BHUBANANANDA ORISSA SCHOOL OF ENGINEERING, CUTTACK

DEPARTMENT OF CIVIL ENGINEERING

LECTURE NOTE ON: ESTIMATION AND COST EVALUATION-II

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SEMESTER: 5th

SECTION: A

SESSION: SUMMER (2022-23)

CHAPTER-1

INTRODUCTION

• Aims and objective of construction management

• Functions of construction management

• The construction team components

• Resources for construction management

CONCEPT OF MANAGEMENT

• The term management has different senses of use. Sometimes it is used in the sense of an organisation in which different class of people work together to provide qualitative and economical product by the use of human beings and other resources like machine, money and material.

• Or sometimes it may be defined as the process consisting of planning, organising, activating and controlling the performance to determine and accomplish the objective by the use of men, machines, materials and money.

1.1. Aim & Objective of construction Managment.

The following are the main objectives of the construction management.

- The work should be completed within estimated budget and specified time
- There should be the motivation to working people to give their level best their capacities to complete the work.
- There should be qualified and trained staff to supervise the work properly.
- The execution of work should be done as per specification.

- The execution of work should be done as most economically.
- The working quality and workmanship should be good.
- There should be a proper plan of work and it should be organised properly.
- There should be an awareness of creating an organisation that works as a team.
- The workers should have been provided with safe and satisfactory.

FUNCTIONS OF CONSTRUCTION MANAGEMENT

The following are the functions of construction management

- Planning.
- Organising.
- Staffing.
- Directing
- Controlling
- Co-ordinating
- Communicating.

PLANNING

• Time needed to complete the whole construction project

• Type, quantity and exact time for delivery of materials of construction.

• Type, number and duration of use of different machines and equipment.

• Category of staff i.e., Managers, skilled and unskilled workers required.

• Type of uncertainties likely to cause delays such as weather conditions, shortage of supply, labour unrest and sub-judice land matter etc.

- WHAT TO DO
- WHEN TO DO
- HOW TO DO
- WHO TO DO

ORGANISING

• After the planning is in place, a manager is needs to organize her/his team and materials according to her plan.

• This process involves to identify the work to perform, to classify or group the work to assign these group of activities to individuals to delegate authority and fix responsibility.

STAFFING

• Staffing is filling the position in the organisation structure for defining recruitments.

• It is a very important responsibility to select right person for right jobs in a construction organisation.

• Staffing is not only about the recruitment but also their training and developing activities.

DIRECTING

• A manager needs to do more than just plan, organize, and staff her team to achieve a goal.

• She must also lead.

• Leading involves motivating, communicating, guiding, and encouraging.

• It requires the manager to coach, assist, and problem solve with employees.

CONTROLLING

• After the other elements are in place, a manager's job is not finished. He needs to continuously check results against goals and take any corrective actions necessary to make sure that his area's plans remain on track.

• Controlling is an important action for ensuring effective and efficient working.

• It reviews the work plan to check and rectify the deviation.

• A manager needs to do more than just plan, organize, and staff her team to achieve a goal.

• She must lead the team.

• Leading involves motivating, communicating, guiding, and encouraging.

• It requires the manager to coach, assist, and problem solve with employees.

CO-ORDINATING

• It means developing harmony between employees and group of employees for smooth and efficient functioning of construction work.

• In large organisation the work is divided into different departments. So there is a great importance for good coordination.

COMMUNICATING

• Communication is the process of transmitting receiving and understanding the ideas by others for the purpose of effective desired results

• There are various methods of communication like verbal return others reports instruction result.

• Ineffective communication leads to confusion misunderstanding Etc.

Construction Team component:-

OWNER

❖ The owner of a construction project may be an individual, group of individuals or public body. The owner finances the project and also recognises the need for a project.

❖ in view of all aspects the owner has the power to take major decisions regarding managerial financial and administrative aspects

Engineers & Architects:-

- Structural engineers are to prepare structural design of structures.
- Mechanical engineers are to design and preparation of working drawings for all mechanical services associated with the construction projects.
- Electrical engineers are to design & prepare working drawing foe electrical power & distribution system during and after construction.

CONTRACTOR

- The contractor executes various types of works and also makes necessary arrangements for labour, machinery, materials, in order to complete the project in the limited scheduled time.

• In some projects, the contractor may appoint sub-contractor. There is a rate or bid between Contractor & owner before starting any project.

RESOURCES FOR CONSTRUCTION MANAGEMENT

• Money the first and foremost recruitment for any project and it should be arranged before starting any construction project for smooth implementation of a project

• If the financial resources are insufficient than the project will not be completed within the limited scheduled time period Material

• Sufficient quantity of materials required for the completion of any project and should also be available at the site.

• Material required for project rest method before starting the project

• For example- bricks, cement, stones, Timber, water supply electrical fitting etc.

Machine

• Different type of machineries and equipment required for any construction work

• Although the cost of machines is high but reduces the high requirement of manpower

• For example mixers, tractors, cranes, pumps, generators excavators etc.

Man power

• Successful completion of any project manpower is an important factor

• It may be skilled and unskilled manpower.

