Contingency allowance
4) Special allowance
5) Policy allowance

1. REST AND PERSONAL ALLOWANCE

- This allowance given for the personal needs of the workers
- This is also known as relaxation allowance

2. PROCESS ALLOWANCE

- this also known as unavoidable delay allowance
- Unavoidable delay like due to process, m/c operation, waiting for workers, waiting of material.
- To compensate this delay, process allowance is given.

3. CONTIGENCY ALLOWANCE

- Waiting for the inspector delays
- Consulting the supervisor delays
- Getting special tools
  - These delays are very short duration this allowance given to compensate the above delay is called contingency allowance.
  - 5% of basic time is given as contingency allowance.

4. SPECIAL ALLOWANCE

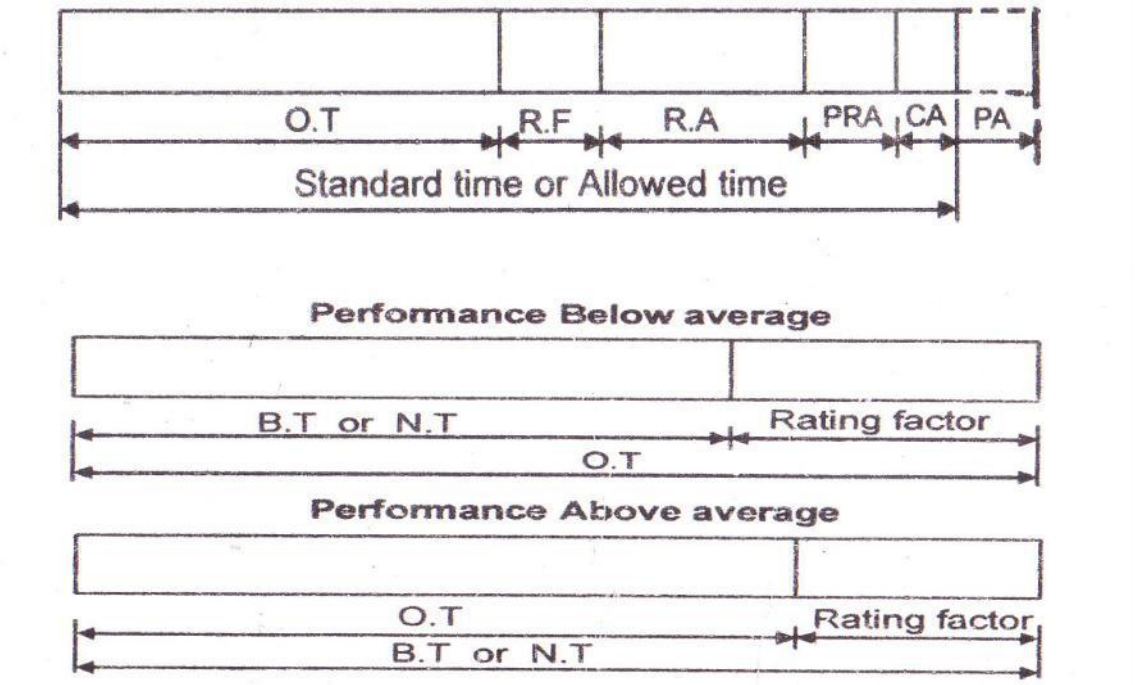
- Some activities occurs very occasionally
- It will not a part of production activity
- But these activities are necessary for production work
  Ex: tool resetting, cleaning, tool maintenance.
- For these activities an allowance given as special allowance.

5. POLICY ALLOWANCE

- This allowance is given by management to workers for benefit

- It is not included in calculating std time.

CALCULATION OF STANDARD TIME



- It is calculated by using stop watch
- Total elemental time is the observed time.

2) BASIC (OR) NORMAL TIME
   - Time taken by a workers with a std performance.

     Basic time = O.T*OR/SR

3) ALLOWED TIME
   - Rest and personal allowance
   - Process allowance
   - Contingency allowance
   - Special allowance

     Policy allowance will may added if management permits

PRODUCTION STUDY

- In this stop watch is used for std time sets.
- Complaints from operator that the time given for job is not sufficient
- It is necessary to check the original time study
- This study is finds the time delay due to occasional elements. The study is l long period study for 1 complete shift.

USES OF PRODUCTIO N STUDY

- To check the accuracy of time std
- To make sure that all the ineffective elements are included in time study
- To observe the waiting time and other delays
- To get data for working out the contingency allowance
- When output goes down this study is conducted

PROCEDURE FOR PRODUCTION STUDY

- Conduct by using stop watch
- It is a long time period one complete shift, repeated activities are noted
- Compare allowance with allowances already taken in std time.

1. Error in original time study
2. Change in condition of materials, tools, and equipment.
3. In experienced operator
4. Change in method
5. Change in working condition
6. Change in layout
7. Incorrect m/c speed

RATIO DELAY STUDY

- It is also known as work sampling (or) activity sampling
- Ratio of delay with working to the total of an activity is found
- It is done by random observation.

RATIO DELAY STUDY IS SUITABLE FOR

1. Long cycle operations
2. Where time study is not possible
   (Ex: office work, supervising work, store work and ware houses)
3. Estimate the % utilization of m/c tools cranes, trucks etc.
4. Estimate % idle time of men in group work
5. Estimate the std time for manual task.

PROCEDURE

1. DEFINE THE OBJECTIVES
   - Decide the element to be study
   - Decide the idle time of men(or) machine
   - Decide the shop floor
   - Decide the nature of activity
   - Decide the location of men and m/c

2. SELECT THE SAMPLING TECHNIQUE
   - Decide the number of observations
   - Decide the length of time of observations
   - Random number tables
   - Random schedule of observation

3. PREPARE THE FORM FOR READING

Date :		Observer :	Study No :	
Number of observations : 150			Total	Percentage
Machine running		𝍸 𝍸	120	80.0
Machine idle	Repairs	𝍸	3	2.0
	Supplies	𝍸 𝍸 ||	12	8.0
	Personal	𝍸 |	6	4.0
	Idle	𝍸 ||||	9	6.0

4. MAKE OBSERVATION
    - visit the work place as per their timing noted in form
    - note down the men (or) m/c is working in the form

5. PREPARE THE DATA
    - Analyses the observed data and calculate the % utility (or) idle time for men (or) m/c

      EXAMPLE:-
      Number of observation made – 150
      Number of times m/c found working – 120
      Number of times found idle -30

        1) Utility of m/c = (120/150)*100 = 80%
        2) Idle time of m/c = (80/150)*100 = 20%

ADVANTAGE OF RATIO DELAY STUDY

1) To overcome the drawback of stop watch time study
2) Cost of study is less
3) It is not a continuous study
4) The study will not disturb the production
5) Trained study man is not required
6) Calculation of idle and utility is easy

LIMITATION: (Disadvantage)

1) This is not suitable for short cycle repetitive operations
2) This is not a detailed study
3) Cost is high when the study is for group of m/c and group of workers

4. SYSTHESIS FROM STANDARD DATA

- It is a work measurement technique work out std for a job by totaling elemental times already obtained from previous time studies
- Two elements are constant element and variable element

PROCEDURE

1) Breaking operation into element, segregate constant and variable element
2) Collect constant elemental time for data bank
3) For variable elements carry out by the graph, formula, charts.
4) Add all the elemental time for constant and variable with addition of allowances.

ADVANTAGES:-

1) More accuracy compare to other study
2) Process is very quick
3) It is very cheaper method
4) Used for estimating cost of production
5) Useful for planning team work such as assembly work

LIMITATIONS:-

1) Collection of data bank is little costly
2) Applied only for larger industry
3) The data bank should be updated periodically.

6. ANALYTICAL ESTIMATING

- It is a work measurement technique done by an experienced foreman
- By his experience the foreman works out the time for a job
- It is applied for finding out the time for non productive work

(Ex) maintenance, repair work job order work, construction work.

PROCEDURE

1. SELECTION OF THE ESTIMATOR
    - Experienced foreman can only estimate the time by knowledge and experience the reasonable by time can acceptable by workers.

2. COLLECTOIN
    - Foreman can collect the data from the conceded supervisor.
    - He can concern the sequence of operations with supervisor.

3. BREAKING DOWN THE JOB INTO ELEMENTS
    - The foreman breaks the operation into various elements. Elements having longer duration (1-5 min) in this study
    - The elements are grouped into constant element, variable, man element and m/c element.

4. ESTIMATING ELEMENT TIMES
    - Foreman will estimate the elemental time, for some element the time may not available in data bank. By his experience he will estimate the time for that element.

5. ESTIMATING THE STANDARD TIME
    - Foreman adds all the elemental time, with adding the allowance to get the standard time.

APPLICATION:-

Maintenance work, repair work, construction work, fabrication work, erecting work, inspection work, job order production, service station

ADVANTAGES:-

- Suitable for man repetitive work
- Target time easily fixed

LIMITATIONS:-

The estimate will not be accurate

PREDETERMINED MOTION TIME SYSTEM

- It is work measurement technique used to establish the standard time for manual work
- It is done by using predetermined time standards for basic human motion available in standard date bank

TYPES OF PMTS

1. Work factor system –study actions and motion of work (WFS) – (1938)
2. Method time measurement (MTM) – (1948)
3. Motion time analysis (MTA) – (1950)
4. Dimensional motion times (DMT) – (1951)
5. Basic motion times (BMT) – (1954)

STEPS IN METHOD TIME MEASUREMENT (MTM)

- Analyze the given manual operation (or) method
- Divide them into basic motion and conditions
- Note down the nature of motion and conditions
- Allot the time for standard data table
- Add the timing of basic motion to get elemental time
- Add the all elemental time to get operation time

BASIC MOTIONS:-

- Reach, move, grasp, position, turn, apply pressure, release, disengage, eye motion, body leg (or) foot motions.
- Accurate observation of different basic motion are made by using cine camera at the frames/sec
- These observation are made on different types of operation at different ages.
- The time are expressed in time measurement unit

  One time measurement unit = 0.00001 hrs (or) 1/28 of sec

ADVANTAGES OF MTM:-

- Std time is worked out before the job is done
- Alternate methods are compared without experiments
- Very effective method for improving existing methods
- For tools designing works

LIMITATIONS:-

- It is used only for manual work.

UNIT III

PRODUCTION PLANNING AND QUALITY CONTROL

CHAPTER-1

PRODUCTION PLANNING AND CONTROL

Production is done as per the prescribed time period and plan and to get the output in control manner.

MAJOR FUNCTIONS OF PRODUCTION PLANNING AND CONTROL

1. Pre-planning 2. Routing 3. Scheduling 4.Dispatching 5.Controlling

1. PRE-PLANNING

Planning is taking decision about the future course of action.

- Pre-planning includes the following activities
  - I. Forecasting
  - II. Product designing
  - III. Estimating the cost of production
  - IV. Product planning
  - V. Process planning
  - VI. Determine the requirement of men, m/c and materials, tools.

2. ROUTING

- Deciding the path of movement of material during the process of production.
- It gives the sequence of operation to be done on the job.
- Route sheet is used for this purpose.

3. SCHEDULING

- Scheduling is deciding the time of manufacturing. It also gives rate of production.
- Main aim of scheduling is to get the required output without delay.
- Gantt chart is used for this purpose.

TYPES OF SCHEDULING

i. Master scheduling
ii. Part scheduling
iii. Machine-load scheduling
iv. Dispatching

4. DISPATCHING

Issuing orders and instructions to various department for starting production**.**

DOCUMENTS CONTAIN IN DISPATCHNG ARE

i. Job order
ii. Material issue order
iii. Tool order
iv. Move order
v. Delivery order

5. CONTROLLING

- Controlling is making the production activities to take place according to the plan.
- The process is continuously checked id any delay (or) shortfall occurs, in production corrective action is done.

TYPES OF CONTROL

i. Material control
ii. Labor control
iii. Cost control

IMPORTANCE OF PPC:

- Ppc is the Nerve centre of factory.
- Ppc department can control all the activities in all department by giving instructions, orders regarding production.
- Hence it is compared with the human Nerve centre(Brain).
- Activities likes what to do, where to do, when to be done, who should do it. These activities is done by Ppc department.

COMPARE PPC WITH NERVOUS SYSTEM OF HUMAN BODY

S NO	HUMAN BODY	FACTORY
1	Gets information through five sensory organs(eye, skin, ear, nose, tongue).	Gets information through Planning, dept, Prod dept, Sales dept, Qc dept, Accounts dept.
2	The Nerve centre(brain) decides the plan of action.	Ppc prepares the plan of various department to carry out production.
3	Nerve system gives instructions to the muscles to do work.	Ppc issues instruction to various dept for production.
4	The nerve centre controls the activities of human body.	Ppc checks the progress of production activities in various department.
5	Nerve system takes corrective action id any this goes wrong.	Ppc takes corrective action on if any shortfall of production.
6	If Nerve centre does not work well, man will not behave in good manner.	If Ppc is not effective the production activities will not produce o/p properly.

TYPES OF PRODUCTION

1. Continuous production .
    i. Mass production (or) line production
    ii. Flow production(or) process production
2. Intermittent production (or) Batch production.
3. Job order (or) Project type production.

FORECASTING

- It is a process of estimation of future activities. Forecasting is the starting point of Ppc function.
- By sales forecasting the quantity of product that could be sold in the target period.
- By forecasting we can analyze the demand of the product in market.

Demand for a product depends on factors like

a. Competitors policy
b. Arrival of new product
c. Fashion changes
d. Economic situation
e. Government policies

Objectives of sales forecasting

a. To determine the production rate and volume of production.
b. To determine the financial requirement.
c. To know the need for plant expansion.
d. To formulate pricing policies.
e. To decide the need for sales promotion activities.

Factors considered for forecasting

a. Trend- Previous few years demand is considered.
b. Cyclic variation- Demand may high(or)low in certain period changes.
c. Seasonal variation- The product may have demand for some few months every year.
d. Irregular variation- Due to sudden vary like floods, strike etc.

Methods of forecasting

a. Estimate based on past experience.
b. Sales force estimate.
c. Trend line estimate.
d. Correlation method.
e. Market research.
a. Estimate based on past experiences
    - It is the oldest type of sales forecasting method.
    - It assumes the sales method of last year.

- It is also known as historical estimate.
- This is not scientific method but it is safe and this method is quicker and cheaper method.

b. Sales for estimate
   - This method is based on information given bye the sales man.
   - Salesman can receive the demand of the product from the market person.
   - Salesman gives information about the current demand of sales manager(Regional).
   - Regional sales manager send their reports to the company.
   - By these reports are analysed and the product demand is estimated.

c. Trend line estimation
   - This is a statistical method and the sales for the previous years are recorded in a graph.
   - Volume of sales is plotted in the Y-axis and year in X-axis.
   - Actual sales of every years id noted. A straight line is drawn. This is called trend line.
   - From the trend line the sales for future is estimated.

d. Correlation method
   - In this method it can be find the sales ration of a product with the sales of relationship product.
   - It this method demand of one relationship product is find out another one is very easy.

   Example: Sales of tyre is based on sales of bike.

e. Market research (or) market survey
   - Very difficult to find the demand of new product.
   - In the market research the sales representation introduce new product in small area, door to door sales is done.
   - Peoples feedback is received and analysed and demand is been estimated.

PRODUCTION PLANNING

It is as planning for the manufacture of product after the product design is done.

1. Breaking down the production.
2. Preparation of part drawing.
3. Deciding the specification and tolerance of each component.
4. Preparation of bill of material.
5. Make or buy decision.

PROCESS PLANNING

- It is a preparation of detailed work.
- It is a planning of method for production.
- Most economical method for production.

Details are planned in process planning are(During)

1. The sequence of operations.
2. Machines used for each operators.
3. Tools and equipments used.
4. Requirement of material.
5. Grade of workmen required.
6. Time required for each operation.
7. Cutting speed, feed and D.O.C

Information required (Before starting planning)

1. Quantity to be produced.
2. Product specification(Drawing)
3. Quality requirement(IOS,ISI)
4. Availability of equipment, tools and operators.
5. Sequence of operations.
6. Standard time for each operation.

Procedure for process planning

1. Selection of process.
2. Selection of material.
3. Selection of jigs, fixtures etc.
4. Time calculation.
5. Process sheet.

1. **Selection of process**
    - Most economical method should be selected for converting new material into finished goods.
    - BEA should be used to find cheaper process.
    - Delivery schedule
    - Availability of machine.
    - Quantity.
    - Quality.
2. **Selection of material**
    - Material should be right quality and chemical composition.
    - To reduce the scrap by designing the shape and size.(Near Net shape)
3. **Selection of jigs, fixture etc**
    - Suitable jigs and fixtures should be used to give high productivity.
    - Reduce and cost of production.
4. **Time calculation**
    - Setup time and standard time for each operation.
    - Time can take in the standard data bank estimated by work study.
    -
5. **Process sheet**

Process sheet

Part description: Part No;
Drg No: Assembly No:
Mat specification: Issued by:
Lot size:

S No	Description of operation	m/c code	Tool code	Labor code	Speed	Feed	Set up time	Std time

Choice of machine in process planning

i. Accuracy – capable of giving high accuracy.
ii. Rate of output – capable of giving high rate of o/p.
iii. Cost – a. Comparative of machines is done.

B. Low cost of production m/c with accuracy and efficiency m/c is selected.

A component is to be produced on either a capstan lathe (or) an automotive lathe. The different cost factors are given below.

Machine q	Machine 2
Fixed cost= Rs 600 Variable cost= Rs 3/piece Components= 1000	Fixed cost= Rs 1800 Variable cost= Rs 1/piece Components= 500

Condition: cycle time for both m/c is same which machine will you select for producing

a. 1000 comp b. 500 comp

What is Break even quantity of production?

Solution:

a. Let N= 1000 components

Machine 1	Machine 2
Total cost= F1+NV1 =600+(1000*5) = Rs 3600	Total cost= F2+NV2 =1800+(1000*1) =2800

Select machine 2 which total cost is less

b. Let N= 500 components

Machine 1	Machine 2
Total cost=F1+NV1 =600+(500*3) =Rs 2100	Total cost=F2+NV2 =1800+(1000*1) =Rs 2800

Select machine 1 which total cost is less

ROUTING

- Routing machines the flow of material inside the plant regarding the sequence of operation.
- From the raw material to finished product it indicates the path to be followed from one m/c to another m/c.
- It product layout routing is easy because the m/c is arranged in sequence of operation but in process layout routing is difficult.
-

Procedure for routing process

1. No of quantity to be produced id found out.
2. Available m/c capacities and m/c characters is found out.
3. Path of flow of material is decided.
4. Based on details in process sheet, the route sheet is prepared.

Difference between process sheet and Route sheet

1. a. In the process sheet only the code of the machine is given (Ex: m/c code is given 20mm centre height-centre lathe).

   b. In the Route sheet the identification number of particular m/c is given (Ex: lathe no: 12, 200mm centre height-centre lathe).

2. a. In both sheets, the sequence of operations is given. The sequence of operation given in the process sheet can be altered during production.

   b. But the sequence of operation given in the Route sheet should be strictly followed.

3. a. Preparation of process sheet is done well in advance (pre-planned).

   b. Route sheet is prepared a few days before the staring of production.

4. a. Process sheet remains the same for a product wherever it is manufactured.

   b. In Route sheet has to be modified for every repeat order.

SCHEDULING

- Scheduling is deciding when and what rate the products are to be manufactured.
- By scheduling we can allocate the workload in m/c and equipments.
- This is done to get the required output with minimum delay.

Objectives of scheduling

1. To deliver the goods to the customer at the right time.
2. To make men, material and m/c readily available for production.

3. To make maximum use of man power and machine capacity (reduce idleness).
4. To prevent overloading for men and m/c.
5. To keep minimum material in the process.
6. To help in production control.

Advantages of scheduling

1. It will minimize the production cost.
2. Less investment of material.
3. Minimum material storage cost.
4. Customer satisfaction.
5. No over loading of men and m/c.
6. Good production control.
7. No under utilization of men and m/c.
8. Good will of the company improved.

TYPES OF SCHEDULING

1. Master scheduling

- Master schedule gives the number of units of different products to be produced for the complete full year.
- It gives the units of production for every month for different products.
- Master schedule is based on the basis of sales forecast.

SSPR COMPANY MASTER SCHEDULE FOR THE QUATES ENDING MARCH GANTT CHART

Sl no	Product description	code	jan	feb	march
1	X	200	800	800	800

2	Y	300	500	500	500
3	Z	400	700	700	700

- In above Gantt chart list of different products to be produced in different months is prepared.
- Master schedule is to plan the production of the products for the demand in the market.

2. Part scheduling

- Part schedule gives the number of units of different parts to be produced from the given product.
- The schedule is prepared for a month.
- It gives the details of production for every week. Part schedule is prepared on the basis of master schedule.

3. Machine loading schedule

- M/c loading schedule is the process of allocating work load for various machines.
- It is a time table for the working of various machines.
- This schedule is prepared for a period of one week. It gives the details of m/c loading for everyday of the week.
- This scheduling is prepared on the basis of parts schedule.

Gantt chart

- Gantt chart is designed by Mr.: HENRI.C.GANTT
- It is a graphical representation of scheduling.
- Gantt chart is used for master, part and m/c loading schedule.
- Gantt chart is used for better production control.

DESPATCHING

Despatching is releasing of work order and other documents to different departments to start production activities.

The different activities of despatching are

1. Releasing the schedule for the production departments.
2. Issuing work orders t o start production work.
3. Releasing material issue order to the stores.
4. Issuing move order for the movement of materials.
    1. From stores to production shop
    2. Within the shop
    3. From shop to shop
    4. From shop to finished goods stores
5. Issuing tool issue order to the tool room.
6. Releasing inspection order.
7. Recording time of beginning and time of completion of job.

Documents issued in dispatching

1. Job order
2. Material issue order
3. Move order
4. Tools issue order
5. Inspection order
6. Job time tickets
7. Final delivery notification

Controlling process

- Production control means making the process activities to take place according to the production plan.
- The progress of manufacturing activities is checked continuously. If any shorted occurs corrective action is taken.
- **Types of control are**
    1. Material control
    2. Labor control
    3. Machine utilization control

1. Material control

- 60% of money is invested in materials only.
- Materials include raw materials, semi-finished component, finished component, spare parts, consumables and work in progress.
- Small savings in material cost will lead to high reduction in product cost.
- Material control leads with purchasing, receiving, storing and issuing of materials to various departments at right time, right quality and right quantity.

a. Purchasing

- Keep records about materials.
- Main records of reliable source of supplies.
- Contact the suppliers.
- Receive and compare the quotations.
- Place and follow up purchase orders.
- Maintain records of purchased.
- Inspect the receive right materials.
- Close contact with suppliers as well as various dept in factory.
- Prepare purchase budget.
- Payment to suppliers.
- Inventory at optimum level.

b. Receiving

- Purchase department should monitor the deliveries are made as per schedule.
- Receiving departments receives the material at gate by store keeper.
- Invoice of payment should be maintained.

c. Issuing

- Materials are issued by store to the various production shops.
- PPC dept issues material issue to the stores.
- Stock history card is maintained.