• Man power deals with engineers architects supervisors repair technicians skilled or unskilled labour etc.

Chapter 2 – CONSTRUCTION PLANNING

2.1 IMPORTANCE OF CONSTRUCTION PLANNING

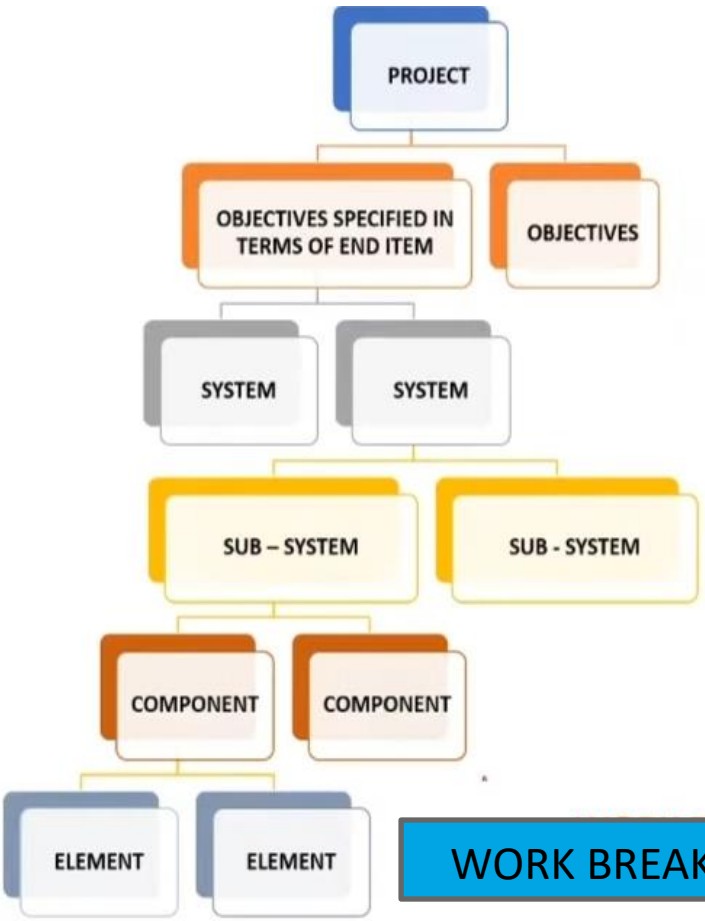
Importance of construction planning are as follows.

- The work may be completed within the scheduled time.
- The work may be executed most economically.
- The work will be both qualitative & quantitative.
- There shall be minimum wastage during construction work.
- The work should be completed as per specification.
- There will be a minimum cost of maintenance of machinery & equipment.
- There will be optimum use of available resources.
- Controlling of construction activities can be possible.

2.2 DEVELOPING WORK BREAKDOWN STRUCTURE FOR CONSTRUCTION WORK:-

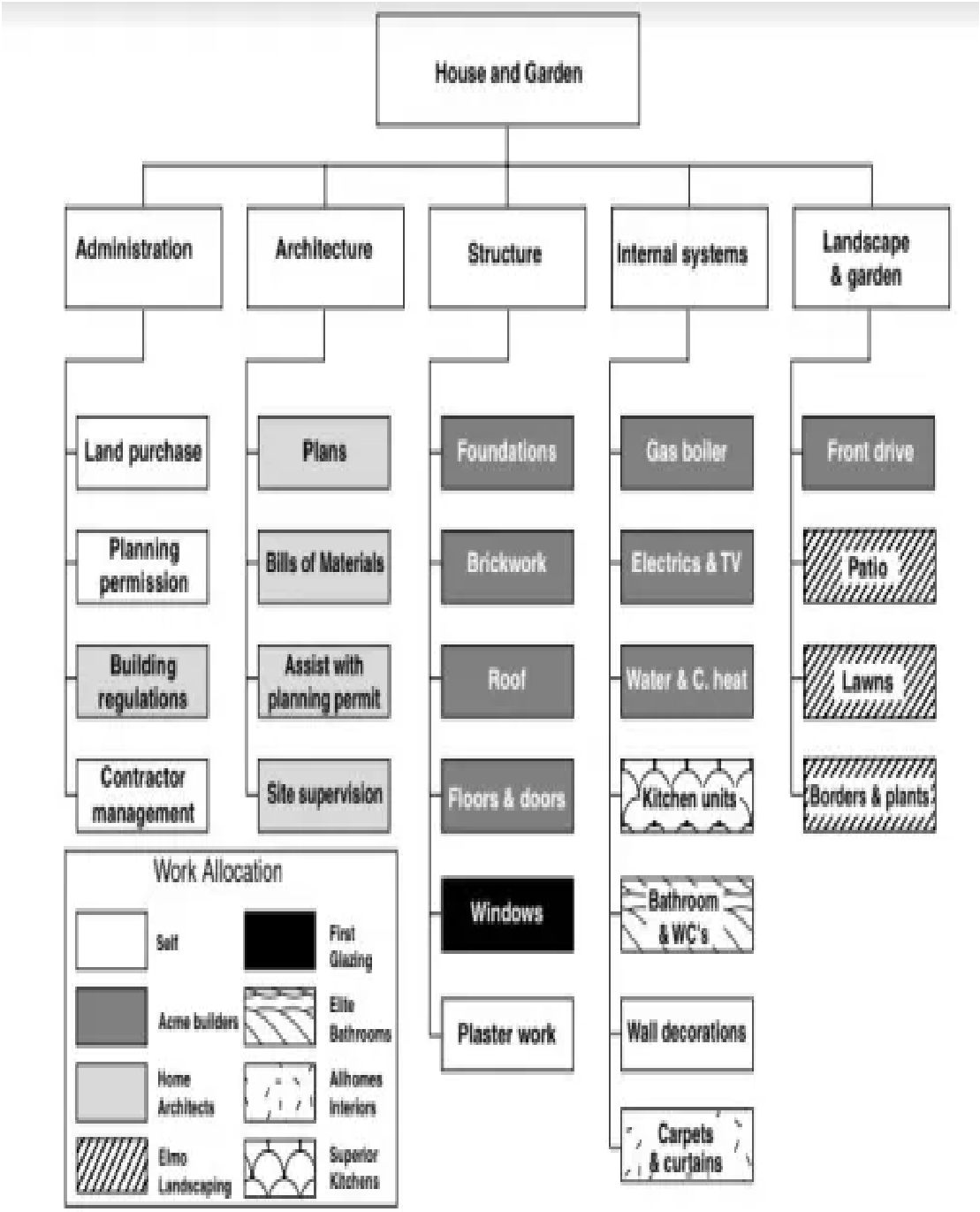
WORK BREAKDOWN STRUCTURE

- It is the preliminary diagram which showing the breaking down a project into sub-systems and each sub-systems into major components and discrete activities.
- In WBS, top-down approach to planning is adopted. Such an approach ensures that the total project is fully planned and all derivative plans contribute directly to the desired end objectives.
- WBS aids in the identification of objectives and allows the planner to see the total picture of the project.
- WBS is developed by considering the end objective and breaking it into smaller manageable units on the basis of size, duration and responsibility.



WORK BREAKDOWN STRUCTURE

Example of WBS



2.3 Construction Planning stages- Pre- tender stage, Post- tender stage:-

Stages of Construction Planning:-

- Planning is very essential activity for efficient implementation of a project at various stages.
- Construction planning can be divided in the following two stages.
    1. Pre-tender Stage
    2. Post-tender Stage / Contract Stage

1. Pre-tender Stage Planning:-

The pre-tender planning is carried out by the contractor after the receipt of tender notice and before submitting the tender paper.

At this stage, the contractor prepares himself for completing the work in the stipulated time.

Steps in Pre-tender Planning:-

(i) At first, there should be careful study of tender documents, drawing & specifications to identify the quantities of each item of work.

(ii) There should be careful study of tender document about the time limit.

(iii) There should be a site investigation & market survey.

(iv)The availability of required materials near the site of work should be determined and if not, also how these can be procured economically.

(v) The selection of the most suitable & economical method out of the alternatives methods should be determined for executing the work.

(vi) The quantities of different item should be estimated.

(vii) The overhead and margin of profit should be decided and the tender price finalized for the completion of the work within stipulated period of time.

2. Post-tender Stage / Contract Stage:-

- Post-tender stage is also known as contract stage. This stage starts after the acceptance of the tender and extends till the completion of the contract.
- Post-tender planning is used to check out the details for execution of the project.
- Improper and inadequate planning at this stage may cause heavy loss of money and time.

Steps in Post-tender Planning:-

(i) The selection of most suitable and economical method out of all alternatives methods considered at pre-tender stage.

(ii) The quantities of materials required at each stage of the work, locating sources of their supplies, their comparative cost from different sources should be worked out properly.

(iii) Inter-relationship of various item of work should be studied and the proper sequence of operations is finalized.

(iv) The requirement of labour, supervisor and managerial staffs should be finalized.

(v) Total number of machinery and equipment should be arranged.

(vi) Accommodation for labour and staff should be arranged like temporary staff office, road etc.

(vii) The work programme of each work should be decided and also starting & ending date finalized.

(viii) A good communication system between the members of the construction team should be established for the smooth running of a project.

2.5 PREPARATION OF SCHEDULES FOR LABOUR, MATERIALS, MACHINARY, FINANCE FOR SMALL WORKS:-

CONSTRUCTION SCHEDULING:-

- Scheduling of a project is done after, it is properly planned.
- A schedule for construction activity is a graphical representation which determines the time of starting and completing date of each activity in order to complete the whole construction project.
- In other words scheduling is the time table for executing each and every activity with its fixed starting and finishing date.

CLASSIFICATION OF SCHEDULING:-

Schedules can be classified into various groups such as;

- Material Schedule
- Labour Schedule
- Equipment Schedule
- Financial Schedule

MATERIAL SCHEDULE

- This type of schedule is prepared for moving and storing of material in advance before starting of construction schedule acts as a guide for preparing materials schedule.
- This schedule is done to avoid delay in the execution of the work.
- The materials should be delivered at site at least one week before its use.
- The materials at site should not remain on used for long
- The materials stored at site long before its use it is likely to deteriorate in quality.
- For example, cement made its strength by 50% if stored for 6 months and steel may be attacked by corrosion due to long storage at site.