- Periodical stork verification is to be done.

2. Labor control

Labor cost is one of the major expenditure which increases production cost.

a. Time keeping

- Recording the time spent by each worker in the factory.
- Arrival time to departure time of the worker.
- Time clock method is used for time keeping. A card is allotted for worker which contains name, dept and designation.
- When workers enters in shop he must insect the clock and punches the time same for exit.
- Late and early departure is printed in red in by clock.

b. Time booking

- In the booking it refers to the worker spent time on each jon.
- In the booking job time card is used and the time spent by workers on no of jobs is recorded.
- Time noted for different types of job spent by workers.
- Idle time should be found out.

3. Machine utilization control

Efficient utilization of m/c is very important to controlling the production cost.

1. Capacity of the machines.
2. Standard time for each piece.
3. Number of pieces to be produced.

- The schedule can be represented by a Gantt chart(used for scheduling and controlling)
- Storage of production, reasons are analysed and rectified.
  (Reason: m/c breakdown, tool break down, storage of material, absence of operator)

NETWORK ANALYSIS

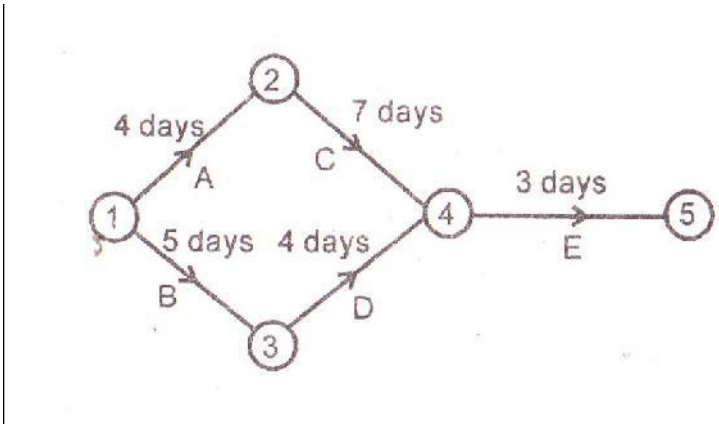
- Projects are broken down into individual activities.
- Activities are arranged in sequence of work.
- Activities to be performed simultaneously is decided.
- Network diagram is drawn and showing relationship between all activities.
- Resources need for various activates are allocated.

1. PERT- Program Evaluation and Review Technique.
2. CPM- Critical Path Method.

Critical Path Method

1. Events - It is a moment of time marks the start (or) end of an activity. It represented by circle and written inside the circle.

2. Activity - For completing a project numbers of operations (or) tasks is mentioned. These operations are called activities. (Ex: Turning, painting and inspection)



- Sequence of activities which decides the total time.
- In the diagram 1,2,3,4, is critical path and it consumes 14 days.
- The path 1,3,4,5, consumes only 12 days.
- Critical path consumes maximum resources.
- Critical path is been controlled and rectified.

1.MASS PRODUCTION:

In mass production, identical parts are produced in very large quantities, using automatic machines and equipments. Ex. Manufacture of bolts, nuts, automobile parts, gears house hold articles like pressure cookers, electrical appliances like bulbs, television etc.

Characteristics of mass production

- Quantity produced is very large.
- Products are highly standardized.
- Product layout is used
- Material handing is minimum

2. BATCH TYPE PRODUCTION

It is also called as intgermittent production, here, identical products are produced in batches of small quantity.

Characteristics

1.products are produced in batches of small quantities.

2. products are standardized

3. both special purpose and general purpose machines are used.

4. A combination of product layout and process layout is used

3. JOB ORDER PRODUCTION

This is the type in which the products are manufactured as per the specification of customers after the receipt of orders within prefixed time and cost.

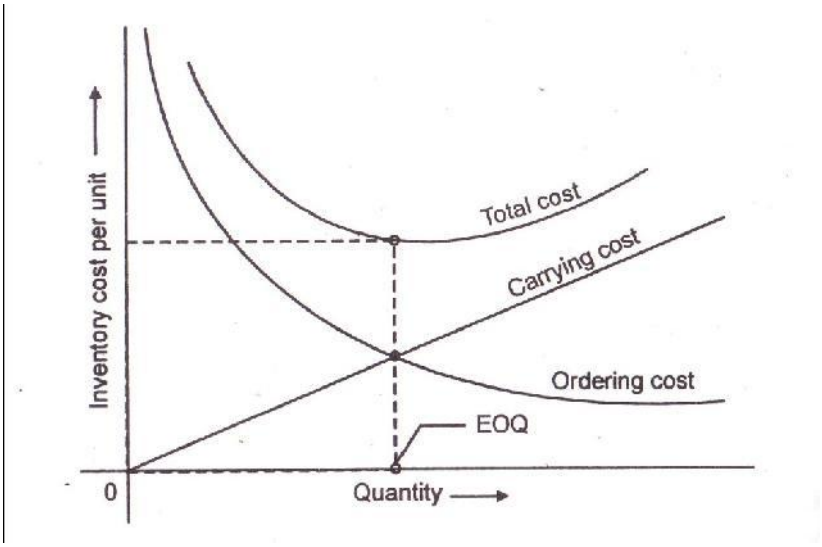
Characteristics:

1. High variety and low volume of products
2. One or few products are produced at a time.
3. A layout by fixed position or static type layout is used

4. General purpose machines are used.
5. Highly skilledworkers are required

ECONOMIC BATCH QUANTITY

- When the number of components to be produced is very large it not manufactured in one batch.
- So it is necessary to find out the most economical on batch.
- This batch size is known as economic batch quantity.



Cost (a) - fixed cost

Cost (b) - variable cost

Total cost = a + b

By mathematically, EBQ can be determined as followed

Q – Economic batch quantity

R – Annual requirements

S – Preparation and set-up cost

C – Constant cost / price

I – Inventory carrying cost

Economic batch quantity (Q) = √2RS/CI

1. Find the economic batch quantity using the data given below

a. Setup cost= Rs.25/setup. (s)
b. Annual requirements= 1500. (R)
c. Inventory carrying cost= 10% of year (10/100=0.1). (I)
d. Cost per part= rs.3. (C)

Solution

E.B.Q=√2*1500*25/3*0.1

=√250000

E.B.Q=500

Therefore the number of batches to be made for manufacturing.

1500/100=3 batches

Make or buy decision

Make or buy decision is the main function of product planning. In this method we can decide which parts to be purchase and manufacture inside factory.

Factors considered for make (or) buy decision

1. Cost factor- Consider the cost of product cost is less means buy decide. Cost is more means make decide.
2. Available plant capacity- Spare capacity is sufficient means we can manufacture otherwise buy decision.
3. Quantity factor- Small amount means purchase it large means make it.
4. Quality factor- Some parts are made with high quality(quantity is strict). So these parts are produced in the factory itself.

5. Design factor- It is necessary to keep the design very secret for new product is introduced. So it safe for make decision.
6. Reliability of supplies- Some parts may not available in market. Even supplies wont supply items in time. So it is safe for make decision.
7. Specialised knowledge of the supplies- Some of supplies may be specialised in making particular products.

Example: Manufacture of tiers. So bike manufacture no needed to manufacture tyre.

BREAK EVEN ANALYSIS

- It is necessary to compare the cost of producing and cost of buying the quantity of product.
- The cost of producing a component is calculated as follows.
    1. Fixed cost
    2. Variable cost
    3. Total cost

1. Fixed cost
    - This cost remains always constant.
    - It does not depend on quantity of production.
    - Various fixed cost are tool Setup cost, Investment and interest, Depreciation cost, building rent, Insurance charges.
2. Variable cost
    - It is a cost varies regarding the quantity of production.
    - Variable cost will increase when the quantity of production raises.
    - It decreases when quantity of production decreases.
    - Variable cost like labor cost, mat coos, operation cost (power, electric, fuel).

3. Total cost

Total cost is the sum of fixed cost and variable cost.

If F-Fixed cost

N-Required quantity

V-Variable cost/unit

i. Cost of producing = F+N*V

ii. Cost of buy = N*P

Where, P- Price of one unit bought in market(purchased)

- These two cost lines are shown.
- In this graph these lines cut at point.
- Quantity corresponding to this point is called breakeven point(BEP).
- If the quantity is less than buying is cheaper.
- If the quantity is more then making will be cheaper.

CHAPTER-II

QUALITY CONTROL

Quality Control:

Quality control aims at prevention of producing defective products.

Activities of Quality Control

1. Fixing the quality standards - Quality standards for incoming material
   Semi and finished good
2. Evaluation (or) measurement of Quality – Inspection Function
3. Reason for the defects are Examined – Critical Examine
4. Corrective action to prevent defects - To prevent the defective product not to reach in customer's hand

Inspection:

Inspection is a function of quality control. It is to compare the quality of materials, product with standards fixed.

Objectives of Inspection:

i. To find out the poor material before it is machined (To avoid wastage of material).
ii. To identify the defective product and corrective action is done.
iii. To ensure the defective product do not reach the customer.

iv. To earn godwill of the customer.
v. For proper assembled products.
vi. Safe working of the products (Boilers).
vii. To identify the defects in design.

Types of Inspection

1. First piece (or) first off inspection.
2. Floor inspection
    i. Stationary inspection
    ii. Roaming (or) Patrol inspection.
3. Centralized inspection.

1. First piece (or) first off inspection

- This is suitable for products made in automatic and semi-automatic machines.
- This inspection is done before starting the production run.
- The machine is setup and first piece is machined and checked carefully.
- If the dimensions are correct then the machine is handed over to operator.

2. Floor inspection

In floor inspection the inspection is done at the actual place of production (Shop floor).

a. Stationary inspection

- It is suitable for assembly line (or) product line (product layout)
- It is suitable for mass production
- The inspector is stationary at one place and product will be bring to the place of inspector for checking
- Defective products will be avoided.

b. Patrol (or) Roaming inspection

- It is suitable for process layout.
- It is suitable for batch production
- The inspector will moving around in doing inspection is called patrol inspection.
- The inspectors will stops the machine if the defective pieces are due to machine fault.
- He will re-arrange the machine and allowed to start production.

c. Centralized Inspection

- It is also known as tool room (or) view room (or) Lab inspection.
- Inspection is done in inspection booths the products are brought to inspection booths from production centers.
- The inspection booths are maintained at required temperature and humidity.

- Precision measuring instruments and equip are available in inspection booths.

Advantages of centralized inspection

1. Operators are not disturbed.
2. No pilling of work pieces near machines.
3. Inspection will be accurate.
4. Inspection will be easy.
5. Costly and precision instruments can be used.

Disadvantages of centralized inspection

1. Not suitable for heavy work pieces.
2. Increased material handling hence chance to damage will occurs.
3. Increased handling cost.
4. Time delay occur.
5. Chances of mixing components.

Methods of Inspection

1. Method of variables
2. Method of attributes

1. Inspection by method of variables:

- In this method quality characteristics of product are measured by using the measuring instruments.
- The quality is measured in terms of variables like diameter, Length, Thickness etc., by using micrometer, vernier caliper.

Example: Dimension of product is 100.00±0.01mm

Upper limit size = 100.02mm
Lower limit size = 99.98mm

Accept	Reject
100.01, 99.99 100.02, 99.98	100.03, 99.97 100.04, 99.96

2. Inspection by method of attributes

- In this method the quality of the product is measured by gauges.
- The quality is measured in terms of attributes like shape and size.

- Products like castings, beakers, paper and is inspected.

Statistical Quality Control (SQC)

Statistical quality control means controlling the quality characteristics of a product (or) process using Statistical methods.

1. Fixing the quality standards – In coming material, semi-finished, finished Product
2. Checking quality of the incoming material - By using sampling techniques
3. Controlling the production process during production – Using X,R,P,C chart
4. Checking finished products - By using sampling methods
5. Taking corrective action.
6. Establishing optimum quality.
7. Developing quality standards in Industry.

Advantages of statistical Quality Control:

1. Improvement in product quality
2. Reduction of scrap and Re-work.
3. Product quality is uniformly maintained.
4. Time and cost of inspection is reduced.
5. Product design can be improved.
6. SQC decides the correct method of inspection.
7. Develops quality consciousness.
8. It satisfy production department and customer.

Types of control charts

The following are the types of control charts.

1. $\overline{X}$ Chart
2. R Chart
3. P Chart(Percent defective chart)
4. C chart(Number of defects chart)

Control Limits

Control limits are used in the chart to find the variations in product quality. A control chart will have the following horizontal lines.

a) Centre line representing mean of the various measured,
b) Line representing UCL(Upper control limit)

c) Line representing LCL(Lower control limit)

The control limits may be 1σ, 2σ, 3σ. It depends on the level confidence level is 68.3%, 95.5%, or 99.7%. Normally

3σ limits are taken for control limits.

$\overline{X}$ And R Charts

These are control chart for variables. It means these can be used when the inspection is done by method of variables. **For example,** the parts are measured by micrometer a venire caliper.

Construction of $\overline{X}$ and R Charts

A number of sample pieces from production line are collected at random at difference interval time. Then they are measured. Suppose, the diameter is measured.

First, the mean value and range are found out for every sample.

For sample, if the selected sample contains 4 pieces whose diameter are d_1, d_2, d_3 and d_4. Then the sample average, $\overline{X} = \frac{d_1+d_2+d_3+d_4}{4}$

Range = (Maximum diameter – Minimum diameter)

A number of samples are collected at random. Then the average value and range and calculated. Then the average is noted as $\overline{\overline{X}}$ and range noted as R.

The following example gives the procedure to construct $\overline{X}$ and R Chart.

Let,

A Sample size = 4 items

Periodic interval = every 20 minutes = 5 times a day.

Description of measurement = diameter.

Let us assume in the present example and tabulated as shown below:

$$\overline{\overline{X}} = \frac{\Sigma\overline{x}}{5} = \frac{50.5}{5} = 10.1 \qquad \overline{R} = \frac{\Sigma R}{5} = \frac{2.7}{5} = 0.54$$

For $\overline{X}$ Chart | for $\overline{R}$ Chart

UCL = $\overline{X}+A_2\overline{R}$ | UCL = $D_4\overline{R}$

LCL = $\overline{X}-A_2\overline{R}$ | LCL = $D_3\overline{R}$

The values of A_2, D_4 and D_3 are taken by referring to the sampling tables. For sample size 4, of this example:

For $\overline{X}$ Chart

UCL = 10.1 (0.73) (0.54) | LCL = 10.1-(0.73) (0.54)

= 10.1+0.3942 | = 9.0758

= 10.4942 | = 9.7 Say

= 10.50 Say

For R Chart

UCL = $D_4\overline{R}$ | LCL = $D_3\overline{R}$

= 2.28x0.54 | = 0x0.54

= 1.2312 | = 0

= 1.2 Say

- The above control limits are marked on both side of mean value on a graph.
- The $\overline{X}$ and R values are plotted on the graph
- The marked points are joined in $\overline{X}$ chart and marked points on R Chart are not joined.
- Finally it can be decided whether the process is under control or not by referring the graph after plotting the points.

The procedure to be followed while construction of an $\overline{X}/\overline{R}$ chart

1. Determine the frequency of taking samples
2. Decide the sample size
3. Check all gauging equipments to ensure accuracy
4. Measure the samples and note the results
5. Calculate $\overline{X}$ and R for each sample
6. Calculate $\overline{X}$ and $\overline{R}$ after taking 10 to 20 samples.
7. Calculate control limits for $\overline{X}$ and $\overline{R}$
8. Plot UCL, LCL and $\overline{X}$ on a paper. This is $\overline{X}$ chart,
9. Plot UCL, LCL and $\overline{X}$ on a paper. This is $\overline{R}$ chart,
10. Do the above functions at periodic intervals.

P and C charts

These are control charts for attributes. These charts can be used only if the characteristics of a product which is to be controlled is measured by method of attributes.

The products are not measured in numerical value. They are checked just using the GO and NO GO gauges.

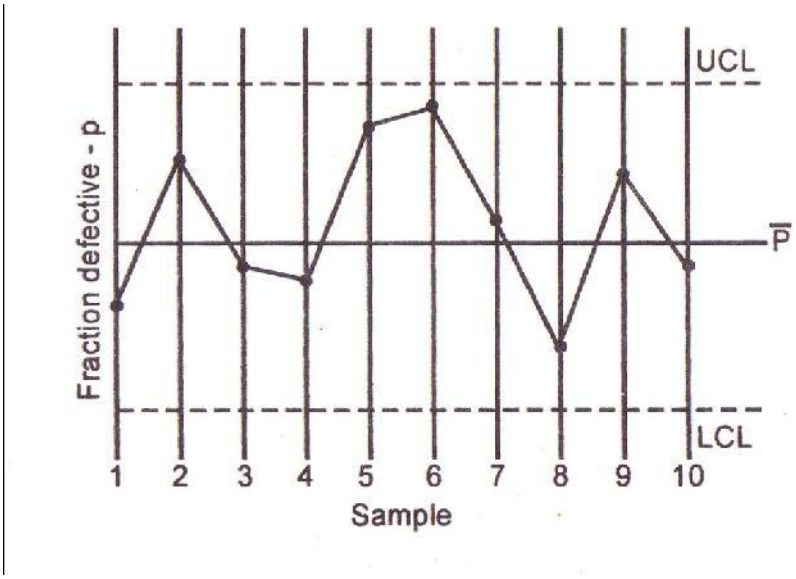
P Chart (Percent of fraction defective chart)

This chart helps to find out the variation in the process based in number of defective pieces found in the total number of pieces inspected.

This chart shows the number of defectives parts found in the given sample. The numbers of defective parts are marked as $\overline{P}$. It is called fraction defective or **percent defective.**

$$\overline{P} = \frac{\text{Total Number of defective parts}}{\text{Total parts inspected}}$$

For example: If 20 products are found to be defective in a sample of 200, thus $\bar{P} = 20/200 = 0.1$.



a) Control limits for P charts

The control limits are based on 3σ limits and expressed in the following equations.

$$UCL = \overline{P} + \sqrt{\frac{\overline{P}(1-\overline{P})}{n}}\ ; \qquad LCL = \overline{P} - \sqrt{\frac{\overline{P}(1-\overline{P})}{n}}$$

Where, $\overline{P}$ = fraction defective

= number of pieces in the sample

b) Construction of P Chart

Using the values of $\overline{P}$, UCL and LCL, the P chart is established a shown in fig 3.2.3 P value of each sample is calculated and plotted on P-Chart. This is done by taking samples periodically. While the process is going on, finally it is considered if the P value is with in control limits, and the process is within control.

C- Chart (Number of defects chart)

C-Chart is also a control chart for attributes just like P-Chart. In this chart, the numbers of defectives per unit are plotted. This chart can be used while inspecting the following.

1. Number of welding defects in a welded part
2. Number of pin holes in a tin sheet.

The following equation is used to calculate the number of defects per unit.

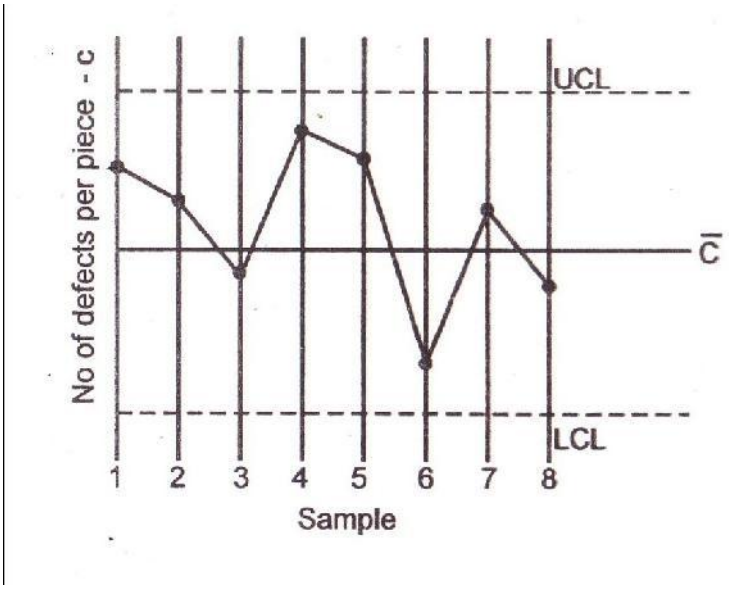
$$\overline{C} = \frac{\text{Total Number of defectives collected}}{\text{Total Number of units inspected}}$$

a) Control limits for C-Chart

The control limits are based on 3σ limits and calculated as below:

UCL = $\overline{C}+3\sqrt{\overline{C}}$; LCL = $\overline{C}-3\sqrt{\overline{C}}$

b) Control chart



Using the above values of C, UCL and LCL, C-chart is established as shown in fig. 3.2.4. C value of each sample is calculated and plotted a C-Chart. This is done by taking samples at the regular period of interval time while the process is going on.

Uses of control charts

- The control chart indicates whether the process is **"in control"** or **"out of control"**
- It defects variations in the process,
- It indicates trends in the process to take corrective action,
- It makes timely warning if there is any departure from specified tolerance limit.

Sampling Inspection

- Sampling Inspection is used for controlling the quality of product after production.
- In sampling inspection, samples are taken from the lot and inspected. If the sample is found to be ok the lot accepted.
- If the sample is found to be not ok the lot is rejected.

Need for sampling inspection

1. In mass production all the components could not inspected, so sampling inspection is used.
2. For destructive test sampling inspection method is used.
3. To avoid wastage of material sampling inspection method is used.
4. For quality conscious (supplied of raw material, spare, semi finished good) Sampling inspection is needed.
5. For quick inspection of product sampling inspection is done

Uses of sampling inspection

i. To decide the acceptability of incoming items to the factory.
ii. To decide the acceptability of outgoing items from the factory.
iii. To decide the acceptability of products from one department to another within the factory.
iv. To select the vendors who supply specified quality material for production.
v. For not more accuracy checking purpose.

vi. When other methods of inspection are costly sampling Inspection is used.

vii. Variety of products can be checked by using sampling inspection.

viii. Sampling inspection can be used where the quality is measured by instruments and gauges (Variables and attributes).

ix. For testing destructive test sampling inspection is used.

x. For quick inspection sampling inspection is used.

General concept of a sampling plan

1. Sampling Inspection is done from a lot.
2. Inspection is done by random.
3. Acceptance Number from lot is "C".
4. Lot size is "N".