LABOUR SCEDULE

- The labour schedule is prepared for deciding the actual number of skilled and unskilled labour which is required for the construction work

- With the help of this schedule required labour can be arranged in time
- It helps in reducing labour cost.
- Labour schedule is important as it is difficult and costly to arrange skilled labour as and when required.

EQUIPMENT SCHEDULE

- This type of schedule is prepared to decide the type and quantity of equipments as also on which date the equipment will be needed. So that they can be arranged when requirement.
- The aim of this schedule is to derive maximum advantage of the equipment when it is required and remove it from the site when the job is over.

FINANCIAL SCHEDULE

- Financial schedule is prepared to estimate the amount of money that owner or contractor has to spend as finance for the project work.
- In maximum construction project the owner will pay a stated percentage of the value to the contractor for the completion of work in each month. it is about 90% of the cost during each month.

2.4 Construction Scheduling by Bar Charts for simple Construction works:-

METHOD OF SCHEDULING:-

Depending upon the size of the project scheduling is done by different methods.

Following are the methods of scheduling.

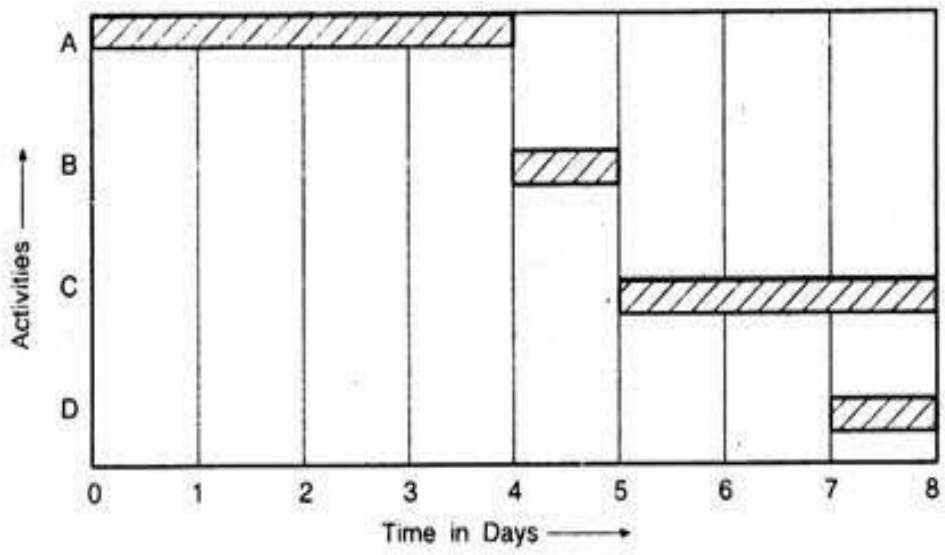
1. **Bar chart or Gantt charts.**
2. **Network analysis (CPM ,PERT)**

BAR CHARTS

- Bar chart is a graphical representation of various activities, their duration, start and period of a project.
- This method was developed by Henry Gantt around 1900.
- They consists of 2 co-ordinate axis, i.e., horizontal and vertical.
- Horizontal axis is used to represent the time required for the completion of activity and vertical axis is used to represent the activities required for the completion of the project.
- The start and end point of bar represents the time of start and finished time of the activity hence the length of bar represents the duration of activity.
- The bar chart or Gantt chart represents the schedule of a project also represent the actual progress.
- We can also check the accuracy of work and can compare the actual progress of work with the schedule.

Symbols of Bar Chart:-

- Activities are shown by thick crossed horizontal bars.
- Planned programme are represented by a thick line.
- Length of bar chart shows time required to complete the work.
- Starting and ending of an activity are represented by small vertical line.
- Actual progress of work is shown by hatched line.
- Float is represented by doted horizontal lines which represents the flexibility range of an activity with which starting and ending time can fluctuate.
- The vertical dotted line represents the dependency of one activity on another activity.



<u>Steps in Preparing for Bar Chart</u>:-

Following steps are involved in preparing a bar chart.

- The project is sub-divided into various activities.
- Name various activities as A, B, C etc.
- The inter-relationship among the activities is determined.
- Activities are arranged in systematic manner.

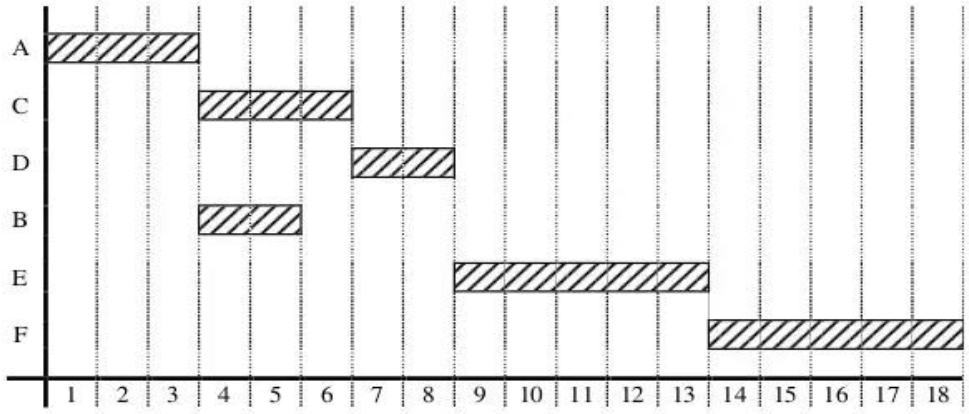
- The quantity of work and requirement of time to complete the work is determined.
- Then bar chart is drawn.