Example: Check the components from lot (N) (500) and set the acceptance Number(C) (5). Check random 50 pieces. If the defects below 5 means total lot size is accepted, above 5 means total lot size is rejected.

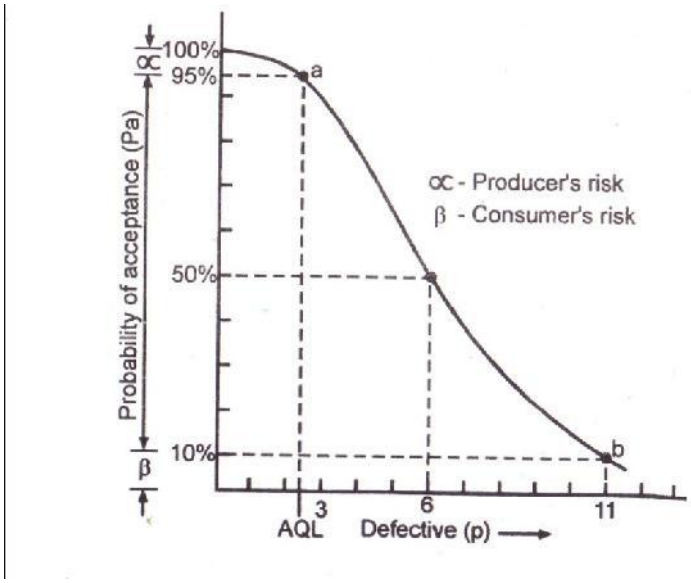
Risk in sampling plan

1. **Producer's risk(α)**
   - The lot may be good but the sample may not show it.
   - So good lot may be rejected.
   - This is producer's risk.

2. **Consumer's risk(β)**
   - The lot may be bad; but the sample may not show it.
   - So bad lot is may be accepted.
   - This is consumer's risk.

Operating Characteristics curve

α – Producer's risk
β - Customer's risk



Operating characteristics curve specifies how much producer's risk and consumer's risk will occur.

Interpretation of O.C. curve:

1. **Producer's risk(α) = 5%**
   i. Sampling plan will accept 95% of lots having 3% defectives
   ii. 95% of good lots will be accepted.
   iii. But there is possibility that 5% good lots can be rejected.
   iv. This is producer's risk.

2. **Consumer's risk(β) = 10%**
   i. Sampling plan will accept 10% of bad lots that are RQL.
   ii. Lots more than 11% defectives will be accepted.
   iii. This is consumer's risk.

3. **Accepted Quality level (AQL) = 3% defectives**
   i. This is shown by a point 'a' in the curve.
   ii. Lot at this level are of good quality.
   iii. The probability of acceptance is high.

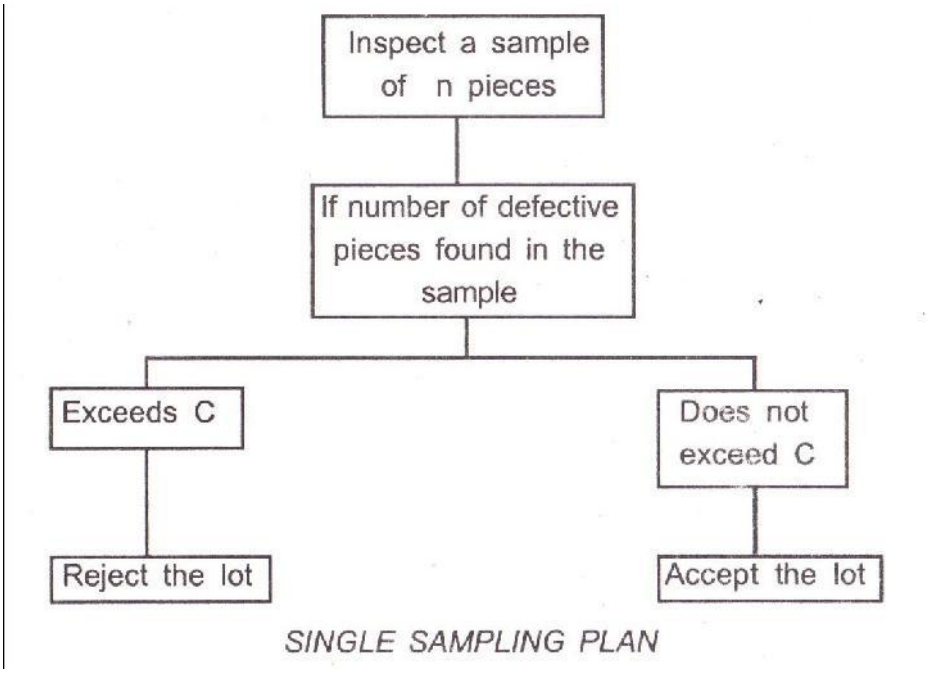
4. **Rejectable Quality Level (RQL) = 11% defectives**
   i. This is shown by a point 'b' in the curve.
   ii. Lot at this level are of poor quality having more defective pieces.
   iii. The probability of acceptance is less.

CLASSIFICATION OF SAMPLING PLAN

1. Single Sampling Plan
2. Double Sampling Plan
3. Multiple Sampling Plan

1. Single Sampling Plan

In this sampling plan, samples of 'n' pieces are taken from a lot of N pieces.



SINGLE SAMPLING PLAN

Where,

N - lot size

n – Sample

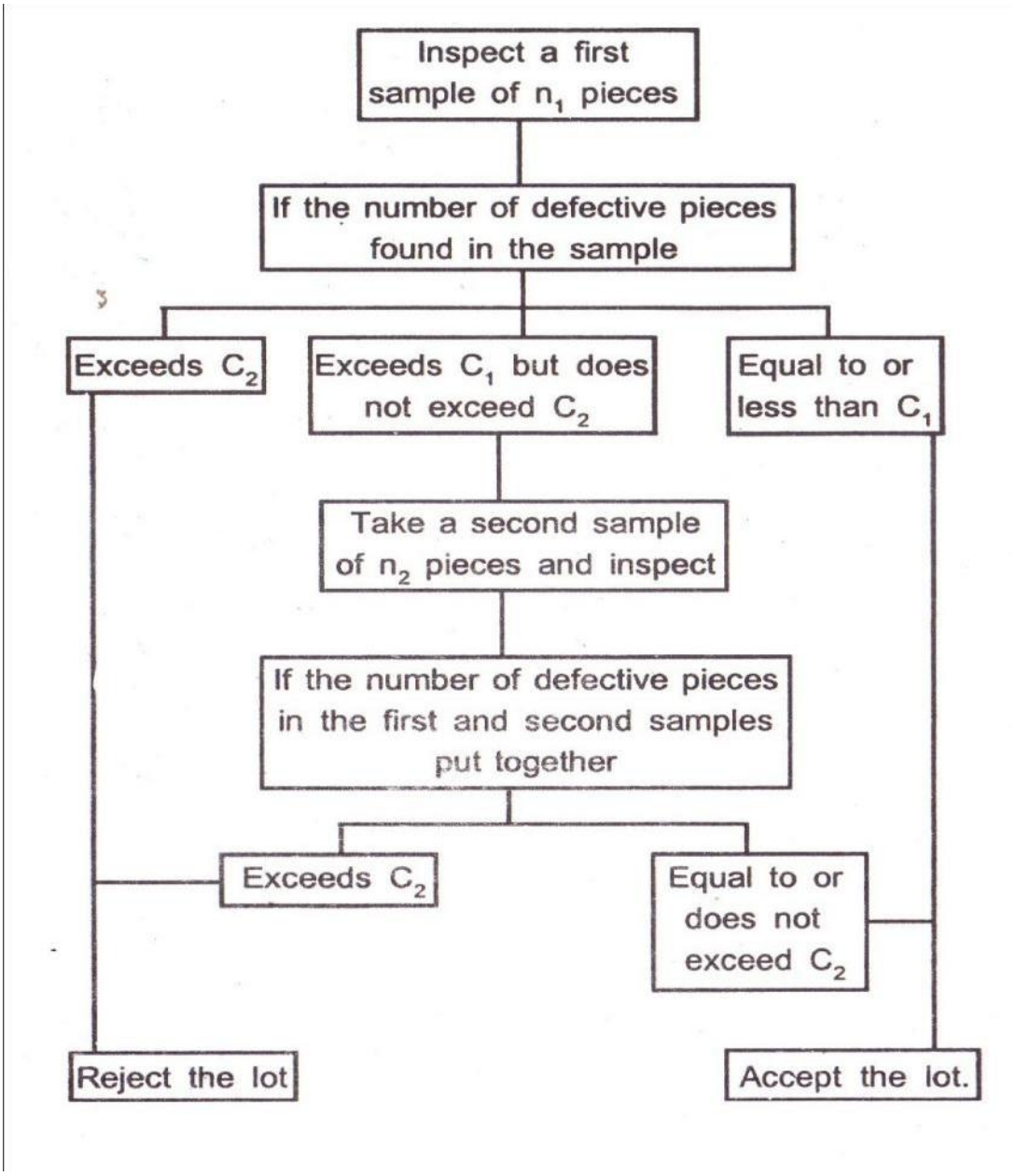
c - Acceptance Number

If this is less than (or) Equal to the 'c' the lot is accepted.

If the number of defective pieces is more than 'c' the lot is not accepted.

2. Double Sampling Plan

In this sampling plan, samples of 'n' pieces are taken from a lot of N pieces and double inspection will done.



Where,

n_1 – first sample size

n_2 - Second sample size

C_1 - Acceptance number for first sample

C_2 - Acceptance number for total (n_1+n_2)

Procedure

1. Take a sample of n_1 pieces and find out the number of defective pieces.
2. If the number of defective pieces is equal to (or) less than C_1 accept the lot
3. If the number of defective pieces is more than C_2 reject the lot
4. If the number of defective pieces is in between C_1 and C_2 take one more sample of n_2 pieces.
5. Find out the Number of defective pieces in the second sample.
6. If the total number of defective pieces in sample 1 and sample 2 is equal to (or) less than C_2 accept the lot.
7. If it is more than C_2 reject the lot.

Advantage of Sampling plan

i. Best suitable for destructive tests.
ii. Less damage to products.
iii. Cost of inspection is less.
iv. No inspection error.
v. To main quality of industry.
vi. Quicker and easy method.

CONCEPT OF ISO 9001:2008

ISO is International standards organization.

It is a quality certificate which is valid for 2-3 years.

ISO certificate is given under the Needs

i. Determining and satisfying customer needs.
ii. Preventing errors.
iii. Customers needs at low cost.
iv. Improved production process.

ISO auditors will inspect the organization and give the ISO Certification.

ISO 9000 is also applicable to service organization such as hospitals, banks, hotels, laboratories, transport, business shop, educational institute.

ISO 9001:2008 group of standards

ISO 9001: For quality assurance in Design, Development, Production, Installation and Servicing.

ISO 9002: For quality assurance in Production and Installation and Servicing.

ISO 9003: For quality assurance in final inspection and Test.

Quality management system registration/certificate procedure

ISO only the standard procedure which was accepted by all the international countries. In India BIS (**bureau of Indian standards**) was the only accepted quality certificate assured institute. At present BIS introduce ISO: 14000 it is equal to ISO: 9000.

ISO: 9000/ISO: 14000 standard quality receiving methods are:

1. **Management commitment**
   From higher level management only decide about the ISO: 9000 quality standards.
2. **Prepare the workmen for change (make sure about the workmen participation)**
   Need proper and enough training for workers for new method regarding quality
   It leads good contribution among the workers.
3. **Selection of appropriate model**

   In ISO: 9000-9003 there is various models are available.

   Among these models the company should select the model based on the requirements.
4. **Study the selected model**

   Completely study the new model based on the methods and steps.

   The mode of study will based on the well trained study man.
5. **Set up steering (co- coordinating) group and subgroups**

   For getting the quality standards workers is also the important concern.

   Workers may be divided into 2 to 4 peoples.

   These sub divided groups must follow the ten standard quality methods.
6. **Arrange training of leaders and coordinators**

   For ISO: 9000 training leaders and coordinators must be placed.

   During training period both of them should completely know about their responsibility.
7. **Prepare a check list**

   Check list should be prepared for all the department development and research purpose.

8. **Prepare corporate quality manual**

Create a complete document and manual for a selected model.

In that manual all the details about the quality should be mentioned.

9. **Prepare procedure,manuals,operation manual/work instructions**

The manual should be created in easy and understandable by all the workers.

Manual should be circulated to all the various departments.

10. **Update all the drawings and specification**.

Delete the unwanted drawing and specifications.
Alter the new drawings in effective manner.
Avoid the confusion work;

11. **Prepare schedule of training programme and educate employees.**

Create a schedule or timetable for the new quality method.

List out the engineer's name, details of work place, time period in the schedule.

12. **Provide tooling, equipments, facilities etc to meet standards**

List out the various jigs, fixtures, tools, devices for the method**.**

13. **Carry out internal audit**

Self audit must be done for before going to submit the documents, bonds etc.

Whether the work is done under the ISO-9000 standards.

14. **Take corrective action**

By self audit make the corrections immediately and change documents clearly.

15. **Apply for trail/external audit**

If need can be applied for BIS/external audit for good verification and suggestions.

16. **Implement recommendations**

By receiving external audit information's, they can be added in the audit check list and finally it will be entered.

17. **Apply for registration**

By the committee it has been send to the BIS quality standards.

By receiving the application by the BIS standards it has been clearly verified and checked by the BIS standards.

If any queries have been identified by the standards the concern company may be change the queries.

18. Grant of license

If the applied application is perfect means according to the standards it has granted to give the BIS/ISO standards immediately.

Benefits of ISO 9000 to organization

1) Products will be more uniform in quality.
2) Production will more efficient and hence production cost will be less.
3) Exporting marketing will be easy of brand.
4) Customers satisfication is more.
5) Improves company Sales ratio.

UNIT- IV

PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR

Management

To get work done through people is called management

Administration

It deals with finance and determination of goals and policies.

Organization

It is a process of of bringing together physical, financial and HR for achieving the goals.

MANAGEMENT THEORIES:

Tradition management

i. In – born quality
ii. As an art (trial and error)

Scientific management

i. By accurate
ii. Using techniques.

F.W. TAYLOR'S SCIENTIFIC MANAGEMENT:

i. F.W. Taylor is called as father of scientific management.
ii. In 1878 he joined as labours at Midvale steel company in USA
iii. Later in 1884 he become on chief engineer.

PROCEDURE TO SOLVE INDUSTRIAL PROBLEMS

1. Observation.
2. Measurement
3. Experiment comparison
4. Formulation of procedure.

MAIN FEATURES OF TAYLOR'S SCIENTIFIC MANAGEMENT

1. Science and not rule of thumb
2. Harmony and not discord
3. Maximum output and not restricted output
4. Specialization – mental work and physical work
5. Training and development of workers

Science and not rule of thumb.

a. Standardization of working condition
b. Standardization of working methods
    i. Method study
    ii. Motion study
c. Establishing standard of performance
    i. Breaking job in to element
    ii. Element time study
    iii. Rating factor.

Harmony and Not To Discord

Employer and employee should be unity and good understanding

Both of them should think same interest on goals.

Maximum Output and Not Restricted Output

Output should be maximum and by encouraging workers production will raise.

Introduce incentive wage scheme for maximum Output

Based on level of performance rating factor is fixed to work.

Specialization:

Separate mental activity (Design, plan)

Separate physical activity (production, fabrication)

Appointed the different (8 foreman like, gang boss, speed boss, repair boss, inspection boss, instruction card clerk, time and cost clerk, route clerk and disciplinarian.

Training and development of workers.

Proper training increases save in production time and wastage of material

Right person - Right job

Continuous development.

HENRY FAYOL'S PRINCIPLES OF MANAGEMENT:

1. Division of work
2. Authority and responsibility
3. Discipline
4. Unity of command
5. Unity of direction
6. Subordination of individual interest to general interest

7. Remuneration of personnel
8. Centralization
9. Scalar chain
10. Order
11. Equality
12. Stability of tenure of personnel
13. Initiative
14. Esprit-de- corps (sense of union)

1. **Division Of Work**
    a. Persons doing same work repeatedly become skilled in that activity.
    b. This increases the quality and quantity of output.

2. **Authority And Responsibility**
    a. Authority – power given to a person to get work from hid subordinates
    b. Responsibility – complete responsible for all the works.
    c. Authority without responsibility will not suitable for production.

3. **Discipline**
    a. Discipline is defined as respect for agreements by organization.
    b. Safety, proper uniform, time of work.(in time & out time)

4. **Unity Of Command**
    a. For any work employee must receive order from only one superior
    b. Proper commands from superior must be followed to avoid conflict.

5. **Unity Of Direction**

a. From top to bottom the activities should be unity towards goals.
b. Unity of command cannot function without unity of direction.

6. Subordination Of Individual Interest To General Interest

a. Every employee will work for his money and his personal needs.
b. Employee should give importance first to general interest that his individual interest.
c. The superiors should set example to others.

7. Remuneration Of Personnel

a. Remuneration is the payment for the service done by person.
b. Remuneration is the factor which normally affects the relationship between employees and employee.
c. Remuneration should be reasonable and satisfy both employer and employee

8. Centralization

a. Power should be given to one person.
b. If power given to all means the organization is decentralized.
c. Limited power should be delegated to sub- ordinates.

9. scalar chain (line of authority)

a. It means line of authority
b. Order must be sent from the top to lowest rank only.
c. Communication should be sent by flow chart method.

10. Order

a. Arrangement of materials and placement of men in industry

b. Material order – proper place of men availability of material
c. Human order – Requirement of men hours of work.

11.Equality

a. Treat are the employees equally in same category.
b. Manage should have tactics, good sense and experience to handle workers.

12.Stability Of Tenure Of Personnel

a. Workers may take time to learn and work efficiently
b. Management should create favorable conditions to workers like good salary, promotions, wage incentive ,welfare facility, opportunity

13.Initiative

a. Power of thinking and executing is called initiative.
b. All employees are come forward with new ideas and they must be encouraged by the superiors.

14. Espirt-De-Corps

a. It is a French word which means feeling unity among all workers in the organization.
b. Management should not follow the divide and rule policy.

FUNCTIONS OF A MANAGER:

1. Planning
2. Organizing and staffing:-

3. Directing
4. Co-coordinating
5. Controlling

PLANNING

It is defined as the process of forecasting future problems. Situations and events and selecting course of action.

1. Determination of objectives
2. Formulation of policies
3. Formulating the procedure
4. Programming
5. Evolving the methods.

1. **Determination Of Objectives:**
    a. Economic objective – selling more products and earning more profits.
    b. Social objective - producing good products with reasonable rates and benefits shared to employee, share holders, publics.

2. **Formulation Of Policies:**
    a. Policies are general guidelines for decision making .
    b. Policies are rule of action.

        Example: Decide no. of shifts, O.T to workers.

3. **Formulating The Procedure**:
    a. It is the sequence of step to be followed to complete activity
    b. Guidelines for every activity
    c. Line of order

4. **Evolving The Methods:**
    a. Method indicates how each step given in the procedure is performed.
    b. In this step each activity is explained in detail.

Example for the Functions of A manger:

Assume the personnel department is recruitment of diploma holders.

1. **Objective**

    Recruitment of 50 diploma holders in mechanical engineering within 3 month.

2. **Policy**

    Deciding source of recruitment by – newspaper, employment exchange, T.V add, posters.

3. **Procedure**

    Evolving different steps involved in recruitment –written test, oral test, IQ test medical test.

4. **Programming**

    Fix a time table for completing the above steps mentioned in procedure.

5. **Methods**
    a. Each step is described in details.
    b. Written test – what type questions, how it is to be evaluated.
    c.

ADVANTAGE OF PLANNING

1. Planning gives direction on objectives.
2. Planning focuses attention on each department focus on goals objectives.

3. Planning reduces uncertainty – elimination
4. Planning helps controlling
5. Planning helps in economical operation (Reduce wastage of man power machine hours, materials)
6. Planning helps to avoid bottle weeks
7. Planning helps to remain the from good name and more competitive.

DIRECTING

- Directing is issuing of instructions guiding and supervising the sub-ordinates.
- By directing the manager can makes the sub ordinates to understand this work clearly as per plan.
- Directing can perform at all levels of management.
- It is a continuous function for creating "Result- Production" technique.

FUNCTIONS OF DIRECTING

1. Communication
2. Proper motivation.
3. Good leadership.

1. COMMUNICATION

Passing information from one person to another.

Element of Communication:-

Sender – sending the message is called sender.

Receiver – who receives the message from the sender.

Communication channel – message passes through proper medium like notice board, circular, telephone, public address.

Symbols- by words, sketch, diagram, figure and action by sender.

DIRECTIONS OF COMMUNICATION:

i) Downward communication
ii) Upward communication
iii) Horizontal communication.

i) **Downward Communication**

Communication from higher level to lower level.

Orders, instructions, information, letters, circulars, etc.

ii) **Upward Communication**

Communication from lower level to higher level.

Reports, ideas, suggestions, proposal, opinion, complaint, appeals, grievance (problem)

iii) **Horizontal (Or) Lateral Communication**

Communication between the people at same level.

Consulting, information, discussions etc.

METHOD OF COMMUNICATION:

i) **Formal Communication**

Communication is passed through proper channel.

ii) **Written Communication**

Circular, leafier, poster, notice boards.

Iii) **Oral Communication**

Phones, by persons.

Informal Communication

Communication is passed through improper channel.

Rumors, grapevine (industry rumors).

Between employees rumors are passed fastly.

2. PROPER MOTIVATION:-

Creates the employee to do his work and goals by energy

Types of Motivation:-

i) Positive motivation.

ii) Negative motivation.

Positive Motivation

The following activities are considered for positive motivation. They are:

1. Credit of work. 2. Competition 3. Appraisal 4. Bonus. 5. Incentive 6. Promotion 7. Increment 8. Power 9. Allowance 10. Positive motivation is pull mechanism

Negative Motivation

- It is a pull mechanism
- Giving fear to the workers.
    - Loss of wages
    - Job security
    - Promotion delay
    - No allowance
    - Reduction in wages, allowances.

THREE DIMENSIONS OF MOTIVATIONS:-

a) Physical dimension
b) Social dimension
c) Ideological dimension.

a) **Physical Dimensions**

Relates to basic needs like food, cloth, shelter etc.

b) Social Dimensions:-

Relates social needs like status, job security, importance in job etc.

c) Ideological Dimensions:-

Relates to physic like achievement of mental satisfaction.

LEADERSHIP:

Leadership: Guiding the sub-ordinates by proper way to achieve the company goals.

TYPES OF LEADERSHIP:

- Authorization leadership.
- Democratic leadership.
- Free rein or Laissez fair leadership.