Bar chart of a residential building

- Example:

Activity ID	Activity Description	Dependency	Duration
A	Excavation	–	3
C	Foundation	A	3
D	Column	B, C	2
B	Moving the soil out	A	2
E	Wall	C, D	5
F	Roof	E, D	5

Solution



Advantages of Bar Chart

- It is simple to draw, easy to understand.
- It can be drawn quickly.
- It is widely used for scheduling.
- There is no requirement of trained or skilled person to draw
- Resources can be shown in the bar chart.

2.6 Limitation of Bar Charts:-

There are certain limitations of the bar Chart.

(i) If the time schedule is changed, it is difficult to readjust length & position of bar.

(ii)Bar chart can only be applicable for small projects.

(iii)The bar chart doesn't show clearly the independence among the various activities.

(iv)The bar chart doesn’t show actual progress of the work as it only represent the estimated time.

(v)The critical activities of the project are not shown in the bar chart.

(vi)The bar chart doesn’t reflect uncertainties of time in activity duration.

(vii)The bar chart doesn’t give any idea about the financial aspects rather than physical progress.

(viii)It doesn’t give any idea about maximum progress necessary for completion of work.

(ix)In case of variation from planned programme, it is difficult to found out alternative course of action.

(x)The sequence of operation is not clearly known as various activities are shown in one chart.

(xi)The bar chart doesn’t help the work of controlling, monitoring and updating the project.

2.7 Construction Scheduling By Network Techniques:-

- Network approach to action planning is a notable advancement in management science in which the projects are broken down to individual jobs or events and arranged in a logical sequence.
- The time estimates are made for execution of these individual jobs.
- The network techniques help in identifying those events which controls the completion of project.

- PERT and CPM are two method of network analysis.

Critical Path Method (CPM):-

- This method is a network technique most suitable for dealing with large and complex projects.
- This method is developed by a German construction company in 1957.
- This help to determining how best to reduce the time required for performing production, maintenance and construction and to minimize the direct and indirect cost of the project.

Different terms used in CPM:-

1. **Activity:-** An activity is a scheduled phase in a project plan with a distinct beginning and end. An activity usually contains several tasks upon completion of which the whole activity is completed. It is denoted by an arrow. The tail of the arrow indicating the start of the activity and head indicating the end of the activity.

2. **Dummy Activity:-** Dummy activity is a hypothetical activity which requires zero time and zero resources for completion. Dummy arrow represents an activity with zero duration. It may be represented either by a dotted arrow or solid arrow with zero time duration.

3. **Eevent:-** It is a stage or point in a network where all previous jobs merging in it are completed and the jobs originating out, are still to be completed. These are represented by circles or mode of junctions of arrows and are serially numbered in their sequential order.

4. **Network:-** The flow diagram or diagrammatic representation of the activities of the entire project is called network.

5. **Early Start Time (EST) :-** The earliest possible time at which an activity may start.

6. **Early Finish Time (EFT);-** It is the sum of EST of an activity and time required for its completion i.e. EFT=EST+t

7. **Late Start Time (LST):-** The latest possible time at which an activity may start without delaying the date of the project.

8. **Late Finish Time (LFT):-** The sum of LFT of an activity and the time required for its completion i.e. LFT=LST+t

9. **Total Float:-** The difference between the maximum time allowed for an activity and estimated duration is called total float. It is the duration of time by which an activity can be start late, without disturbing the total project schedule.

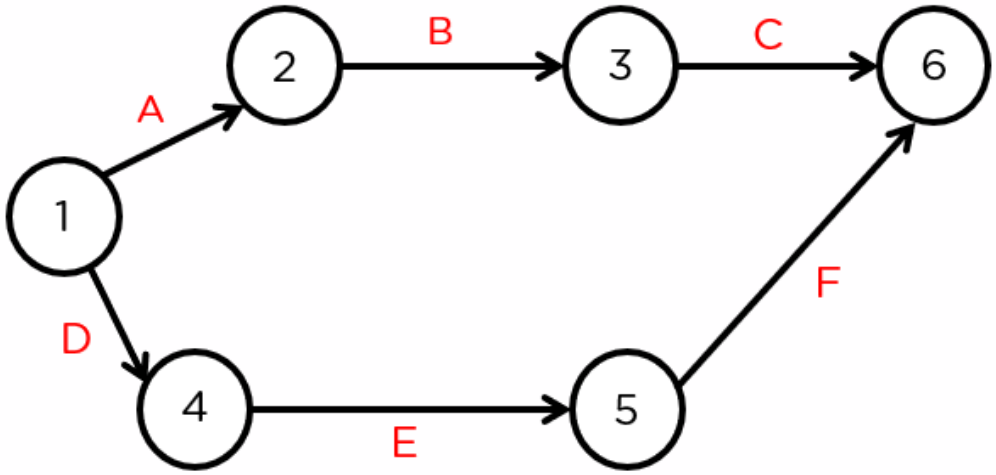
10. **Free Float:-** The duration of time by which the completion of time of an activity can be delayed without affecting the start of the succeeding activity.