1. Authorization leadership:

- In this type of leadership the leader takes decisions by himself.
- Full authority is held by the leader..
- Subordinates should follow his directions without any questions.
- Negative motivation is used in this leadership.

Merits:

- Highest productivity.
- No disturbance in production.

De-merits:

- Employee morale is less.
- Absence of leader will affect production.
- Satisfaction is less.

Democratic leadership:

- In this type of leadership the leader takes the decision in consultation with subordinates.
- Decisions are taken after group decision.
- Subordinates participate in the decision making process.

Merits:

- Good team spirit will develop.
- Good morale.
- Labour turn over will be minimum.
- Absence of leader will not affect output.

De-merits:

- Productivity may not be high compared to authorization type.
- Decision making time is more.
- Not suitable for all production.
- Subordinates is lazy means controlling is difficult.

3. Free rein or laizzes fair type:

- In this type, complete freedom is given to the subordinates.
- They are allowed to take decisions by themselves.
- Leader does not take part in decision making process.
- Authority is completely decentralized.(Power is not in one hand.)

Merits:

- Complete freedom to workers and decision making is easy.
- High morale to subordinates.
- Suitable for sincere, educated and intelligent subordinates.

De-merits:

- Lack of discipline.
- Lowest productivity.
- No control and coordination.

CONTROLLING

Controlling: It means making difficult events to happen according to plan.

Functions of controlling:

- Establishing standards.
- Measuring actual performance.
- Comparing actual performance with standard and analyse deviations.
- Taking corrective action.
-

1. Establishing standards:

- **Quantity standard:**
    1. Volume of production.
    2. Sales volume.
- **Quality standard:**
    1. Dimension
    2. Surface finish.
    3. Life.
- **Cost standard:**

  Money spend and calculate for raw material, labour cost, advertisement charge, sales charge.
- **Time standard:**

  Setup standard time for completion of each work.

2. Measuring actual performance.

- After establishing the standards to be achieved actual performance is to be measured.
- Measurement can be done by personal observation.
- Eg: Dimension can be measured by random samples.

3. comparing actual with standard performance analyzing the deviations.

- Compare the actual measured performance with standards.
- Find out the major deviations.
- If there are deviations, reasons should be analyzed.

4. Corrective action:

- Once the reason for the deviation is found out action should be taken immediately.
- Corrective action should be taken immediately to avoid loss.

Types of controlling:

- Production control, Inventory control, Budgeting control, Cost control, Labor control, Quality control.

Modern management techniques:

- Just in time.
- Total quality management.
- Quality circle.
- Zero defect concepts.
- 5's concept.

JUST IN TIME.

Just in time is a new type of production management concept introduced in Japan.

- Motto of JIT is ":Produce only quantity which can be sold."

- Produce products required for the day only, which reduces wastages, improves quality, improves plant layout, improves balancing of machines.
- First step of JIT is to reduce the batch size as far as possible.
- In JIT concept the U-type layout is suitable.
- Group of machines is arranged in U- type layout each operator in the group knows about the all the machines.
- If there is any problem in any work centre all the operators are grouped and setback right the machine.
- In JIT inventory required is very low.
- The reduction in batch size improves quality and eliminates wastage.
- The defects if any is found out immediately in the next work cente. Corrective action is taken immediately.
- Hence the rejection and rework are very much reduced.

Advantages

- Inventory cost is very much reduced.
- Wastage is reduced.
- Rework is reduced.
- Improves plant layout.
- Reduced batch size.

"Total Quality management"

Total quality management is a process aimed at producing products as per the customer's expectation.

- It makes the total work will focus on only the quality systems.
- It is a process which involves the whole organization, every department, every activity, every single person at every level in the production of quality products.
- Main aim of TQM is to spend more time in helping to prevent errors rather than in inspecting and correcting errors.

MAIN RESPONSIBILITY FOR QUALITY:

1. **Design department:** Quality standards, drawing with size and tolerance.

2. **Purchase department:** Purchase quality raw material.

3. **Production department:** Produce products as per quality.

4. **Inspection department:** Inspect and send quality product to customer.
5. **Marketing department:** Receive complaints from the customer and rectify objects.

KEY FACTORS FOR THE SUCCESS OF TQM:

- Right first time – Right every time.
- For any variation in quality, the route cause may be found out.
- Use statistical process charts and control charts.
- Provide very clear work instruction cards to workmen.
- Don't fight with person – but fight for the issue.
- Make total employees towards involvement.
- Look for continuous improvement.

Quality circle:

- Quality circle is a concept invented in Japan in 1960's.
- Quality circle refers to a group of people from the same work area.
- They come together voluntarily to identify work area problems.
- They analyze these problems and find the solutions.
- QC normally consists of six to eight members. They meet once on a regular basis.
- They fix, time and place for their meeting.

STAGES IN QUALITY CIRCLE PROCESS:

1. **Problem collection:**
    - Various problems to be solved in work area are collected by the members.
2. **Problem selection:**
    - Priority (Importance) is fixed for each problem depending on the importance.

- It is decided by the quality circle.

3. **Problem analysis:**
    - Every member of circle participates in problem analysis.
    - Modern statistical technique used.
4. **Problem solution:**
    - After lot of discussion and suggestion arguments the optimum solution is found out.
5. **Management presentation:**
    - The members should present the solution to the management.
    - The benefits adopted by the circle are put forward.
    - The management accepts the proposal.
6. **Implementation, review and follow up:**
    - The circle member's prepare schedule for implement the proposal.
    - They also review the results obtained.
    - They also take the follow up action is required.

BENEFITS OF QUALITY CIRCLE:

- Gets self confidence.
- Gets job satisfaction.
- Leadership quality develops.
- Improved more communication skills.
- Working atmosphere is tension free3.
- Self development through training in problem solving.
- Knowledge sharing improves.
- Productivity is improved.

"Zero Defect" Concept in Management.

- Zero defect concept is a motivation and improvement programme developed in USA in 1961 by Phil Crosby.
- Zero defect concept main motto is a error free work performance.
- "Do it right at the first time".
- Zero defect concepts eliminate the lack of knowledge and lack of attention.

STEPS INVOLVED IN ZERO DEFECT PROGRAMME:

1. **Creating awareness:**
   - Employees should be made to accept a challenge to produce error free performance.
2. **Identification of causes of errors:**
   - Causes of errors are indentified.
   - Steps to taken for rectify.
3. **Inspection:**
   - Proper training is given for Inspection.
   - By inspection any deviation is found out immediately and rectification is done.
4. **Motivation.**
   - Workers must motivate the workers to achieve zero defect.

5S CONCEPT

5S: Seiri, seiton, seiso, seiketsu, shitsuke.

- The 5's concept is a practice in a house keeping technique.
- A well maintained work place results in a safer and more efficient operation.

S.NO	JAPANESE TERM	ENGLISH EQUIVALENT.	MEANING IN JAPANESE CONTEXT
1	SEIRI	Sorting out	Separating out all unnecessary things and remove.
2	SEITON	Systematic arrangement.	Arrange the essential things.
3	SEISO	Spic and span.	Clean the work place, machine, tools etc.
4	SEIKETSU	standardizing	Standardize the way of maintaining

			cleanliness.
5	SHITSUKE	Self discipline	Practice five 'S' daily make it a way of life.

BENEFITS OF 5S:

- People become disciplined.
- High employee morale.
- Shop floor becomes clean.
- More floor space.
- Good company image.

Management Information System (MIS)

- Management information system is a systematic cyclic pattern of communication.
- MIS provides information about the past, present and projected future activities.
  , happening inside and outside the organization.

First line manager. (Supervisor)

- Supervisor must get information about the performance of men, machine and material under his control on daily and weekly basis.
- He must know whether the material wastage is excessive or more re- work.

Middle level manager: (Work manager)

- Middle level manager are concerned with the curre3nt and future performance of their units.
- They need information concerning about their units.
- Production level, problem with supplier reduction in sales, demand, product details.

Top level manager (Management)

- They require various information to plan for the future.
- They need the following information from :-

1. External sources

- Economic condition, technological development, actions of competitors.

2. Internal Sources

- Financial status, sales and profit, stock value in market.

S no	SUPERVISOR RECEIVES DAILY REPORT.	WORK MANAGER WEEKLY REPORT.	TOP MANAGER RECEIVES MONTHLY.
1	Direct and indirect labour.	Financial status	Plants compare.
2	Material usage.	Cost analysis	Financial reviews.
3	Scrap	Product cost	Sales and profit
4	Rework	Demand	Performance analysis
5	Production quality	Product level	

SWOT ANALYSIS

It is an acronym for strengths, weaknesses, opportunities, and threats and is a structured planning method that evaluates those four elements of an organization, project or business venture,

A swot analysis can be carried out for a company, product, place, industry, or person. It involves specifying the objectives of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieve the objectives.

Internal Origin

(a) Strengths

(b) Weaknesses

External Origin

(a) Opportunities
(b) threats

Strengths: internal factors that are favorable for achieving your organizations objectives.

Weaknesses: internal factors that is unfavorable for achieving your organizations objective.

Opportunities: external factors that are favorable foe achieving your organizations objectives.

Threats: external factors that is unfavorable for achieving your organizations objectives.

Internal and external factors

Swot analysis aims to identify the key internal and external factors seen as important to achieving and objective.

Swot analysis groups keys pieces of information into two main categories.

(i) Internal factors- strength of weaknesses

(ii) External factors- opportunities and threats.

Analysis may view the internal factors as strengths or as weaknesses depending upon their effect on the organizations objectives.

What may represent strengths with respect to one objective may be weaknesses (diofactions, competition) for other objectives. The factors may include all of the 4 pc as well as personnel, finance, manufacturing capabilities and so on.

The external factors may includes macro economic matters, technological change, legislation, and socio cultural chares, as well as changes in the market place or in competitive position, in presented in form of a matrix.

Advantages of swot analysis:

1. Explore new solutions to problems.
2. Decide on direction that will be most effective.
3. Reveal possibilities and limitations for change.
4. Helps in setting of objectives for strategic planning.
5. Developing a product, branches or business idea.

APPLICATIONS:

Workshop sessions

Problem solving

Planning

Product evaluation

Competitor evaluation

Brainstorm meetings

Limitations to swot:

Need to go back and check the swot stays the same time consuming.

Difficult to identify the elements,

Validity can produce results that are bias.

Business process re- engineering (bpr):

ERP is a result of a modern enterprises concept of how the information system is to be configured to the challenging environments of new business opportunities.

ERP has to reengineer its processes in one form or the other. This process is known as business process re engineering (bpr).

Definition:

- BPR is the fundamental rethinking and radical redesign of processes to achieve dramatic improvement, in critical, cimtemporates measures of performance such as cost, quality, service and speed.
- Dramatic achieved means to achieve 80% or 90% reduction and not just 5%, 10%reduction.
- Radical redesign means BPR is reinventing and not enhancing or improving and not enhancing or improving.
- Fundamental rethinking means asking the question "why do you do what you do" by eliminating business process altogether if ti does not add any value to the customer.

OBJECTIVES OF BPR:

(i) Customer focus;

Customer's services oriented processes aiming to eliminate customer complaints.

(ii) **Flexibility:** adaptive process and structures to changing conditions and competition. Being closer to the customer the company; cum develop the awareness mechanism to rap idly spot the weak points and adapt to new requirement of the market.

(iii) **Quality:** obsession with the superior service and valve to the customers. The level of quality is always the same controlled and monitored by the processes.

(iv) **Innovation;** leadership thought imaginative change providing to organization competitive advantages.

(v) **Productivity:** improve drastically effectives and efficiency

Methodology of a BPR project implementation

All methodologies could be divided in general model stages.

The envision stage: the company reviews the existing strategy and business processes for improvement are targeted and it opportunities are identified.

The initiation stage: project teams are assigned. Performance goals, project planning and employee notification are set.

The diagnosis stage: documentation of processes and sub processes takes place in terms of process attributes.

The redesign stage: new process design is developed by devising process design alternatives and through brainstorming and creativity techniques

The reconstruction stage: management technique changes occur to ensure smooth migration to the new process responsibilities and human resources roles.

The evaluation stage: the new process is monitored to determine if goals are not and examine total quality programs

Advantages.

- Performance improvement
- Increase in profit
- Increase in productivity
- Better business practices
- Speed up business processes.

Disadvantages of bpr:

- Lower employee motivation
- High cost
- Risk for long term commitment.
- Enterprises resource planning (erp)

An enterprise resource e planning system is a fully integrated business management system covering functional areas of an enterprise like logistics'. Production, finance, accounting and human resources.

- Erp promises
- One database
- One application
- One user interface
- Evolution of erp
- Aggressive cost control initiatives.
- Need to analyze costs
- Flexibility to respond to changing business requirements.
- More informed management decision making.
- Changes in ways of doing business.

ERP CHARACTERISTICS

- **Flexibility:**
- An erp system should be flexible to respond to the changing needs of an enterprise. The client server technology enables ERP to run across various database back and through open data base connectivity.
- **Modular & open:** ERP system has to have open system architecture. This means that any module can be interfaced or detached whenever required without affecting the other modules.
- **Comprehensive:**
- It should be able to support variety of organizational functions and must be suitable for a wide range of business organizations.
- **Beyond the company:** It shows not be confined to the organizations boundaries, rather support the on line connectivity to the other business entities of the organization.

- **Best business practices:** it must have a collection of the best business process applicable worldwide. And ERP package imposes its own logic on a company's strategy, culture and organization.

Features of erp:

-ERP provides multi- platform, multi facility, multimode, manufacturing, multi-currency, multi-lingered facilities.

- IT supports strategic and business planning activities, operational planning and execution activities, creation of materials and resources.

- ERP covering all functional areas like manufacturing, selling and distribution, payables, receivables, inventory, accounts, human resources, purchases.

- ERP performs core activities and increases customer service.

- ERP performs core activites and increases customer service.

-ERP IS the solution for better project management

Benefit of Erp

- Reduce paper documents by providing on line formats for quickly entering and retrieving information.
- Improves timeliness of information by permitting posting daily instead of monthly.
- Greater accuracy of information with detailed content, better presentation, satisfactory for the auditors.
- Improved cost control.
- Better monitoring and quicker resolution of quires.

supply chain management (scm) :

a. Supply chain strategy (or) design.
b. Supply chain planning.
c. Supply chain operation.

a. Supply chain strategy (or) design:

i. In this phase a company decides the structure of supply chain for the next four (or) five years.
ii. Location and capabilities of production process, the ware housing facilities, the transportation methods at different stages.

b. Supply chain planning:

i. Planning has been done for every 3 months.
ii. In this planning, decision are taken about:-
- Which market to be supplied from which location.
- Sub contracting manufacturing.
- Inventory strategies.
- Forecasting and market promotion methods.

c. Supply chain operation:-

i. Already taken decisions are implemented.
ii. Incoming orders are handles in the best possible manner.
iii. Manufacturing schedules are followed.
iv. Dates are set and followed for delivery of final products to customer in the right time.
v. Proper transportation is arranged for delivery.

Benefits Of Supply Chain Management:

1. Correct information about the flow of product is transparent.
2. Sufficient inventory and hence products are readily available to customers.
3. Each stage is very much visible to both supplier and customer.
4. New product introduction becomes easier and the sales promotion also becomes effective.
5. Even for the products having short life cycle scm results in profitability.

Activity Based Management (ABM)

Activity based management (ABM) is a procedure that originated in the 1980s for analyzing the processes of a business to identify strong and weaknesses.

1. Operational ABM:

(i) Activity based management (ABM)
(ii) Evaluates the costs and values of process activities
(iii) To identify opportunities of improve efficiency.

ABM Model Components:

(i) Jit
(ii) Strategic planning
(iii) Activity accounting
(iv) Customer value analysis
(v) Target costing
(vi) Bench working
(vii) Continues improvement
(viii) Investment management

2. **Strategic ABM**
   Uses ABC informance to decide which products to develop and which activities to use.
   Uses ABC information to identity to indentify which customers are the most profitable and focuses move on them.
   Applications

   Organizations application of ABM.
   1. Budgeting and forecasting.
   2. Performance monitoring
   3. Process improvement.
   4. Controlling shared services.

      Benefits
      1. Improved customer value.
      2. Enhanced profitability.
      3. More efficient production.
      4. More accurate cost determination.
      5. More effective performance evaluation.

GLOBAL PERSPECTIVE- PRINCIPLES

A global perspective is when someone can think shouted a situation as it relates to the rest of the world. It may seems silly to some that every business should be concerned with what goes on in another country, but today we are connected in a lot of ways,

Monolingualism is one sign that a nation suffers from managers working in a global business world. It is not unusual for Germans, Italians to speak three of four languages. May be that is the reason of their best management. As wide knowledge of language is important for successful management.

There are three types of global attitude.

1. Ethnocentric attitude
2. Polycentric attitude
3. Geocentric attitude

	Ethnocentric	Polycentric	Geocentric
Orientation	Home country	Host country	World
advantages	Simpler structure	Extensive knowledge of foreign market	Forces understanding of global issues
	More tightly controlled	More support form host government	Balanced local & global objectives
		Committed lever managers with high morale	
Draw backs	More ineffective management	Duplication of work	Difficult to achieve
	Inflexibility	Reduced efficiency	Managers must have local and global knowledge.
	Social and political back loss.		

CHAPTER-II

PERSONAL MANAGEMENT

Responsibilities of Human Resources Manager (HR)

- To formulate, propose and get the acceptance for personal policies.
- To avoid the various departments manages about personal policies.
- To maintain an organization with the leadership and co-operation.
- To select right person for right job.
- To provide training to shaft and provide right placement.
- To measure the employee performance and deal with their promotion, transfer, punishment etc.
- To do job analysis, job evolution, fixing wage structure.
- To look for various welfare schemes for employees.
- To provide and maintain proper working conditions.
- To administrate incentive plans, profit sharing plan and bonus scheme
- To establish rational wage policy
- To maintain good contact with the trade union leaders.
- To improve industrial relations.
- To give secure co-operation from the trade union problems.
- To look periodical review of man power requirement.

Characteristics of Good Human Resources (Hr) Policy

- The policy should be stable
- It should satisfy the employee, employee and consumers.
- It should not contain ambiguities and uncertainties.
- It should guarantee permanent employee to competent employees.
- It should be flexible when the condition changes.
- Policy should be easily understood by all.
- It should lead to a fair wage agreement.
- It should provide good working conditions safety and medical benefits.
- It should organize and encourage the social work.
- It should be periodically reviewed.

- It should provide opportunity for employee to express their problems to management.
- It should lead to communicate between employer and employees.
- it should give security to employees
- it should give security to employees
- Policy's should be transparent.

Recruitment and selection process in industry

Recruitment

It is a process of searching prospective employee and making them to apply.

Source of Recruitment

- By promotion
- By transfer
- Friends and relatives of present employees
- By campus interview
- Though employment exchange
- Application from post
- Though labor unions

Selection Process

- Developing job description
- Receiving application forms
- Employment tests
- Interview
- Physical examination.

a) **Developing Job Description**:-

- It is a statement about the complete work to be done.

  The Details Are Followed:-
  - Job title and department
  - Work to be done by new employee
  - Job responsibilities

- Job knowledge
- Mental concentration needed
- m/c tools to be handle
- qualification and experience required
- working environment

b) Receiving Application Forms

- Form the received application from the following details are verified
  - Age, material status, education, experience
  - Eliminate the unsuited application forms.
  - Application form be made simple and easy to check

c) Employment Tests

1) Performance Test

- Also known as achievement test (or) trade test
- This test is conducted to find the physical ability of candidate.

  Example: a welder is asked to weld a job

2) Aptitude Test

- This test is used to find out the inborn quality of person.

  Example: mathematical problem, science question

3) Intelligence Test

- It deals with alertness, ability to learn, symbol, number, etc.
- Intelligence quotient (IQ) of candidate.

4) Dexterity Test

- This test is to find out the candidate cleverness' to work with hands and fingers.
  Example: fixing a wheel in vehicle

5) Personality Test

- Knowledge about behavior
- Originality
- Self confidence

- Patience
- Emotional stability

d) Interviewing

- It is a face to face test (or) conservation between employee and candidate
- Oldest method of human evaluation.

Interview Helps To Study Candidates

- Quickness in action
- personality
- emotional adjustment
- behavior
- adaptability

e) Physical Examination

- Family medical history
- Height, weight measurements
- Examination of joint, skin, eyes, nose, throat, teeth (ENT)
- X-ray tests
- Heart and blood pressure (BP)
- Urine and blood test

These tests are also to find out whether the candidates have any diseases.

Various types of inspection in industry.

Types of Inspection

1. Apprentice training
2. On the job training
3. Vestibule school training (training can be method)

1) **Apprentice Training**

- This training method used for job which require more trade knowledge and skill
- In this method training is given theatrical knowledge and practical skill
- Training period varies from 2 to 3 years.

- Normally, apprentice training is needed for machinist, printer, tool maker, patter designer, machine, carpenter, weavers, fitter, jeweler, die maker, electrician, turner, welder, engraver and molder.
- 16 to 18 years age of trainers and trained for 2-4 years. Apprentice agreement is made between trainee and employee about company terms and condition for training.
- Apprentice training given for IT, holders and diploma holders according to government rules.
- In apprentices training stipend money is paid to trines every month.
- In stipend money government will provide 50% of the amount to this scheme.
- After training is trainee is placed in the organization itself.

2) On The Job Training

- This is the most common and most widely used method of training
- In this method an employee is placed in a new job and told how it is may performed.
- This is done under proper watchful of master mechanic (OR) craftsman.
- Trainees are coached and instructed by skilled co-workers, supervisors and instructors.
- It is a process of learning and doing, (worker learns as well as produces)

  Merits

  - Trainee learns in the actual equipment and environment.
  - It is economical with less cost
  - Trainee learns the rules, regulation and procedure
  - Quickest training pried (2-3 weeks).

De Merits;-

- This is not properly supervised.
- Skilled worked cannot give quality training like a training instructor.
- Trainee is Not motivated Properly.
- Wastage of material is more.

3) Vestibule school training (Training centre method)

- This type of training is given outside the slop floor.
- Vestibule means “Entrance Hall.”
- A separate training centre is created for the Purpose of giving training to new workers.
- Machines and Tools are arranged in the training centre similar to the Production slop.
- New workers are given training by trained instructors, after completion of training the worker may placed in actual production slop.
- This training method avoids the disturbance may placed in actual production slop.
- This training method avoids the disturbance of Production.
- This training method also avoids the Fearness of New Employees.

Merits:-

- A large Number of trainees can be given training quickly and uniformly.
- It does not affect the Production line.
- Specially trained instructors give Effective training.
- Wastage of material and Rework is avoided.

Demerits:-

- It is a costly method.
- There is a duplication of m/c.
- Time of training period is more.
- Workers may confuse for demand.

Job Evaluation.

- Job Evaluation is a systematic Process of Evaluating different jobs in an organization.
- Job Evaluation determines the relative worth of jobs, depending upon their characteristics.
- Then the values are fixed to Each job.
- Based on these values, wage rates, and salaries are fixed to different jobs.
- Job Evaluation deals only with jobs not with persons.

Objectives of job Evaluation

- It decides the Relative value of different Jobs.
- It helps to fix correct wage structure.
- It helps to fix Equal payment for all the jobs of Equal value.
- Find outs the authority and Responsibility for Each job.
- It Reduces the labour turn over by Providing job satisfication to Employees.
- It provides a base base for Recruitment and selection.
- It Provides a propel review of wage structure.

Merit Rating

- Merit Rating Evaluates the Persons.
- Merit Rating determines how much an Employer meets the job Requirements.
- Merit Fating decides about the rewards to be given to an Employee.
- It is also known as performance appraisal.

Objectives of merit rating

1. **Employee Performance**
    - Employee is informed about his performance level.
    - It lads self improvement.
    - It leads self improvement.
2. **Employee development**
    - Merit Rating find outs the drawbacks of individual Employee.
    - It helps to increase the training level.
3. **Incentives:-**
    - It helps to grant merit incentives to Employees.
4. **Promotion and Transfers**
    - It serves as a reliable tool for giving transfer, Promotion and lay off.
5. **Available quality of work force**
    - Management to know the quality of the Employees in company.

Factors affecting the wage structure

1) Cost of living
2) Demand and supply
3) Ability to pay

4) Bargaining capacity of trade union.
5) Government Regulation.

1. **Cost of living:-**
    - Cost of living very much affects the wage structure.
    - Wage structure should be Reasorable to balance the cost of living.
2. **Demand and supply:-**
    - Demand and supply condition of labour, greafly affects the wage rates.
    - If demand of labor is high then the wage rate be high.
3. **Ability to pay:-**
    - It a company gets high profit then they will be able to pay the wage rate high.
    - Organization pays wage at the rate Equal to that paid by competitors (Other Company)
4. **Bargaining Capacity of trade Unions;-**
    - In some organizations, there will be strong unions.
    - The bargaining Power will be more and they can demand and get high wage rate will.
    - If the Union is Not strong then wage rate will be fixed low.
5. **Government Regulations;-**
    - Government will fix the Proper wage rate.
    - Payment of Bonus, Provident fund Etc.

Components of wage

1) Basic wage
2) Dearness allowance.
3) Bonus
4) Overtime Payment
5) Incentives.

1. **Basic wage**
    - It represents the money value Equivalent to the worth of job.
    - It does Not include any allowances.
    - For Every job of Employee, a scale pay is fixed.

Example: A scale of supervisior may be a 1500 – 50 – 2000.

This means during the first year is Rs. 1500/- and during second year Rs. 1500 + 50 = 1550/- and after 10 years it will be Rs 2000/-

2. **Dearness allowance (DA):-**
    - This allowance is given to compensate the increase in cast of living due to rise in Price of different commodities (Products).
    - For Government Employers DA is given by the Price Index Number (PIN).
    - Dearness allowance is fixed on the Percentage of Basic wage.
3. **Bonus:-**
    - Bonus is the Extra amount paid to the Employees form the profit of company
    - As per bonus act, the minimum bonus to be paid to Employee is 8.33 % of his yearly Earnings.
    - More the companies pay more than this minimum amount to 30%.
4. **Overtime Payment:-**
    - This is Extra wage Paid to workers above their Normal Working time.
    - Overtime wages will be double the Normal wages.
    - Overtime Payment is applicable only for workers Not for managers.

5. **Incentives:-**
    - Incentive is a reward given to; a worker for his efficiency and hard work.
    - It Encourages and motivates a worker to produce more and better products.
    - This reward is given with addition of his Normal wage.

Types of incentives:-

1. Direct Incentive. - given to individual
2. In direct Incentive - given to group of
3. Financial Incentive - given by payments
4. Non-financial Incentive. - Promotion, Job security, housing, medical incentive, training.

6. **<u>Other allowances:-</u>**
    - House Rent Allowances (HRA)
    - City compensatory Allowance (CCA)
    - Medical Allowance.
    - Conveyance Allowance.
    - Travelling allowance.
    - Hill Allowance.
    - Night shift allowance.
    - Risk allowance.

Principles of wage fixation

1) Difference in pay for different jobs should be based on job requirements.
2) The pay should be depending upon the job.
3) The wage level should be in line with same level Employees.
4) Equal Pay should be given for Equal job.
5) There should be a clear procedure for hearing the complaints about wage.
6) The trade union should be informed about the procedure using for fixing wage rate.
7) Wage rate should be reasonable for the standard of living.
8) The wage structure should be flexible.
9) For Revision of wages, a wage committee should be setup.
10) Wage structure should be simple and Easy understood by all.

Payment of wages by time rate system

- In this system the worker is paid wage for the time he spends on the work.
- Wages are paid at hourly, daily, weekly (or) monthly rate.
- If workers for 'N' hours and his wage rate is 'R' Per hour, then the worker will be Paid a wage of R*N.
- Here wages do not depend upon output.

Merits:

1) The method is simple and Easy for Calculating wages.
2) All workers are treated Equally.
3) Workers should Not Rush up to complete work.
4) It breakdown occurs total wages will lost.

Demerits:

1) Efficient workers are not paid any incentives.
2) Productivity is less because workers may not work hard.
3) More supervision is needed.
4) Rate of output will vary.
5) Overhead cost increases.

Payment of wages by Results:

- In this system of payment, the worker is paid proportional to his output.
- Workers will get a minimum guaranteed wage, irrespective of the output.
- The standard output is fixed.
- When the worker Produces more than the standard output, he will be paid additional wage and it is called incentive.

Merits:-

i. It Encourages all the workers to produce more.
ii. Productivity increases.
iii. Production cost is less.
iv. less supervision is required
v. Efficient workers are paid more.

Demerits:

i. Workers will Rush up work.
ii. Dead to more accident.
iii. Clerical work increases
iv. Material wastages more.
v. Workers strain is high.

Types of payment by Results:

i. Straight Piece rate system.
ii. Standard hours system.
iii. Halsey's 50% plan.
iv. Roman's plan.

v. Emerson's 66 2/3 Efficiency Plan

Methods of Payment by Result.

1) **Straight Piece Rate system:**
   - In this system the worker is paid at a certain Piece rate for the Number of Pieces Produced by him.
   - The worker is given a guaranteed minimum wage.
   - If the worker produces less than the standard output he will get the minimum wage.
   - If he produces more than the standard output he will get a wage with the number of Pieces Produced.

Example:

Let the standard output per day of 8 hours is 16 pieces. The guaranteed minimum wage is Rs. 24 the piece rate is Rs. 1.50/piece.

1. If a workers Produces less than 16 pieces (say 14) he will gets the guaranteed minimum wages of Rs. 24/-
2. If he produces more than 16 pieces, say 20,m he will get 20 * 1.50 = Rs 30/-.

Hasley's 50% plan

In this system, an hourly rate is guaranteed to the worker's. A standard time is fixed for performance of each job from the previsous record. Minimum wage is guranteed for each worker's. The worker's is paid at an agreed rate per hour for the time spent lus a fixed percentage (say 50%) of time saved by him.

Therefore the earning of worker's

$E = RxT + (S-T)R/2$

Rowan’s plan

In this plan also, the standard time (output standard) is fixed for each work from the past production records. Minimum wage is garunteed for each worker.

$$E=(RxT)+(\frac{S-T}{S})R.T$$

Emerson’s Efficiency plan:

In this system also,minimum wage is guaranteed. The efficiency of each workler is calculated as follows:

$$\text{Efficiency} = \frac{\text{standard hour}^{'}\text{sallowed for the work}}{\text{Acutal hours taken by the workers}}$$

CHAPTER-III

Organizational Behavior:

An organization is a consciously coordinates social unit, composed of two or more people that functions on a relatively continuous basis to achieve a common goal or set of goals.

Organization behavior is a field of study that investigates the impact that individuals, groups, and structure have on behavior within organization, for the purpose of applying such knowledge toward improving organizations effectiveness.

Principles of organization:-

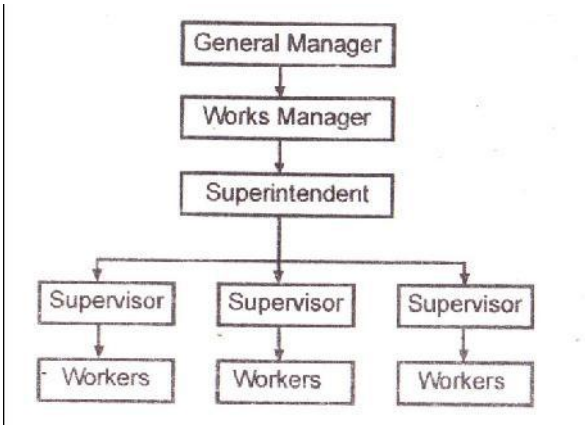
1. **Unity of objective**
   The objective of the organization should be clearly stated. The whole organization should work to achieve the basic objectives.
2. **Specialization or division of work**
   Single work should be allotted to each and every member of the organization. The activities are to be divided according to the different functions and the same assigned to persons according to their specialization.
3. **Scalar principle**
   The information or commands are to be passed in a clear line from the top to the bottom of the organization.
4. **Principle of authority**
   The manager can get the work from subordinates by his authority. So, authority of each manager should be clearly defined.
5. **Unity of command**
   Every employee should get command from one superior to ensure discipline to fix responsibility for results.
6. **Principle of responsibility**
   A supervisor should not avoid responsibility. The superior should be held responsible for the actions of his subordinates.

Types of organization

1. Line organization
2. Functional organization (Taylor's functional organization)
3. Line and staff organization
4. Committee organization

Line organization

In this type of organization, the authority flows directly from the General Manager to the workers. Authority flows downwards and responsibility moves upwards but directly in a straight line. It is also called "military, traditional, and hierarchical". Promotion of employee goes step by step upwards.



a) Advantages

- It is very simplest method
- Quick decision making
- There is unity of command
- There is unity of direction
- It is easy to maintain discipline among the people in the organization.

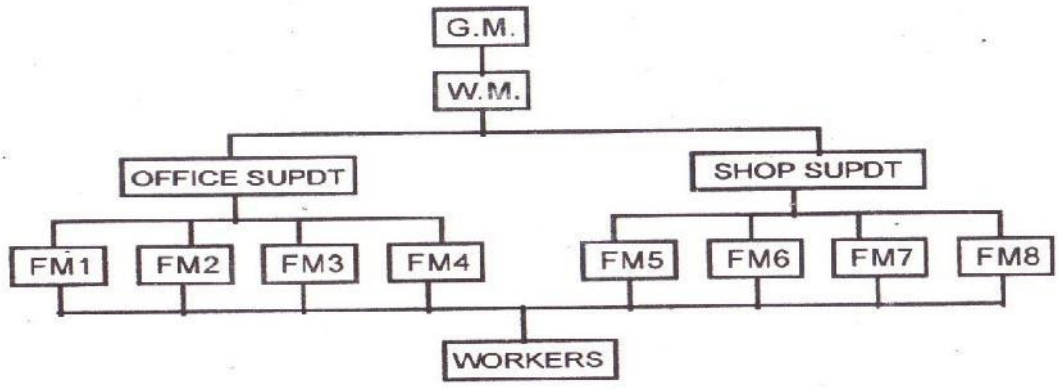
b) Disadvantages

- It is not suitable for larger industries
- Highly skilled supervisors are needed
- The efficiency of manager will not be uniform because of the overload.

Functional organization

This type of organization structure was developed by F.W. Taylor. It eliminates some of the advantages of the line organization. A foreman in a line organization has to perform has following works.

a) Preparing the job for workers
b) Supervising the operations in the machine
c) Maintenance of machines and equipments
d) Inspection of material and finished products.
e) Planning the work
f) Preparing and giving instruction to workers.
g) Recording various expenditure.
h) Time keeping of workers.



Block Diagram of Taylor's Functional Organization

Generally, it is very difficult to perform the above functions by a single foreman in the line organization. So, Taylor recommended having eight functional foremen instead of one foreman. He located the four persons in the shop floor and remaining four persons in the office. The eight functional foremen are named as follows:-

1. **Gang boss**
   His works are:
   - Preparation of material for loading into the machines
   - Arranging tools, jigs and fixtures

2. **Speed boss**
    - He checks whether proper cutting tools are used or not
    - He checks the speeds, feeds and depth of cuts of running machine.
3. **Repair boss**
    - Responsible for proper maintenance of tools, machines and other equipments.
4. **Inspection boss**
    - To inspect the quality of raw materials, work in process and finished goods.
5. **Route clerk**
    - He prepares route sheet for each job.
    - He determines the method of doing work.
6. **Instruction card clerk**
    - He prepares instruction to workers
    - He authorizes issue of materials.
7. **Time clerk and cost clerk**
    - He records the time spent by the workers in completion of jobs.
    - He takes steps to control costs.
8. **Disciplinarian**
    - He is responsible for maintaining discipline in the factory.
    - He notes and records the worker's late coming, absenteeism, leave, increments and promotions.

a) Advantages

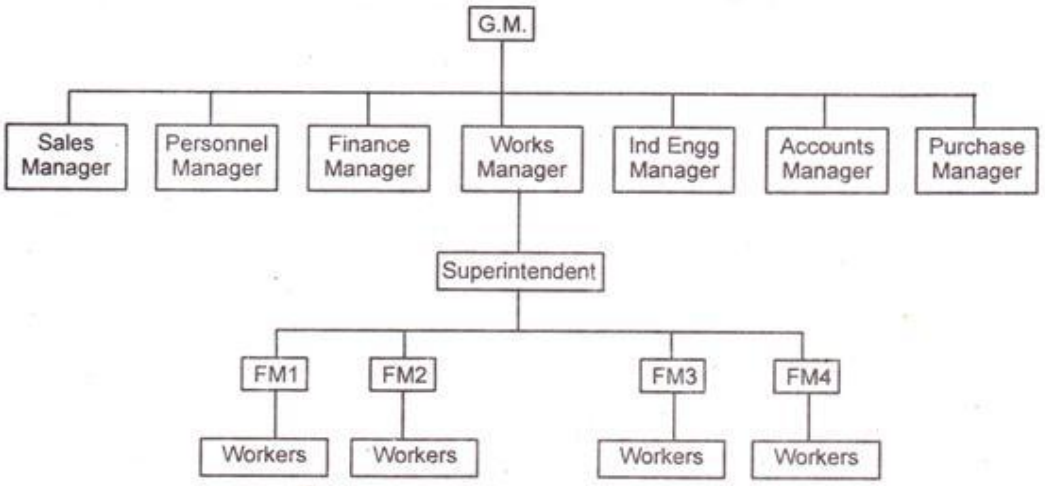
- The efficiency of workers will be high because of manual work and mental works are separated.
- Better cooperation among the workers.
- Principles of division of work.

b) Disadvantages

- Discipline maintenance is difficult
- Coordination between foremen is very difficult
- There may be a lack of coordination

Line and staff organization

Line function: In a manufacturing industry, all the activities carried out by the people who are directly engaged in production are called line function.



BLOCK DIAGRAM OF LINE AND STAFF ORGANIZATION

Staff function: All the activities carried out by the people who are not directly involved in production but help the production activity in one way or others are called staff function.

Line and staff type of organization integrates the advantages of both line type and functional type of organization.

a) Advantages

- There is specialization as in functional organization
- The structure is flexibility
- Discipline maintenance is easy
- There may be relief to line executives

b) Disadvantages

- There may be conflicts between line executives and staff executives.

- This is the costliest organization.

Committee organization

A committee is a group of experts. In Industry, the committee is formed to find solutions for a problem. These problems normally cannot be solved by ……

Committee members may be drawn from various departments.

Classifications of committee (types)

1) **Problem solving committee:** It collects the information and prepares the report.
2) **Manufacturing committee:** It consists of representatives of different departments.
3) **Works committee:** It helps to solve the day to day problem in the shop.
4) **Permanent committee:** It is formed to a complex organization with problems almost all times.
5) **Executive committee:** The essential work of this committee is to give suggestions for the management.

Organizational Approaches

This article throws light on the four important approaches to the study of organizational behavior, i.e.,

1. Human Resource Approach,
2. Contingency Approach,
3. Productivity Approach, and
4. System Approach.

1. **Human Resources Approach**

   This approach recognizes that human resources in an organization are the central force. Their development will contribute to the success of the organization. Human resources approach provides for the changes in the managerial role. It requires that the managers, instead of controlling the employees, should provide active support to them by treating them as part of the group.

   The superiors and managers should practice a style where workers are given the opportunities and encouragement to perform under loose supervision. By treating individuals as mature adults, organization can increase productivity and at the same time meet the needs of individuals for independence and growth.

2. **Contingency Approach**

   The approach stresses that there is no single way to manage effectively under all circumstances. The methods of behaviors which work effectively in one situation may fail in another. The organizational structure and the processes of management are governed by the external environment and several aspects of the internal environment.

   Effective management processes will vary in different situations depending on the individuals and groups in the organization, the nature of the job and technology, the environment facing the organization and its structure.

3. **Productivity Approach**

   Productivity means the numerical value of the ratio of output to input. Higher the value of this ratio, greater is the efficiency and effectiveness of the management. The traditional concept of productivity was concerned with economic inputs and output only. But nowadays human and social inputs and outputs are equally important.

   Productivity, a significant part of organizational behavior decisions, is recognized and discussed extensively. These decisions relate to human, social and economic issues. For example if better organizational behavior

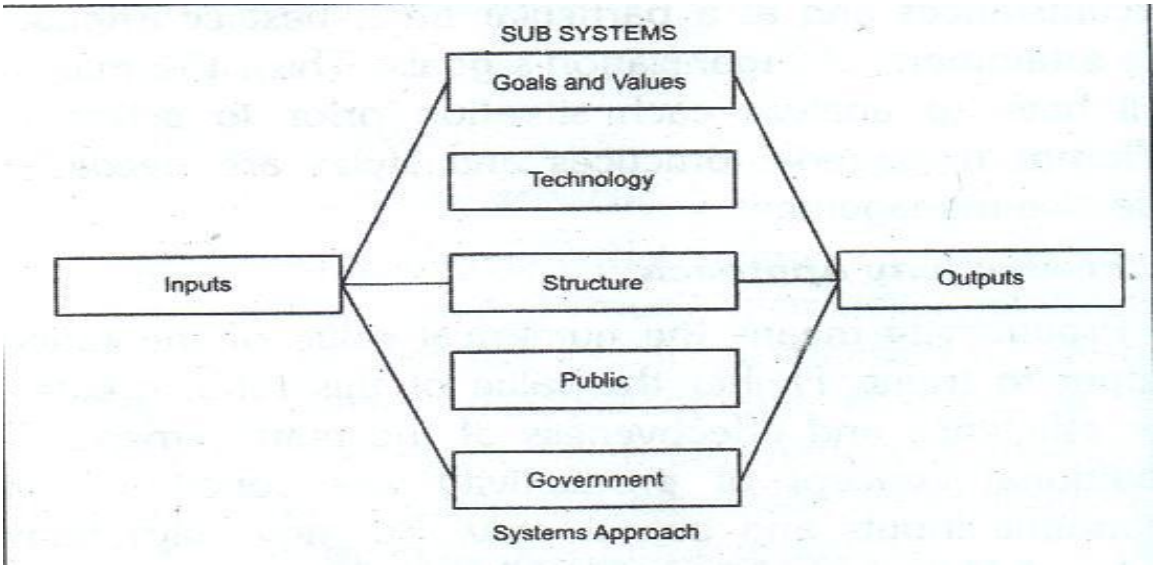
can reduce worker's turnover or the number of absentees, a human output or benefit occurs.

4. System Approach

The systems approach is of the view that an organization is a powerful system with several subsystems which are highly and closely interconnected. Any action taken to solve the problems in one subsystem will have its effect on the other subsystems as well; since all the parts of the organization are closely connected.

Thus, this approach gives the managers a way of looking at the organization as a whole, whole group, and the whole social system. Systems approach has become an integral part of modern organizational theory. Organizational are termed as complex systems comprising of interrelated and interlocking systems.

The following figure shows the relationship clearly:



BLOCK DIAGRAM OF ORGANIZATIONAL APPROACHES

The public and government have been included keeping in view the relationship between organization and external environment. The other subsystems are integral part of overall organizations.

Organizational approaches to cope stress

1. Improved selection and job placement
2. Training to manage stressful situation/crisis
3. Use of realistic goal setting
4. Redesigning the jobs
5. Employees involvement
6. Improved organizational communications
7. Offering employees sabbaticals
8. Establishing corporate wellness programs – programs that focus on employee's physicals and mental conditions.

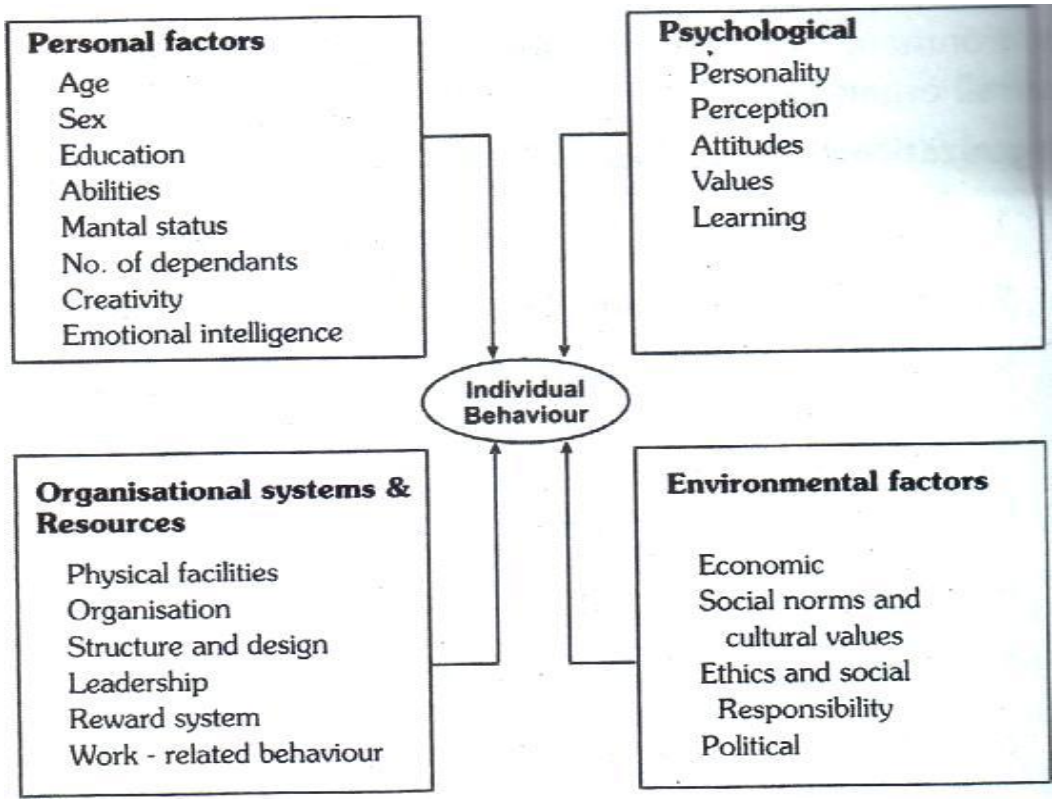
Individual behavior

Individual behavior means some concrete action by a person.