11. **Critical Activities:-** The activities with zero float are called critical activities, which are required to be completed on schedule.

12. **Critical Events:-** The start and end points of critical activities.

13. **Critical Path:-** The path of network joining the critical events along with no float is called critical path of network.

Example of CPM:-



Problem 1

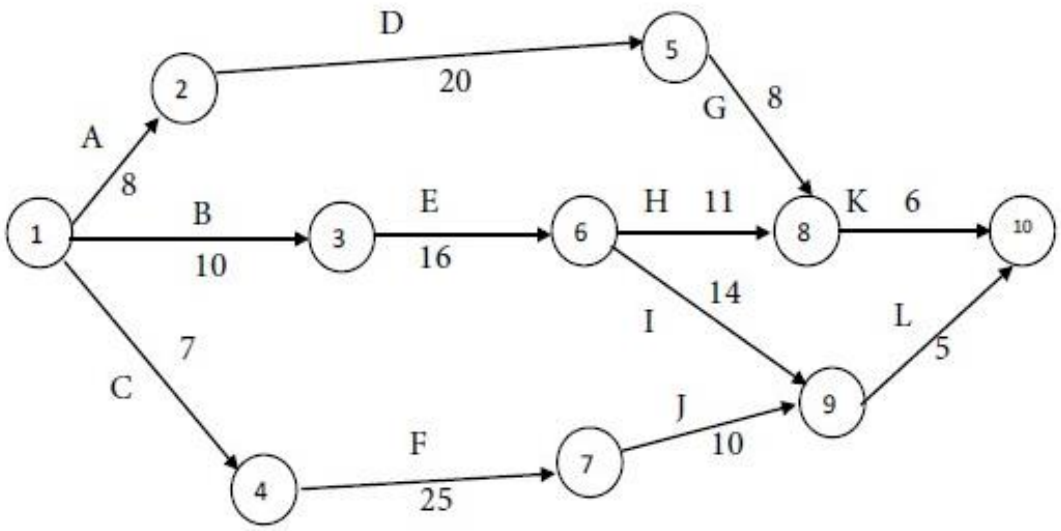
The following details are available regarding a project:

Activity	Predecessor Activity	Duration (Weeks)
A	-	3
B	A	5
C	A	7
D	B	10
E	C	5
F	D,E	4

Determine the critical path, the critical activities and the project completion time.

Problem 2

Find out the completion time and the critical activities for the following project:



Advantages of Critical Path Method (CPM):

It has the following advantages:

1. It figures out the activities which can run parallel to each other.
2. It helps the project manager in identifying the most critical elements of the project.
3. It gives a practical and disciplined base which helps in determining how to reach the objectives.
4. CPM is effective in new project management.
5. CPM can strengthen a team perception if it is applied properly.
6. CPM provides demonstration of dependencies which helps in the scheduling of individual activities.
7. It shows the activities and their outcomes as a network diagram.
8. It gives a fair and concise procedure of documenting of project.
9. It helps in determining the slack time.
10. An explicit and clear approach of communicating project plans, schedules, time and cost performance is developed.
11. It is extensively used in industry.
12. It helps in optimization by determining the project duration.

Disadvantages of Critical Path Method (CPM):

It has the following disadvantages:

1. The scheduling of personnel is not handled by the CPM.
2. In CPM, it is difficult to estimate the completion time of an activity.
3. The critical path is not always clear in CPM.
4. For bigger projects, CPM networks can be complicated too.
5. It also does not handle the scheduling of the resource allocation.
6. In CPM, critical path needs to be calculated precisely.

Programme Evaluation and Review Technique (PERT) :-

- PERT is a project network analysis technique used to plan and control large construction projects.
- It focuses on the relationship between the time each activity takes, the costs for each activity and the resulting time and cost for the expected completion of the entire construction project.

- PERT technique is used for scheduling and controlling the projects whose activities possess considerable degree of uncertainties in their performance time.
- It has different time estimates for each activity of the network such as optimistic time, most probable time, expected time, or average time etc.

Different Terms used in PERT:-

1. **Event**:- The start and finish of an activity is called an event. It is represented by a circle.

2. **Activity**:- The actual performance of a task is called an activity. It is represented by an arrow.

3. **Optimistic Time**:- The least amount of time it can take to complete a task is called optimistic time. It is usually denoted by " t_0 ".

4. **Most Probable time**:- The most realistic estimate for time, which an activity may take for its completion under normal condition is called most probable time. It is denoted by " t_m ".

5. **Pessimistic Time**:- The maximum time that may take by an activity, If there is delay at every stage except natural calamities is called pessimistic time.