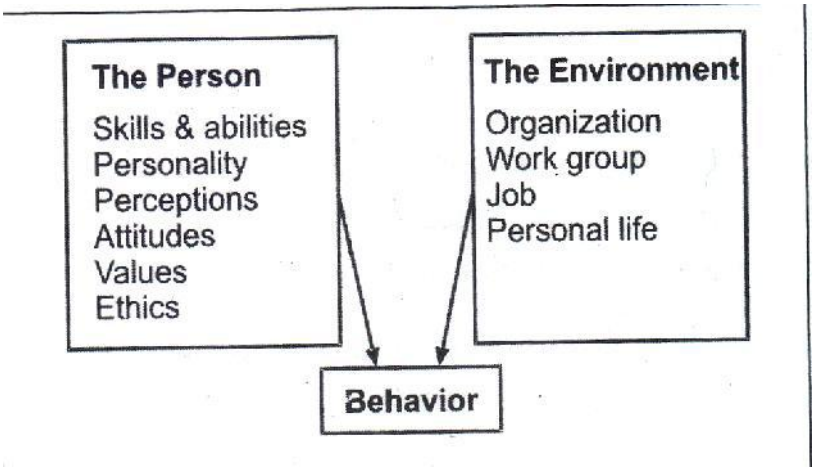
The behavior of an individual is influenced by various factors, some of the factors lie within himself like his instincts, personality traits, internal feelings etc.

While some lie outside him comprising the external environment of which he is part.

Foundations of individual Behavior



Variable influencing individual behavior



BLOCK DIAGRAM OF Variable influencing individual behavior

Causes of individual behavior

Characteristics

1. Inherited Characteristics; 2. Learned characteristics

Inherited Characteristics are passed on in the chromosomes inherited from your parents.

Eye color	Curly or straight hair
Ear shape	Dimples
Skin color	Freckles
Height	Nose shape
Hair color	Fur color
Beak shape	Shape of needless or leaves
Shape of teeth	Stripes or spots

Each chromosome contains genes that code for characteristics such as eye colour, hair type and height.

Reading a book	Cooking
Playing an instrument	Tiger sensing up on prey
Cats using a little box	an aquarium for food
Dogs sitting on command	speaking a language
Writing	Eating with fork
Style of hair	

Environmental effect

Change and complexity

Environmental change occurs in two ways:

- Degree to which change in environment is occurring
- Degree of homogeneity or complexity of the environment
- The environment is either simple or complex.

Uncertainty

A driving force that influences organizational decisions

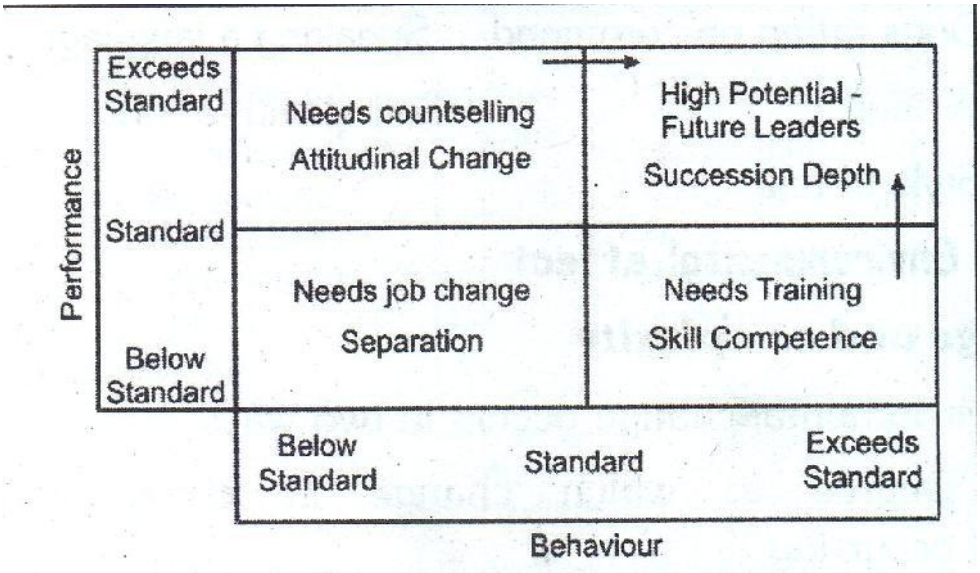
Affects predictability and ability to forecast events

Stable or dynamic

Behavior and Performance

Behavior is the range of actions and mannerisms made by individuals, organisms, systems, or artificial entities in conjunction with themselves or their environment, which includes the other system or organisms around as well as the (inanimate) physical environment. It is the response of the system or organism to various stimuli or inputs, whether internal or external, conscious or subconscious, overt or covert, and voluntary or involuntary.

A **performance,** in the performing arts, generally comprises an event in which a performer or group of performers present one or more works of art to an audience. Usually the performers participate in rehearsals beforehand. Afterwards audience members often applaud.



Perception

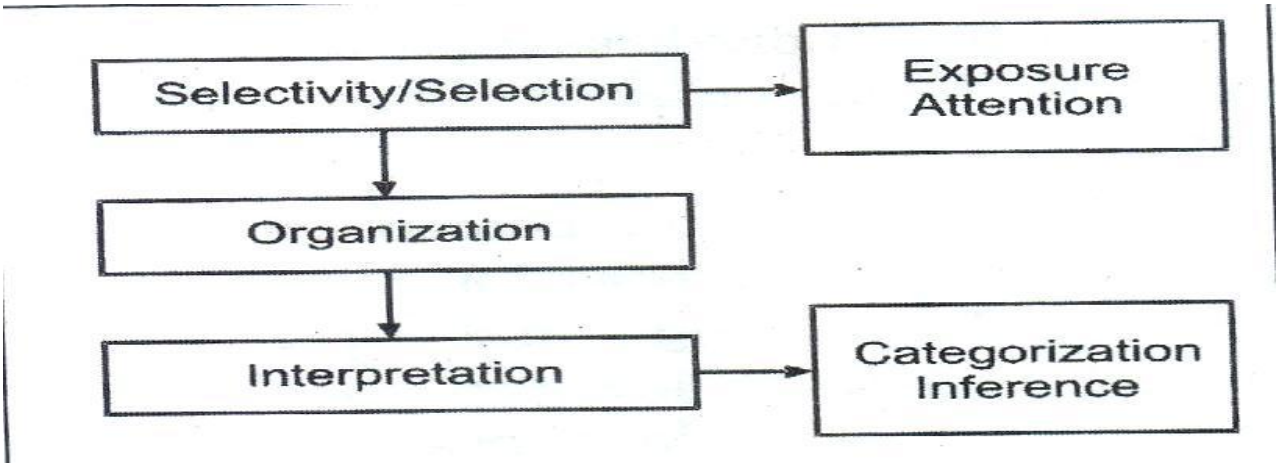
A process by which individuals organize and interpret their sensory impressions in order to give meaning to their environment.

Perception (from the Latin perception, percipio) is the process of attaining awareness or understanding of the environment by organizing and interpreting sensory information. All perception involves signals in the nervous system, which in turn result from physical stimulation of the sense organs. For example, vision involves light striking the retinas of the eyes, smell is mediated by odor molecules and hearing involves pressure waves. Perception is not the passive receipt of these signals, but can be shaped by learning, memory and expectation. Perception involves these “top-down” effects as well as the “bottom-up” process of processing sensory input. Perception depends on complex functions of the nervous system, but subjectively seems mostly effortless because this processing happens outside conscious awareness.

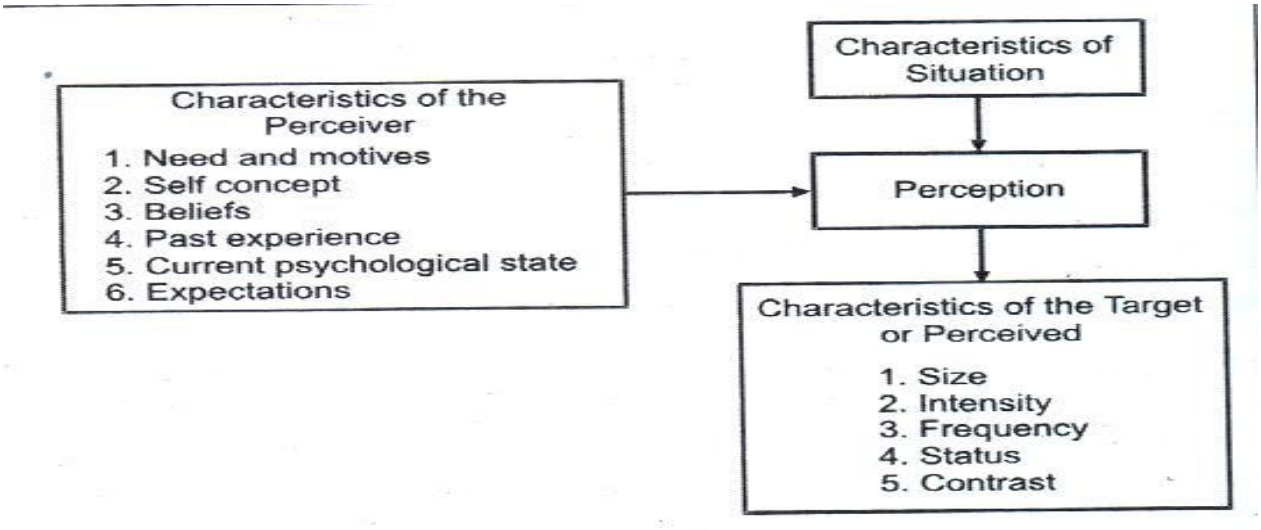
Nature of perception

1. Intellectual process
2. Cognitive or Psychological process
3. Subjective process
4. Socially co-created
5. Culturally influenced
6. Self-fulfilling.

Process of perception



Factors influencing perception



Organizational implications

Organizational implications:-

Behavior of individuals is caused, and follows a pattern, because of this, behavior is unpredictable. Study of behavior is however, rewarding and necessary for management. It is doubtful whether the manager can perform his tasks satisfactorily without developing a fair degree of understanding of the people around him.

Any attempt to learn why people behave as they do in organizations requires some understanding of individual differences. Managers spend considerable time making judgments about the fit between individuals, job tasks and from these approaches it can be concluded that there is an overwhelming consensus that the, environment has a much greater effect than it is believed. It means that large areas of human behavior are modifiable.

Organizational design, training and development can have a profound impact on the behavior of the members of an organization.

Implications of Organizational Development

For Individuals

- Most individuals believe in their personal growth.
- Majority of the people are desirous of making greater contributions to the organizations they are serving.

For organization

a) Create learning organization culture.
b) Adopt win-win strategy for sustained growth.
c) Create cooperative dynamics rather than competitive organizational dynamics in the organization.

Organizational Implications

Organization types are incompatible

- Different use of offices
- Different compensation models
- Different incentive models
- Leads to problems with employees, worker’s council, HR.

Best solution

- Different Legal Entities
- Offices in different parts of the city
- But additional overhead for later re-integration

Unit –V

FINANCIAL MANAGEMENT

Financial Management

Money is lifeblood of any commercial of industrial organization. Money is needed for starting the industry and running it. Making the money available and using it is called finance. The finance may be defined as the study of money-its nature, creation, behavior, regulation and problems.

In olden days, scale of manufacturing operation was very small. The manufacturing activity is labor oriented. So finance was not an important factor in a manufacturing activity. But nowadays industries operate on a large scale. Manufacturing is done using advanced technology. This needs a huge amount of money. So the need for finance is too great now.

Financial management may be defined as that part of management which is mainly concerned with

i. Raising funds in the most economic manner
ii. Using their funds as profitably,
iii. Planning future operation
iv. Controlling current performance and future development.

So the main functions of finance manager are

i. Determining the capital requirement
ii. Selecting the sources of capital and raising the capital
iii. Effectively using the capital and protecting the capital.
iv. Managing the earnings.

Determination of capital needs

It is very important for any factory to make correct estimate of capital requirements. If the capital requirement neither is nor determined properly, it will produce problems in smooth functioning of business.

There are two methods of finding the total capital needed

A. Classification bases on the nature of assets

1. Estimating method 2. Comparison method.

1. Estimating method

In this method an estimate is made on the various costs such as cost of land and building, plant and machinery, fixed and current assets. Besides this, intangible assets such as promotion expenses, organization expenses and patent expenses etc are also considered in the above estimates.

Merits

1. It is more accurate
2. Details of each expenditure are available
3. It helps in better financial control
4. Estimation may be more reliable.

Demerits

1. It is time consuming and also costlier
2. Proper skill of estimation is required.
3. Readymade data may not be available

2) Comparison method:

In this method, an attempt is made to find a number of concerns similar in size and condition to the proposed company.

Merits

1. It is quick and also cheap
2. No skill is required in calculating the capital requirements.

Demerits

1. Data supplied may be wrong or may not be relevant.
2. It may lead to wrong calculation.
3. Computation of working capital requirements may be different.

The requirements of capital for various activities are as below.

- Expenses for promotion

When a new concern is started, it requires money for promotion. This includes expenses for

i. Discovering business idea, product and developing it.
ii. Registration of the concern
iii. Establishment of the organization.
iv. Commencement of business etc.

- Cost of fixed assets

  This is the amount required for purchasing fixed assess like land and building, plant and machinery, furniture and fixture etc.

- Cost of current assets

  This is the amount required for raw materials, wages, credit sales, electricity charges and other day to day expenses.

- Cost of getting capital

  A company incurs a huge expenditure for raising the capital. These include advertisement, brokerage, commission etc.

- Cost of development

  In the initial stage, a business may need funds to meet its losses. In later stage, it needs funds for growth and development.

Types of capital required

The total capital required for a company for various purposes may be classifies as below.

Classification based on the nature of assets in which funds are invested

1. Fixed capital

It represents the amount of capital invested in fixed assets. It is a long term investment. It cannot be withdrawn during the life time of the company.

2. Working capital

It represents the amount of capital invested in the current assets. It is a short term investment. The capital requirement changes from time to time.

3. Capital for procuring intangible assets

Sometimes, a company is required to purchase intangible assets like goodwill, patents, trade mark etc. Funds are required for this. This may be long term of short term requirement.

B. Classification bases n period for which investment is made

1. Long term capital

It is the investment required for a longer period (20-25 years). The capital required for fixed assets comes under this category.

2. Short term capital

This type of capital is required for a short period (6 months to 2 years). This is for having current assets.

3. Medium term capital

If the investment required is for a period of more than 2 years and less than 10 years, it is termed as medium term capital. This is required for development scheme; modernization scheme and advertisement campaign and for part of working capital needs.

Fixed capital

Fixed capital is the capital which is invested in the fixed assets of the company. Fixed assets are land and building, plant and machinery, office and factory equipments, furniture and fixtures etc These assets are retained permanently in business.

Fixed capital is needed for the following purposes

- Purchase of fixed assets
- Replacement and renovation of old fixed assets.
- Diversification, expansion and growth.
- Modernization, research and development.
- Permanent and regular working capital.

Factor which determine the amount of fixed capital

The total amount of fixed capital required varies from company to company. It depends on the following factors.

1. Nature of business

This is the main factor which influences fixed capital requirement. Manufacturing companies require huge fixed capital whereas commercial and trading companies require lesser fixed capital.

2. Scale of operation

For the same type of business, a large scale factory requires larger fixed capital than small scale factories.

3. Technique of production

For the same production output of the same product, two different industries using different production technique may require different fixed capital. If an industry uses labor intensive technique, it requires less fixed capital and if an industry uses modern technique, it may require higher fixed capital.

Sources of finance for fixed capital

1. Issue of shares
2. Issue of debentures
3. Public deposits
4. Long term loans from financial institutions
5. Accumulated earnings.

Working capital

This is the capital invested for raw material and to meet day to day expenditure like wages, rent, electricity charges, etc. Working capital is used as a short term capital. Working capital is also known as current capital.

Working capital keeps on changing its form. Money becomes raw material, raw material becomes semi finished product, semi finished product becomes finished product. At every stage, some value is added to the material. Finished product becomes money or amount receivable.

Types of working capital

1. Permanent of fixed working capital

Sometimes, irreducible minimum amount is required permanently to run the factory. This is called permanent working capital. This is just like fixed capital. So this amount has to be obtained through long term sources.

2. Temporary of variable working capital

In general, some portion of working capital requirement will vary from time to time depends upon the condition. This is called temporary working capital.

Factors which determine the working capital requirement

The requirement of working capital depends upon the number of factors described below.

a. Length of period of manufacture

A factory manufacturing a product requiring a long period of manufacture will need large amount of working capital. Because more capital will be locked up as semi finished product.

b. Nature of the business

There are some businesses like trading companies require little fixed capital and large amount of working capital. Similarly, a labor oriented business will require more working capital.

c. Size of business

A small scale industry will require only lesser working capital than large scale industry.

d. Seasonal variation

Some raw materials will be available only for few months in a year. So the industries using such type of raw material will need large amount of working capital at that time only. Ex. Sugar factories. Some products will have high demand only in some months on the year. These products are produced and stocked in the remaining months. So here also more working capital is required Ex. Woolen products, air conditioners etc.

e. Policy of buying and selling

The organizations purchase raw material by giving cash and sell the finished product for credit. It needs more working capital. The organizations purchase raw material on credit and sell the finished product on cash. It needs lesser working capital.

f. Labor and Raw material

Labor intensive industries need higher working capital; Industries using costly raw material will need larger working capital.

Sources of finance for working capital

1. For permanent working capital

i. Shares
ii. Debentures
iii. Retained carryings

2. For variable working capital

i. Bank loans
ii. Public deposits
iii. Borrowing from promoters, directors, publics etc

RESOURCES OF CAPITAL

For starting and running an industry money is needed. This money is the main source of production from which the product are manufactured. This money may be invested by a single person. This is sole proprietorship. In order cases the money may be invested by a a number of people who start the industry with partnership deeds. In some other cases, the money may be but up by the means of shares, debentures or loans. The different sources of finance available are,

1. Shares
2. Debentures
3. Public deposits
4. Loans from banks and financial institutions
5. Retained earnings
6. Development corporations.

Issue of shares:

The company invites members of the public through the public through the prospectus to buy shares. Those who purchase shares of the company, become a part owner of the company.

Issue of debentures:

The finance required by the company is obtained as loan. The total loan to be raised is divided into many equal portions. Each portion is known as debenture. Like shares, the debentures are offered to the public by means of a prospectus.

Public Deposits:

It consists of acceptance of deposits by a company directly from the members of public for periods varying from six months to several years. In the case of public deposits no legal formalities are required. Collection of deposits may be done in consultation with the Reserve Bank of India (RBI).

Commercial Banks:

Only short term requirements of the business concerns are met by these banks

A. by granting advances, loans, overdraft and cash credit and

B. by discounting bills.

The usual method of lending by bank is granting cash credit. A cash credit permits the borrower to withdraw from the bank up to a stipulated amount. The banks grant cash credit on the execution of promissory notes with tow “signatures or the pledge of stock of raw materials of hypothecation”.

SHARES

Shares represent company’s own capital which is divided into a large number of equal portions. Each shareholder being entitled to a portion of the industry’s profits, corresponding to the number of shares he holds. For example the capital of a company be 5 cores. This can be divided into 5,00,000 parts of Rs 100 each. Each part is known as a share.

Types of shares:

1. Preference shares.
2. Equity shares.

Preference shares:

Preference shares are those, which have preference in respect of A. payment of dividend and B. return of capital in the event of winding up of the company. Out of the profits of the company, the preference shareholders are paid dividends first to a fixed rate.

Preference shares may be ‘cumulative’ or ‘non-cumulative’.

Cumulative preference shares: If no dividend is paid in a certain year due to inadequate profit, they can claim the same in the subsequent years.

Non-cumulative preference shares: Due to inadequacy of profits, no dividend is paid in a particular year; dividends for such year will not be paid in future at all.

Preference shares may be convertible or non-convertible.

In the preference shareholders are given a right to convert their shares into equity shares within certain fixed period, those shares are known as conversable preference shares.

If such a right of conversion is not given, they will be known as non-convertible preference shares.

If a company issues shares, which are returnable after sometime is known as redeemable preference shares. Those which are not redeemed and it is known as irredeemable preference shares.

Merits of preference shares:

1. Provides a fixed rate of return.
2. Provides safety to investment.
3. It is a cheaper source of funds as the dividend paid is lower.

Demerits of preference shares:

1. Rates of dividend paid are higher.

2. Cumulative preference shares are a permanent burden to the company.
3. Large number of preference shares, reduces the credit worthiness of the company..

Equity shares:

Equity shares also called as ordinary shares. Shares which are not preference shares are called equity shares. The equity shareholders get dividend after the payment of dividend to the preference shareholders. The rate of dividend payable on equity shares vary from year to year depending upon the amount of profits and the intention of the board of directors. In the event of the winding up of the company, capital is returned to them only after return of capital to the preference shareholders and after payment of all other claims such as debentures etc.,

Equity shareholders occupy primary position in the company posses voting right. They are responsible for formulating policies of the company. These share holders will earn good dividends when the company is prospering. But at the same time they run the risk of getting nothing when the company is facing depression. Thus they undertake risk.

Merits of equity shares:

1. Provides permanent capital to the company.
2. Not a permanent burden to the company.
3. Equity shares increase the borrowing capacity of the company.

Demerits of equity shares:

1. It dilutes the voting powers.
2. It reduces earning (dividends) per share.
3. It is very risky for investors.
4. It reduces the scope for ‘trading on equity’.

DEBENTURES:

The money received by the company must be recorded and acknowledged. The document which the lender receives from the company is called a **debenture**.

Debentures holders do not have any right to vote. Debenture holders are not the owners of the company. There are only creditors.

TYPES OF DEBENTURES:

1. **Registered and bearer debentures:**
    - The names and address of the debenture holders are registered in the company.
    - There is no record maintained in the company.
    - The bearer of the debenture becomes its owner.
    - It is transferable.
2. **Secured and unsecured debenture:**
    - Secured debentures are mortgaged against the assets of the company.
    - Unsecured debentures are not secured by any mortgage on the assets of the company
3. **Redeemable and irredeemable debentures:**
    - Redeemable debentures will be end at the end of a certain specific period.
    - Irredeemable debentures need not **to be repaid** by the company
4. **Convertible and non convertible debentures:**
    - Convertible debentures can be **converted into** equity shares of the company at end of a specified period.
    - Non-convertible debentures cannot be converted into equity shares.

MERITS AND DEMERITS OF DEBENTURES:

Merits:

- The rate of interest is **more than** the dividend.
- The interest paid to debentures is considered as company expenditure.
- Debentures provide financial flexibility. They can be returned at any time at the opinion of the company.

Demerits:

- Debentures reduce the borrowing power of the company.
- Interest has to be paid whether profit is earned or not.

Comparison of preference shares and equity shares:

S.No.	Preference shares	Equity shares
1	Money is not refunded to share holders	Money is not refunded to the share holder
2	Fixed rate of dividend is given to share holders.	Fixed rate of dividend is not given to the share holder.
3	Long period finance	Long period finance
4	These share holders cannot control the company.	These share holders become owner of the company

Comparison of share holder and debenture holder:

S.No	Share holders	Debenture holders
1	Owner of the company.	Creditor of the company.
2	Fixed cost.	Fixed cost.
3	No dividend unless the company earns a profit.	Can receive interest irrespective of the profit earned
4	Share holders having the right to vote.	Debenture holders are not having the right to vote.

PUBLIC DEPOSITS:

- The company may raise the required capital by getting the deposits directly from the public.
- The deposit period may vary from **6 months up to a 3 years.**
- A company can receive public deposits up to a maximum of **35%** of share capital.
- As per the company rules **1975**, company can raise the capital through the deposits.

MERITS AND DEMERITS OF PUBLIC DEPOSITS:

Merits:

- The interest rate is lower than the bank interest rates.
- Deposit holders do not have the right to vote.

- Cost of receiving is less than of shares and debentures.

Demerits:

- Difficult to get larger capital in this method.
- Public may not be interested because there is not security for this investment.

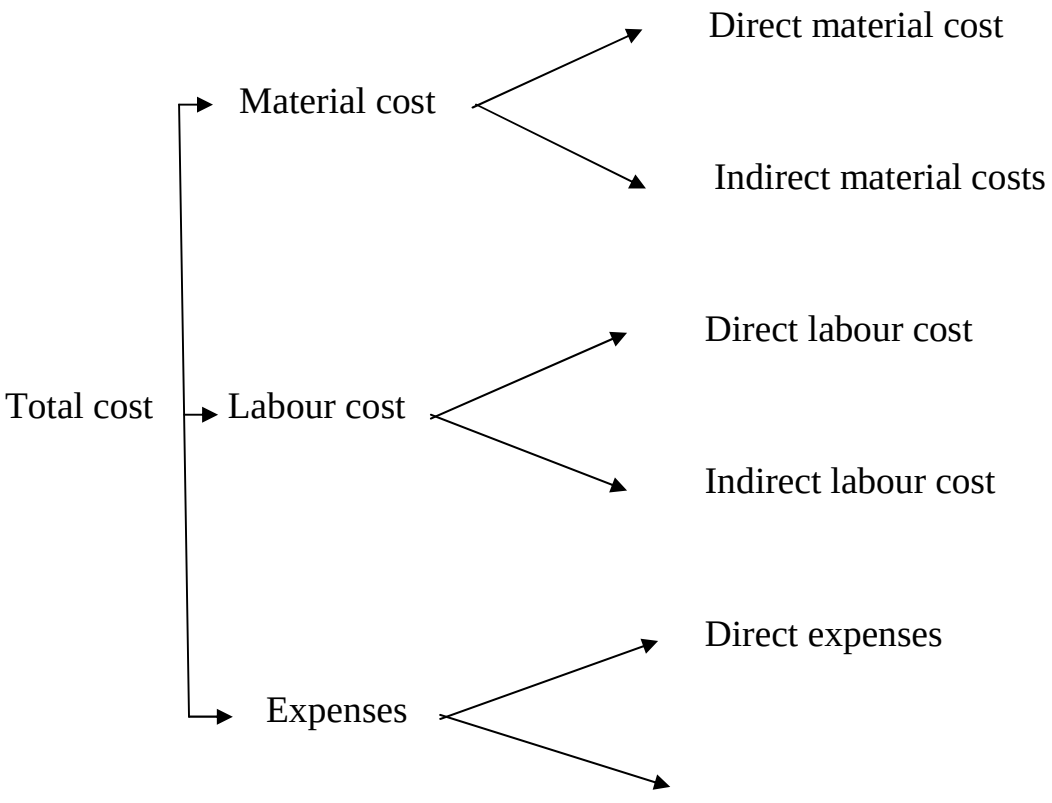
FACTORY COSTING:

Costing is the technique of calculating the expenditure incurred for men, machine and material for the manufacture and sale of the product. It is also known as **cost accounting.**

Objectives of costing:

- To decide make or buy decisions.
- To analyze the expenses for proper cost control.
- To reduce wastages and improve economy.
- To prepare and estimate to the customer.
- To determine the actual cost of each component and final product.
- To compare the actual cost with the estimated cost.

Elements of cost:



Direct or overhead expenses

The total cost of manufacturing a product consists of:

1. Materials cost.
2. Labour cost.
3. Expenses.

Normally, the cost of indirect material, indirect labour and other expenses are common top all the components produced by a company. All these common to all the components are grouped and called **factory overhead.**

The elements of cost are given below:

1. Prime cost:

a. Direct Material cost.
b. Direct labour cost.
c. Direct expenses.

2. Factory overhead:

a. Indirect material cost.
b. indirect labour cost.
c. Other expenses.

3. General overhead:

a. Administrative overhead.
b. Sales overhead.

1.a. Direct material cost:

It is the cost of direct materials required for the manufacturing of the product. Direct materials are also known as process materials, store materials are also cost materials. **Ex:** Wood used for making a table, plastics used to make buckets.

1.b. Direct labour cost:

It is the wages paid to the direct labour. The labour involved for the manufacture of a product is known as the **direct labour.** Direct labour is also called as **operating labour** and **process labour.**

Ex: Welder for doing welding works, Mechanic doing repairing work in workshop.

1.c. Direct expenses:

All the expenditures other than direct materials cost and direct labour cost are known as **direct expenses.**

Direct expenses are also known as **chargeable expenses.**

Ex: Cost of experimental work for a particular product. Cost of tools, jigs and fixtures.

2.a. Indirect material cost:

It is the costs of the materials are essentially needed in various shops for helping the direct materials to be **converted into** the finished product.

Examples of indirect material are: Grease, lubricating oil, coolants and kerosene etc.

2.b. Indirect labour cost:

It is the wages paid to the indirect labour. All kinds of labour who work inside the shop except eh direct labour is known as **indirect labour**.

2.c. Indirect expenses:

All the expenditures other than the direct material cost, indirect labour cost and direct expenses are indirect expenses.

Indirect expenses are also known as **overhead charges.**

Ex: Insurance charges, Maintenance cost of equipments, etc.

3.a. Administrative overhead:

All expenses incurred for the administrative work of the organization is called **administrative overhead,** they include:

1. Depreciation charges.
2. Salaries to manager and clerical staff.
3. Rent for the office buildings.
4. Maintenance of office building.
5. Audit charges.

6. Legal expenditure.
7. Insurance charges.
8. Telephone, postal and internet charges.

3.b. Sales overhead:

All expenditure incurred for marketing the product is known as **sales overhead.** This includes all the expenditures incurred from the time the product is manufactured till the product reaches the customer. Hey include:

1. Advertising charge.
2. Sales commission, discount.
3. Packing charges.
4. Rent for buildings including warehouse.
5. Salaries to sales manager and other staffs.
6. Travelling expenses of sales people.
7. Insurance charges.
8. Depreciation charge on building and equipment.

The sales overhead depend on the demand for the product. If the demand is less, the sales overhead will be more. If the demand is more, he sales overhead will be less.

SELLING PRICE OF A PRODUCT:

The selling price of a product consists of the following components of cost. The selling price can calculated as explained below:

(i) Prime cost
(ii) Factory cost
(iii) Production cost
(iv) Total cost or sales cost

PRIME COST:

It is the sum of direct material cost, direct labour cost and direct expenses

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Prime cost= Direct material cost+ direct labour cost

FACTORY COST:

It is the sum of prime cost and factory over heads

Factory cost= prime cost+ factory overheads.

PRODUCTION COST:

It is sum of the factory cost and administrative over heads

Production cost =factory cost+ administrative

TOTAL COST OR SALES COST:

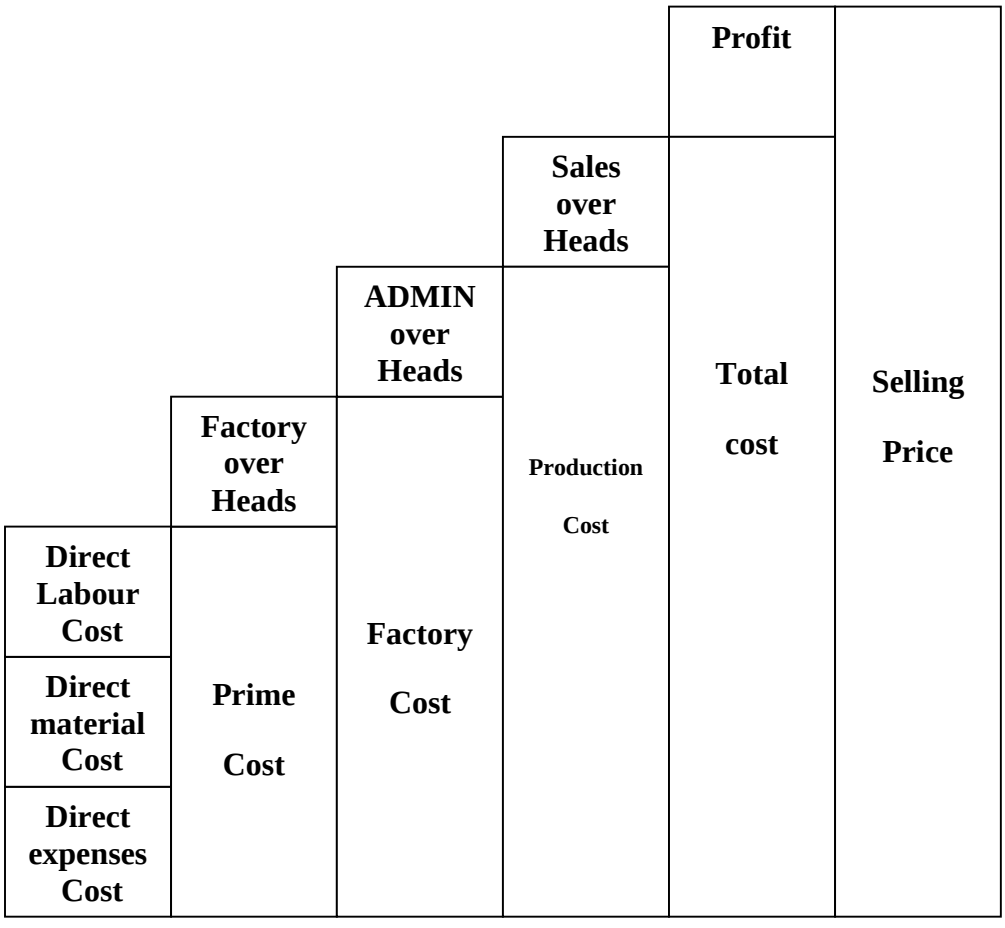
It is the sum of product cost and selling over head

Total cost = production cost+ sales over head.

The customers get the product by paying the named as selling price. It is the sum of total cost and profit.

The above procedure to calculate sales price of a product Is illustrated by a block diagram shown below:

SELLING PRICE BLOCK DIAGRAM



FACTORY COSTING PROBLEMS

1. **Estimate the selling price to quote for a product from the given data.**
   Direct material cost per piece= Rs.14
   Direct labour cost per piece= Rs.8
   Factory overhead= 100% of prime cost
   General over head= 25% of factory cost
   Profit= 10% of total cost

Solution

1. Prime cost= direct material cost + direct labour cost + direct expenses (if any).
   =14+8+= Rs.22
2. Factory OH = 100% of prime cost
   = (10/100)*22= Rs.22
   Factory cost = Prime cost+ Factory OH
   =22+22= Rs.44
3. General OH = 25% of factory cost
   = (25/100)*44= Rs.11
   Total cost = Factory cost + General OH
   =44+11= Rs.55
4. Profit = 10% of total cost
   (10/100)*55= Rs.5.50
   Selling price = total cost+ profit
   =55+5.50
   = Rs.60.50 (Ans)

2. **The direct material cost per unit of a product is Rs.5.20. The direct man hours required for 50 units of product=225hrs. The factory overheads are 100% of direct labour cost. The factory labour wage is estimated as Rs.4 per hour. The administration and selling expenses are taken as 150%$ of factory cost. A discount of 20% is given for the distributors on the list price. The price of the product is fixed on the basis of 20% margin on the total as profit. Fix the first price per unit of product.**

Solution

1. Direct labour cost = Rs.4 per hr
   = 4*225 =900(for 50 units)
   = 900/50 =18 per unit.

   Prime cost = Direct material cost per unit + direct labour cost per unit+ direct expenses (if any).
   =5.20+18+0= Rs.23.20
2. Factory OH = 100% of direct labour cost
   = (100/100)*18= Rs.18

   Factory cost = Prime cost + Factory OH
   =23.20+18
   =Rs. 41.20
3. Administrative and selling expenses (or) General OH= 150% of factory cost
   = (150/100)*41.20
   = Rs. 61.80

   Total cost = Factory cost + General OH
   =41.20+61.80
   = Rs. 103
4. Profit = 20% of total cost
   = (20/100)*130= Rs. 20.60

   Selling price = Total cost+ profit
   =103+20.60
   =123.60
5. List price =x (say)

   Discount = 20 % of list price
   = (20/100)*x= 0.2x

   List price= Selling price + discount
   x=123.60+0.2x
   x-0.2x=123.60
   0.8x=123.60
   x=123.60/0.8=154.50

   List price = Rs. 154.50 per unit

3. **Estimate the selling price per unit for the following data**

No of units = 500
Direct material cost = Rs. 5000
Direct labour cost = Rs.3000
Factory overheads =100% of direct labour cost
General overheads =12.5% of factory cost
Profit = 10% of total cost

Solution

1. Prime cost = Direct material cost + direct labour cost + direct expenses (if any)
   = 5000+3000+0 = Rs. 8000
2. Factory OH = 100% of direct labour cost
   = (100/100)*3000 = 3000
   Factory cost = Prime cost + Factory OH
   = 8000+ 3000
   = Rs. 11000
3. General OH = 12.5 of Factory cost
   = (12.5/100)*11000 = 1375
   Total cost = Factory cost + Genera OH
   = 11000+ 1375 = Rs. 12375
4. Profit = 10% of total cost
   = (10/100)*12375
   = Rs. 1237.50
   Selling price = Total cost + profit
   = 12375+1237.50
   = 13612.50 (for 500 units)
   =13612.50/500 = 27.225
   Selling price = **Rs. 27.25** per unit

DEPRECIATION

Depreciation is the reduction is value of and asset (machine, building, equipment etc., Due to passage of time, because of certain causes. This is overhead expenditure.

Causes of depreciation:

The following are the causes of depreciation

(i) Wear and tear
(ii) Physical delay
(iii) Obsolescence
(iv) In-adequancy
(v) Different maintenance

1. **Wear and tear:**
   Any assets, is kept to deteriorate when it is in use because of chemical and mechanical actions. This sort of deterioration, which can be rectified by proper repairs and renewals is known as wear and tear.
2. **Physical delay:**
   Even when assets (machine, building etc) are kept under good maintenance, there is some general deterioration.
   They will become unless due to passage of time. The delay may be 50 great that repairs are uneconomical. They need replacement. Such deterioration is called physical delay.
3. **Obsolescence:**
   Some assets may become outdated due to the introduction of modern types.
   For examples, by the introduction of capstan or turret lathe, the engine lathes were outdate. So they loose their value. This called obsolescence.
4. **Inadequate:**
   When industries are expanded higher capacity machines will be needed. Now so the available machine with low capacity becomes adequate, though the machine is in good condition. So the available machine losses its value.

For example, of an over head crane of one ton capacity was installed initially, if may be inadequate for transporting capacity of 3 or 5 tones when the factory has developed.

5. **Deferred maintenance:**
   Even if the physical assets, are maintained will they will losses their value due to passage of time, if however proper repair and maintenance work is not carried out, they will loose their value very quickly.

Method of depreciation:

Generally there are three methods of depreciation

1. Straight line method
2. Sinking fund method
3. Percentage on diminishing value method

1. **Straight line method:**
   This is the most commonly used and easily understood method. In this method, the depreciation is assumed to be uniform throughout the period (i.e.) the amount of depreciation is constant for every year. This amount is recovered every year as depreciation amount.
   The amount of depreciation
   $$D = \frac{V - S}{N}$$

Where:

V = initial value of a asset

S= scrap value

N= Life of asset in year or number of year of service.

2. **Sinking fund method:**
   In this method of fixed amount is set aside annually is a bank. The amount will accumulate with compound interest. By the end of life of an asset as amount equal to the different between the initial cost and scrap value will be

available in the bank. The depreciation amount is set aside in this method. But in straight line method, it is retained in the business as part of working capital

Depreciation amount $D=\frac{R(V-S)}{(1+R)^N-1}$

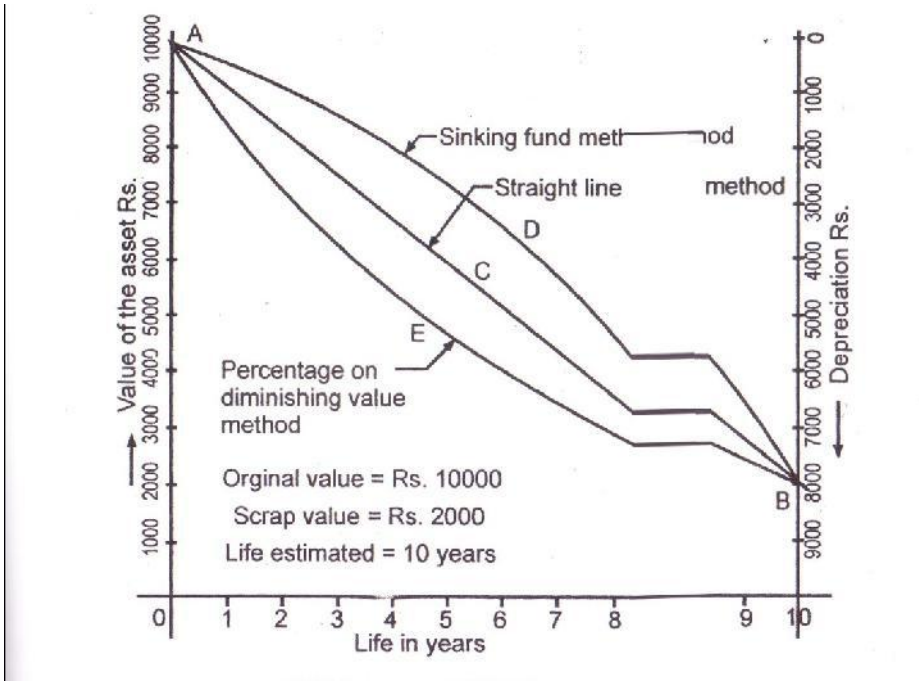
R- Rate of interest,
V- Initial value or original value
S- Scrap value
N-Life of machine in year

3. Percentage on diminishing value method:

This method is also called as declining balance method. In this method, a fixed percentage of the book value of the asset is taken as depreciation for the year.

The book value of the asset for the second year is obtained by deducting the depreciation for the first from the book value of asset in the first year. In this way the book value of asset will decrease every year. Therefore, depreciation per year also goes on decreasing.

Depreciation % rate (P) = $\left\{1-\left(\frac{S}{V}\right)\right\}$ x100



CHAPTER II

MATERIAL MANAGEMENT:

Generally material meant the raw materials use in the manufacturing process. It also includes bought-out finished components, semi finished components, spare parts, consumables and work in process. Most of the manufacturing industries spend more than 60% of money for materials. Even a small saving I material will be lead to heavy reduction in production cost.

Also there are so many problems attached with the management of materials such as investment in materials, idle funds, storage and obsolescence problems, wastage of materials in handling etc. these problems will require immediate attention of management to reduce the production cost and maintain the product quality.

Material management deals with purchasing, stocking, and issuing go materials to various departments at right time, right controlling the type, amount, location, movement, timings of purchase of various materials used in the industry.

FUNCTIONS OF MATERIAL MANAGEMENT

1. Material planning
2. Purchasing of materials
3. Receiving and ware housing
4. Storage and store administration
5. Inventory control
6. Standardization, simplification and value analysis
7. External transportation and material handling
8. Disposal of scrap surplus and obsolete materials.

INVENTORY CONTROL OR STOCK CONTROL

Stock control is also known as inventory control. Stock or inventory means the detailed list of movable goods such as raw materials, materials in process, semi finished products, finished products, general supplies and equipments etc. it gives the quantity and value of each item. Stock control means controlling the stock so the materials are available at the correct time at the least cost.

Objectives

1. To ensure the supply of materials to the various departments as and when requires.
2. To avoid shortage as well as overstocking
3. To purchase materials at an economical rate.
4. To keep the money invested in stock to minimum.
5. To provide suitable storage location for different materials.
6. To check up the stock periodically.
7. To evolve procedure for receipt and issue of stocks.

Advantages of good stock control system.

1. Enables the continuous supply of materials to various departments.
2. Production is carried out as per plan, without delay.
3. Products are delivered to customers in time. This leads to customer satisfaction.
4. Materials are neither overstock nor under stocked.
5. Materials cost is kept low, so production cost is reduced
6. Money invested in stock is kept minimum.
7. Scarcity of materials in marked will not affect the production. Because, in a good stock control system a reserve stock is maintained.
8. Lower transportation cost because e of bulk purchase
9. Rate of production can be increase when needed.

ABC Analysis

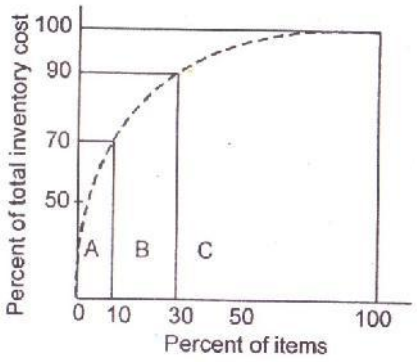
In this, the stock items are grouped as A item, B item and C Item. This grouping is done according to the money value of the items.:

A-item:These are all costly items, but less is numbers

B-item:These are all medium cost items.