6. **Expected time or average Time**:- The expected time is nothing but the pre-estimated time within which the Project is supposed to get completed. This particular time is mutually agreed upon by the Parties or decided jointly in presence of

all the Stakeholders, Contractors & Clients while signing the Project Contract.

$$t_e = \frac{t0 + 4tm + tp}{6}$$

7. **Earliest Expected Time (T_E)**:- It is the time when an event can be expected to occur earlier. It is equal to sum of the expected time of the preceding activities.

8. **Latest allowable Time (T_L):-** It is the largest possible time an event can take without delaying the final completion date of the project.

9. **Slack Time:-** The difference between the latest allowable time and earliest expected time is called slack time.

   Slack = T_L - T_E

10. **Critical Path:-** The path of network of a project along which there is no slack is called critical path. In other word, longest duration path of a network is called critical path along which sum of the expected times of all activities is maximum.
11. **Length of the Project:-** The sum of the expected times of all the activities along the critical path of the network of a project is called length of the project.
12. **Standard deviation of an ativity:-** It is calculated by,

$$S_t = \left(\frac{tp-to}{6} \right)$$

13. **Variance of an activity :-** Variance of an activity is calculated by,

$$V_t = \left(\frac{tp-to}{6} \right)^2$$

14. **Variance of the Project**:- The sum of the variance of all the activities along the critical path of the network of a project is called variance of the project.

15. **Standard deviation of the project**:- The square root of the total variance of a project which is calculated along the critical path of its network is called the standard deviation of the project.

Advantages of PERT :-

The advantages of PERT are mentioned below:

1. Planning For Large Projects
2. Visibility of Critical Path
3. Analysis of Activities
4. Coordinating Ability

Disadvantages of PERT:-

Various Demerits of PERT are mentioned below:

1. Time-Focused Method
2. Subjective Analysis
3. Inaccuracy due to Prediction
4. Expensive

Difference between PERT and CPM :

S.No.	PERT	CPM
1.	PERT is that technique of project management which is used to manage uncertain (i.e., time is not known) activities of any project.	CPM is that technique of project management which is used to manage only certain (i.e., time is known) activities of any project.
2.	It is event oriented technique which means that network is constructed on the basis of event.	It is activity oriented technique which means that network is constructed on the basis of activities.
3.	It is a probability model.	It is a deterministic model.
4.	It majorly focuses on time as meeting time target or estimation of percent completion is more important.	It majorly focuses on Time-cost trade off as minimizing cost is more important.
5.	It is appropriate for high precision time estimation.	It is appropriate for reasonable time estimation.
6.	It has Non-repetitive nature of job.	It has repetitive nature of job.
7.	There is no chance of crashing as there is no certainty of time.	There may be crashing because of certain time boundary.
8.	It doesn’t use any dummy activities.	It uses dummy activities for representing sequence of activities.

9.	It is suitable for projects which required research and development.	It is suitable for construction projects.

Problem-1:-

If 6, 8 and 12 days are optimistic time, most probable time, pessimistic time estimates of an activity respectively, calculate the following for the activity

a) Expected time (t_e)
b) Variance (V_t)
c) Standard deviation (S_t)

Problem-2:-

Two experts A and B examined an activity and arrived at the following time estimates.

Expert	Time Estimate		
	t_o	t_m	t_p
A	4	6	8
B	4	7	10

Determine which expert is more certain about his estimates of time.

Problem-3:-

Find out the time required to complete the following project and the critical activities:

Activity	Predecessor Activity	Optimistic time estimate (to days)	Most likely time estimate (tm days)	Pessimistic time estimate (tp days)
A	-	2	4	6
B	A	3	6	9
C	A	8	10	12
D	B	9	12	15
E	C	8	9	10
F	D, E	16	21	26
G	D, E	19	22	25
H	F	2	5	8
I	G	1	3	5

Chapter – 3 Materials And Store Management

INTRODUCTION:-

- For the execution of different kinds of works in public work department, different types of material and equipment are required.
- It is necessary to maintain a store of various types of construction material at one or more place in a division so that the execution of work will be efficient.
- Before start of any work material should be arranged well in time.
- The safe custody and proper distribution of store materials are the responsibility of its Divisional Officer.
- So Store and material management is an integral function of different sections of the organisation.
- It deals with the supply of material and other related activities and aims at minimum expenditure on materials.
- Material management deals with the overall activities of materials such as type, amount, movement, purchase, location, and timing of various materials which are used in an organisation.

Objective of material management :-

• To select the right quality

• To meet the production requirements

• Selection of suppliers

• Limit the Wastages

• Product enhancement

• Forecasting

• Standardization Process Objective of material management

• To select the right quality

• To meet the production requirements

• Selection of suppliers

• Limit the Wastages

• Product enhancement

• Forecasting

• Standardization Process

Function of Material Management:-

These are the main functions of material management.

I. Material planning.
II. Material Purchasing.
III. Store and store administration.
IV. Inventory control.

3.1 Classification of stores:-

Stores can be divided into four categories according to public work department.