C-item:These are all cheaper items, but more in number’s

For costlier items more attention is required. For chapter items less attention is enough.



Procedure for A.B.C Analysis :

1) First, all the items are listed out,
2) Money value of each items are found out
3) The items are divided as costly items, medium cost item and cheap items.
4) Percentage of these items and percentage of inventory cost are calculated
5) A graph is plotted with number of items. (in percentage) on x axis and money value of items (in percentage) on Y axis.

From the graph in can be seen that:

1. Costly items are named as “A” items. Money value of these items put together is about 70% of the total inventory cost. But these items are only about 10% of the total number of item in stock.
2. Medium valued items named as “B” items. Money value of these items put together is about 20% of total inventory cost. The number of “B” item is about 20% of total items in stock.
3. Cheap items are named as “C” items. Money value of these items put together will be about 10% of total inventory cost. However the number of items is about 70% of the total item in stock.

Conclusion:

1. As a items are a few in number they occupy less space for storing. But they require more attention for their inventory control. Minimum and maximum limits of stock and recorder level should be maintained. These items must be handled properly and stored safely. As the cost of these items are more, they can be purchased just on month before the beginning of production the number of recorder may be more

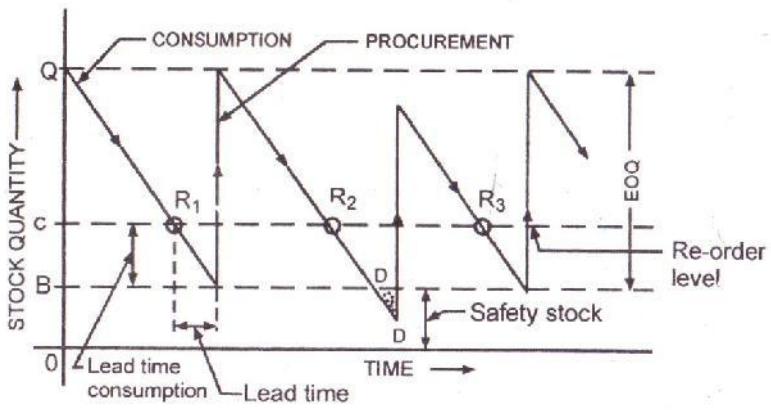
2. "B" items are medium valued items. Their number lies between A and C items. They are less important than A items. These items also require attention to stock as A item. A safety stock of upon 13 month may be maintained.
3. "C" items are in large number. Hence they require more space for storing. These items include, the least important items like. Washer, rubber bushes and chips. These items do not need any control and record. They can purchase jest before they go out of stock. The determination for future requirement is also not necessary.

Policy guide lines for ABC- Analysis

S.No	A-Class high value	B-Class Medium Value	C-Class Low Value
1.	Right control on stock levels	Moderate Control	Less Control
2.	Low Safety stock	Medium safety stock	Large safety
3.	Ordered frequently	Less frequently	Bulk ordering
4.	Individual posting in stores	Individual posting	Collective poxstings
5.	Continuous check on schedules and revision when called for	Broad check on schedule revisions	Hardly any check required
6.	Weekly control statements	Monthly control reports	Quarterly Control reports

7.	Procured from Multiple Sources	Two or more reliable sources	To reliable Sources for each time
8.	Minimize waste obsolute and surphus	Quarterly control over waste	Annual review regarding waste
9.	Continuous efforts to reduce lead time	Moderate efforts	Minimum Efforts

Procurement and Consumption Cycle



- Let us assume that a material is consumed at an uniform rate throughout the year.
- Let the quantity of buffer stock kept in the stores is B-units.
- When the order is placed, the material is received in one lot.
- In the beginning, the stock of quantity ’Q’ is available. It is consumed in uniformly and the level of stock goes on reducing.
- When the stock reaches the reorder level (c) action is taken for purchase.
- When stock reaches in B-units the materials is received in a lot.

i. Minimum stock (or) Buffer stock (or) Safety stock:

- Buffer stock (or) safety is minimum quantity of stock available in stores.
- This stock is kept as emergency use.
- When the material is not received in time from suppliers the buffer stock can be used.
- Buffer stock is used when the supplier is delay, transport delay.

ii. Lead time:

- It is also known as procurement time.
- This is the total time taken from the store sends its purchase requisition to the purchase department, to the time the material is taken into stock in stores.

Lead time includes the following:

- Sending the purchase requisition by store.
- Calling for quotation and approval
- Placing the purchase order
- Delivery time taken by supplier
- Transportation of material
- Receiving material at the company
- Inspection of material received

iii. Re-order level

- This is the level of stock in stores at which a purchase requisition is placed to procure material.
- When this level is reached, the store keeper send request to purchase department.

Methods of Purchasing

i. Market purchasing

- This purchasing is done by taking advantage of market conditions.
- Heavy purchases are made when prices are rising.
- Hand to mouth purchasing is done (limit)

ii. Speculative purchasing

- Purchasing may be made more in excess of the requirement.
- These purchases are made when the prices are very low.
- These purchases are made for reselling the material at higher prices and earn profits.

iii. Contract purchasing

- This method is adopted by large companies which use large quantities of material like coal, coke, pig iron, petroleum etc.
- These materials are continuously required for a longer period of time.
- For frequent orders, a written contract is signed with supplier for supply of material

iv. Requirement purchasing

- Here purchase is made as and when material is required.
- This method is used when supply is seasonal.

v. Lot purchasing

- Many times, purchases are made in lots of quantities larger than the requirements.
- This is done to get heavy discounts.

vi. Group purchasing

- In this method, the purchase department places a single order for a number of small items required for company.
- Placing of large number of orders is avoided. This reduces paper work and also ordering cost.
- Both Buyer and seller are benefited by group purchasing.

Purchasing procedure:

i. Getting purchase requisitions

- This is the first step in purchasing process.
- Purchase requisition is a document which gives the following particulars.
  a. Specification
  b. Quantity

c. Purpose of need
d. When it is needed

- Purchase requisition authorizes by the purchase department to place order.
- Purchase requisitions may receive from foreman, workshop, engineering department.

ii. Obtaining quotations

- If the material required is not important, the purchase officer places purchase order with reliable suppliers.
- But if the material is costly and important and the amount is large, the purchase officer makes enquires from carious suppliers.

iii. **Selecting the source of supply**

- After receiving the quotations from various suppliers, they are compared with reference to quality, quantity, time of delivery, price and terms of payment.
- Based on the best the suppliers is selected.

iv. Placing the purchase order

- After selecting the suppliers, the purchase order is prepared. The purchase order (P.O) contains.
  a. Purchase order number
  b. Quantity
  c. Material
  d. Date of delivery
  e. Billing, packing and price
  f. Terms of payment

Copied of P.O sent to the following department

- Two copies to the supplier (One will return with acknowledgment)
- One to purchasing department
- One to store keeper
- One to accounts department
- One to inspection.
- One to follow up clerk.

v. Follow up , receiving and inspection

- After dispatching the P.O the purchase department should follow up the delivery date.
- In receiving the material store keeper should check with P.O and store.
- Generally inspection of material is done by receiving department.

Store Keeping Of Material

a. **Functions of store department are**:
   i. Receiving, storing, inspecting and safeguard.
   ii. Issuing correct material.
   iii. Maintaining stores record.
   iv. Giving proper information to purchasing material.

b. **The Following Types Of Material Are Kept In Store**:
   i. Raw material
   ii. Indirect material consumed during production
   iii. Tools and equipment
   iv. Finished product
      - Un worked raw material are generally called as stores. The place where they are stored is called store room.
      - Finished products are stored in stock room (or) ware house.
      - Store room should be located at a place where the total cost of handling materials is minimum.

c. **Factors Considered For Locating Store Room**:
   i. Store room for raw material should be near the point of use
   ii. Finished goods are stored near the transport conveyance.
   iii. Store room for un flammable products away from main plant.
   iv. Store room for bulk goods (large) should place in ground floor and near to plant.
   v. Tools and consumables for daily use should near the shop placed.

d. The layout of a store room must provide.
   i. For receive and storage of material.
   ii. For easy and quick issue of materials.
   iii. For protection against damage and fire.

iv. For easy identify and location of material
v. For easy adoption of “first in first out” principle.

Receiving of material

- In large industries, there is a separate store department for receiving the materials. But in small industries, store keeper receiving the materials, receiving the material from supplier the following steps are done,
- Receiving the goods.
- Check the quantity, quality and size of the material
- Record the information of materials in this store registers
- Informed to the accounts department and purchase department about to the received materials
- If any fault found in the material should be return to the suppler
- Store the good components

ISSUING OF MATERIAL

- Record the following information in register
- When do you send the material?
- How much of quantity send the material
- Who received the material?
- Direct material issued- MIR sent by PPC department
- Indirect material issued_ MIR sent by used department.

COST OF INVENTORY

The main aim of good stock (or) inventory control system is to keep the total cost of inventories to a minimum.

Types of cost of inventory;

1. Inventory carrying cost.
2. Ordering cost

1. **Inventory carrying cost:**

- The interest for the money invested in the material stocked.
- Rent for stores.
- Salary for storekeeper, watchman etc.
- Maintenance cost for stores.
- Wastage of material in handling.
- Loss of material due to theft.
- Insurance charge, fire insurance etc.
- Stationary and other consumables used in stores.

2. **Ordering cost:**

- Salaries for people employed.
- Rent for office.
- Postage, telephone, telegraphic and computer chargers.
- Travelling charges.
- Stationary and other charges.
- Legal expenditure, depreciation charge.

ECONOMIC ORDER QUANTITY

Let us consider the purchase of the material required for one year.

- If we purchase and stock the entire quantity at a time, the inventory carrying cost will be high.
- To avoid high inventory cost, we can purchase material in small quantities.
- If we have to place a number of purchase orders it will increase the ordering cost.
- So it is necessary to find the ordering quantity to minimize the total inventory cost (Inventory carrying cost + ordering cost)

Determination of economic order quantity (EOQ)

Let

A - Annual requirement (No of units).

Q - Quantity per order (No of units).

C - Cost of material / unit in Rupees.

S - Ordering cost per unit in Rupees.

I - Inventory carrying cost.

Total cost = Ordering cost + Inventory carrying cost.

Ordering cost = Cost per order * No of orders.

Number of orders per year = Annual requirement / Quantity per order.

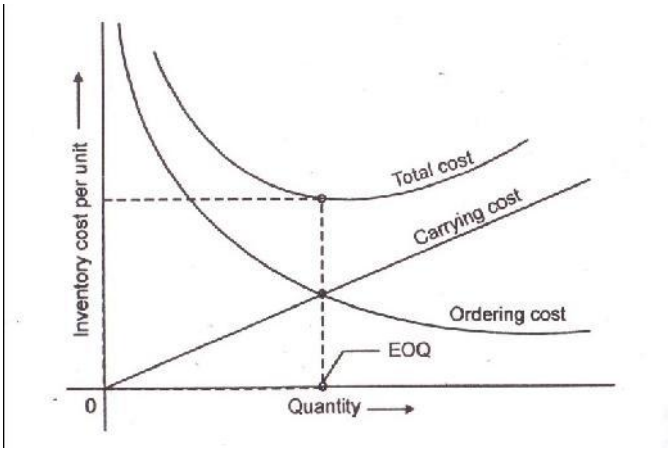
= A/Q

$Q = \sqrt{2AS/CI}$

$EOQ = \sqrt{2AS/CI}$

The following assumptions are made while calculating EOQ:

1. There is uniform consumption of material.
2. The entire quantity order is received at one time.
3. There is no discount for purchase.



PROBLEM OF EOQ

1. **If the demand for an item is 4,000 units per annum, procurement cost is Rs 140.00 carrying cost is Rs. 2.50 per unit per annum, calculate EOQ**.

Given:

A = 4,000 units per annum

S = Rs. 140 per order

R = Rs. 2.50 per unit per annum

Solution

Formula EOQ = $\sqrt{\frac{2A}{R}}$ or $\sqrt{\frac{2A}{I}}$

= $\sqrt{\frac{2\times4\quad\times1}{2.5}}$

=**669 Units**

2. **The annual demand for an item is 10,000 units. The inventory carry cost is 15% of the stock cost. Cost per unit is Rs. 50%. The ordering cost Rs.80/order. Calculate the economic order quantity.**

Given:

A= Annual demand = 10,000 units

I = Inventory carrying cost = 15% = 0.15

C = Cost per unit = Rs. 50

S = Ordering cost per order = Rs. 80

Solution:

Formula of EOQ = $\sqrt{\frac{2A}{R}}$ or $\sqrt{\frac{2A}{I}}$

= $\sqrt{\frac{2\times1\ ,0\quad\times8}{0.1\ \times5}}$ = 461 units

3. **The annual requirement of an item for a ferm is 20,000 units. Ordering cost is Rs. 10.50 carry cost per unit per year is Rs 10. What is EOQ? If the lead time is 3 days and the firm works 300 days in a year what is reorder level.(Note: No safety stock is kept.)**

Given:

A = Annual consumption = 20,000

S = Ordering cost per order = Rs. 10.50

R = Carry cost per unit per year = Rs. 10

Solution:

EOQ $= \sqrt{\frac{2A}{R}}$

$= \sqrt{\frac{2\times 2\ ,0\quad \times 1\ .5}{1}}$ = 204 units

Re order level (ROL) = Safety stock + Lead time consumption

Safety stock = 0

Lead time consumption = Daily consumption × Lead time in days

$= \frac{2\ ,0\quad \times 3}{3}$ = 200 units

Therefore ROL = 0+200 = **200 units.**

4. **The rate of consumption of a material from stores is 30 u7nits per year. The cost of placing and receiving an order is Rs. 40.00. the cost of each unit is Rs.100. the cost or carrying inventory in maximum lead time is 6 months and normal lead time is 4 months. Calculate safety stock and order point.**

Given:

A = Annual Requirement = 30 units

S = Ordering cost per order = Rs 40

C = Cost per unit = Rs. 100

I = Inventory carry charges = 0.17

Solution:

EOQ $= \sqrt{\frac{2A}{I}} = \sqrt{\frac{2\times3\times4}{0.1\times1}} =$ 12 units

Order point:

Re-order level(ROL) = Safety stock + Normal lead time consumption

Safety stock = (Maximum lead time – Normal lead time)

Consumption Rate.

Maximum lead time = 6 months

Normal lead time = 4 months.

Rate of consumption = 30/ 12 units per month

So, safety stock = (6-4) × 30/12 = 5

ROL = (6+4×30/12) = **25 units**

5. **Calculate the economic order quantity and total inventory cost for a factory. Whose annual requirement cost is Rs. 400 per order. Inventory carry cost per unit per year is Rs. 160.**

Given:

A =Annual consumption = 2000

Unit S = Ordering cost per order = Rs. 400.00

R = Carry cost per unit per year = Rs. 160.00

Solution:

EOQ $= \sqrt{\frac{2A}{R}}$

$= \sqrt{\frac{2\times2\times4}{1}}$ **= 100 units**

SUPPLY CHAIN MANAGEMENT (SCM)

Supply chain management is the route through which the raw material is converted into finished products into the hands of customer.

A. Activities of supply chain management:

1. Purchasing (or) procurement of raw material from supplier.
2. Transforming these materials into product by manufacturing.
3. Distributing finished products to customer through dealers and retailers.

The main purpose of supply chain management is to satisfy customer needs and the main benefit if SCM is maxims the overall value of the product.

B. Stages of supply chain management:

Stage 1	Base line	Understanding of material flow from purchasing of distribution.
Stage 2	Functional Integration	Understanding functional of A. material management B. manufacturing management
Stage 3	Internal Integration	Internal integration of material management, manufacturing management and distribution.
Stage 4	External Integration	Integration of suppliers, internal supply chain and customers.

PURCHASING METHODS

Market purchasing: This is done by taking advantage of market conditions. Hand to mouth purchasing is done when prices are falling.

Speculative purchasing: Sometimes, purchasing may be made much in excess of the requirement. These purchases are made when the prices are very low.

Contract purchasing: A written contract is signed with the supplier for supply of material for specific period at specific prices. Schedule of delivery is also agreed upon.

Lot purchasing: Many times, purchases are made in lots of quantities to avail heavy discounts.

Group purchasing: In this method, the purchase department places a single order for a number of small items required by the company.

Requirement purchasing: Here purchase is made as and when material is required.

PURCHASING PROCEDURE

The purchasing procedure involves the following steps.

1. Checking the purchase requisition and bill of materials received from stores.
2. Selecting the list of suppliers.
3. Inviting quotations/tenders from suppliers.
4. Preparing comparative statements of quotations.
5. Negotiations.
6. Choosing the right supplier based on quantity, rate, terms and conditions.
7. Placing the purchase order with the selected supplier.
8. Taking follow up action for delivery.
9. Inspecting the materials received.
10. Verifying the invoices for payments.
11. Closing the order.
12. Updating of records and files.

PURCHASE REQUISITION AND BILL OF MATERIALS:

If any department needs materials, it is requested to the purchasing department, through a document known as purchase requisition. The purchase department-takes action to purchase materials on the basis of purchase requisition. A purchase requisition contains the following information.

a. Specifications of materials.
b. Quantity and quality of materials.
c. Date by which material is required.
d. Place at which the materials should be delivered.

BILL OF MATERIALS:

A bill of materials is list of all standard items required for a job. It is generally prepared by the production planning department and send fo stores. It is an

advance intimation to the store keeper about the requirement of materials. The store keeper works out the total mateial requirement of materials, find out the existing stock and decides the actual materials to be purchased. Then a purchase requisitions is prepared and send to purchase department.

Selecting the list of suppliers;

Reliable suppliers shall be selected. For purchasing new items, suppliers list may be prepared from catalogues, Journals, Advertisements, Trade Exhibitions, Trade directories . It is always better to maintain a record of classified list of suppliers dealing with various items.

Inviting tender/Quotations:

The tender/quotations are invited from the firms dealing with the supply of required items.

Comparative statement:

After receiving the quotations from different suppliers, a comparative statement is prepared. This helps to study the various offers easily in one glance. After studying the comparative statement thoroughly, the supplier is selected.

The following factors shall also be considered in selecting the supplier.

- Quality of the material and make.
- Period of supply and guarantee period.
- Other expenses like freight, tax, packing and forwarding charges etc.
- Reliability of the supplier.
- Terms of payment etc.

Negotiating;

The selected suppliers are called for final negotiation directly.

Purchase order:

After selecting the supplier, a purchase order is sent to him. It is a letter sent to the suppliers, asking to supply material. It is a legal document and authorizes the vendor to supply materials and bill.

Follow up of purchase order:

Merely placing the purchase order will not guarantee the supply. It must be ensured that materials will be supplied in time. In case, materials are not recivied in time, corrective action shall be taken, such as transferring order to other vendors.

Inspection of material Received:

After the receipt of materials, the same is inspected and compared with the purchase order.

Verifying supplier's Bill or Invoice:

The bills are verified for the correctness of the materials (quantity and quality received and the prices, discounts, taxes and other terms and conditions. After confirming the above, the bill is passed for payment.

Closing the completed order:

The file copy of purchase order is removed and entries such as 'materials received in good condition bill passed for payment' etc are made. Then it is stored in the file of closed orders.

Updating of records and files;

The stock files are updated.

STORE KEEPING

Stores is a place where goods are kept. Store keeping refers to the safe custody and maintenance of all materials stocked in stores. Stores keeper is a person who is in charge of store keeping. The materials shall be easily located and issued promptly.

Advantages (objectives) of store keeping:

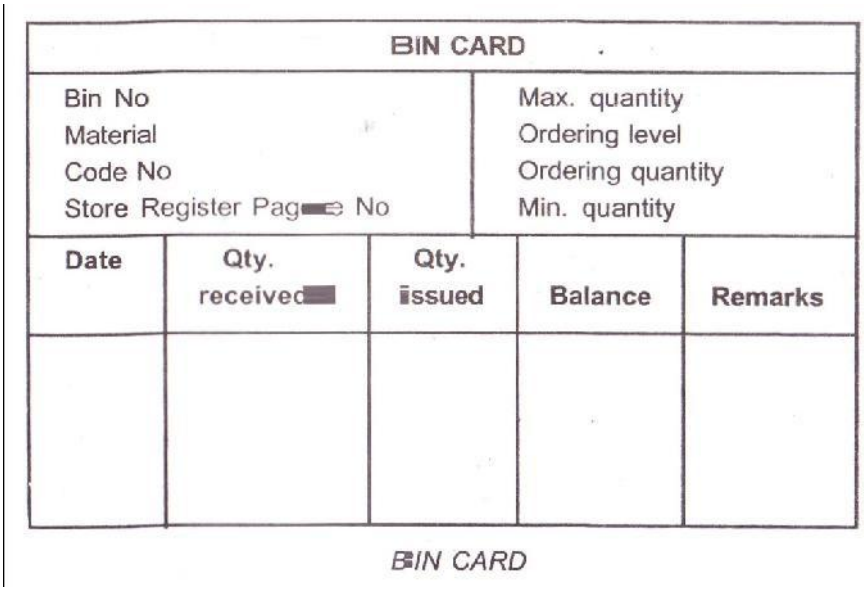
1. To check and receive materials.
2. To maintain accurate records of materials received and issued.
3. To ensure that there is no over stocking of materials.
4. To avoid stock out and maintain safety stock.
5. To verify carefully all materials received.
6. To arrange for systematic and efficient storing of materials.
7. To keep stock safely in good condition.

Duties of Store keeper/Functions of Stores Department:

1. To receive and check materials.
2. To keep record of all the details about the materials.
3. To plan and store the materials systematically.
4. To inform the purchasing department to arrange for purchase of materials when stock position comes to re-order level.
5. To keep entries of receipts and issue of materials and keep the records up to dates.
6. To issue materials promptly.
7. To make periodical physical stock verification.
8. To maintain stock safely and prevent theft, damage pilferage etc.
9. To avoid stock out.

BIN CARD

It is a card in which stock position is entered at every transition. This is a card which is attached to each bin, rack, etc., in the stores. Bin card is very handy and useful to the storekeeper for ready reference of stock position. Bin cards are prepared in duplicate. One card is attached to the bin and other with the store keeper for ready reference. The stock position in the bin cards should agree with the stock ledger accounts. Bin cards are checked periodically by the inspectors to see that they are accurately maintained.



BIN CARD				
Bin No Material Code No Store Register Page No			Max. quantity Ordering level Ordering quantity Min. quantity	
Date	**Qty. received**	**Qty. issued**	**Balance**	**Remarks**

BIN CARD