1. Stock

2. Tool and plants

3. Road metals

4. Material charged directly to works.

Stock:-

The stock is the store which is required for general work and kept under suspense head and finally issued for the work.

The items which are in common use in the construction activity for the execution of different works are kept in stores. Such materials of general use such as cement, timber, bricks, aggregates, steels, paints etc. are kept in store are called as stock.

Reserve stock limit

The maximum amount of materials that can be kept in a stock in a division is fixed and is known as the reserve stock limit.

The limit is fixed by the Government keeping into consideration the normal requirements of stock in the division.

Note

'Stock' is a suspense head of account. When an item of stock is purchased, its cost is debited to the suspense head 'Stock'.

When the item is issued for use in a work, the cost of the item issued is credited to the suspense, head 'Stock' and debited to the final head of the work concerned.

Subhead of stocks

The various materials of similar nature grouped under different heads to facilitate the proper maintenance of stock account are known as sub-head of stock.

The following are some of various sub heads of stocks

1. Small stores (like nails, screws, hinges, bolts, etc.).
2. Building materials (like cement, aggregates, bricks, lime, etc.).

3. Timber (like deodar, chir, plywood, hardboard, etc.).

4. Metals (like mild steel bars, rolled steel sections etc)

5. Fuel (like kerosene, coal, etc.).

6. Painter's stores (like paints, varnishes, etc.).

7. House fittings (like bathroom fittings, pelmets, etc.).

8. Miscellaneous stores (like cord, wood preservatives, fertilisers, etc.)

9. Lands, kilns, etc. (like road metal quarries),

10. Manufacture (i.e. manufacture in Government workshops).

11. Storage (i.e. charges incurred on the storage of articles, such as rent of go-downs, payment to work charged store establishment.

3.2 Issue of materials:-

- The store keeper can issue the materials to different departments upon the receipt of a withdrawal form with proper authority and it is called as material issue requisition form.
- Depending upon the nature and amount of material to be withdrawn from stores the material requisition is prepared in duplicate by the manager.
- Both the copies are sent to the store keeper who issues and records the materials distributed.

Indent and Invoice

- The material from the stores is procured by the process of indenting.
- Materials received from the stock on demand in a proper form called indent form.

- Indent form consist in triplicate of counter foil, indent and invoice.
- The counter foil and indent part of the indent form filled by the Indent officer.
- Then this form with blank invoice sent to the issuing officer in charge of the stock.

• Invoice is an indent having list of articles actually should and giving price and particulars of the articles.

• Then the issuing officer corrects the indent and fills up the invoice. • Then the issuing officer sends it back to the indenting officer to sign the invoice and they return it to him as an acknowledgement.

Rules for preparing indent and invoice :-

Indent is prepared on the prescribed form P.F.R-26 which is in indent book. Each indent book consists of book No. and has 100 leaves in triplicate.

Some points are to be taken into consideration while filling up indent form:-

• There should be description of unit of supply and quantity of material

• The cost of materials of the head of account should be specified

• The name of work should be given when the material is issued.

• Full details of department, division and any other person for which the materials are issued should be given.

The preparation of indent is done by indenting officer in triplicate with a carbon copy and these are forwarded to the supplying officer.

Bin Card

• Bin Card is a card which maintains the details of quantities of each type of material received issued and on hand each day.

• The material and other items are kept in appropriate bins, drawers etc. The store keeper maintains the record on a Bin Card.

• A bin or shelf is attached to each bin card.

• Bin cards are made in duplicate

• One is attached to the bin and another is for the store keeper.

Company Name

Bin Card

Bin No.....
Description.....
Code No.....
Stores Ledger Folio.....

Minimum Level.....
Reorder Level.....
Reorder Quantity.....

Date	Receipts		Issue		Balance	Stock Verification	
	Ref. no.	Quantity	Ref. no.	Quantity	Quantity	Date	Initials

Procedure for store accounting

Final head

The cost of acquisition of stores is debited to the particular work for which they are required. This is known as final head of account.

Suspense head

Suspense head includes the temporary booking of expenditure incurred for the purchasing of materials for the execution of work is debited to the final head of the expenditure is debited to the minor head i.e. suspense expenditure.

a. The procedure for store accounting is done separately for various classes of stores such as stock, tools and plants, road metals and other miscellaneous material.

b. When the stock is placed then the store is debited to suspense head .When the stock material is issued for the execution of a particular work then it is debited to the final head.

c. The supply of tools and plants in the division and its expenditure is debited to the minor head sometimes for general use special items of tools and plants are not required but for a specific work they are debited to that work.

d. For certain road the road metal is required for the construction its cost is debited to the estimate of that road construction and once the road metal is required for the maintenance of the road it is debited to the sub head under minor head.

e. Similarly for other materials if the materials are purchased for general requirement then the cost is debited to the suspense head.

f. The initial account of all receipt and issues is maintained by the section officer.

g. After closing the monthly account section officer forwards its to the sub divisional office.

Physical Verification And Inspection of stores Necessity:-

Inspection of stores and its physical verification is essential for fulfilment of following,

(i) To ensure the correctness of stock held by comparing them with the balance shown in the store ledger or bin cards.
(ii) To avoid shortage of materials in the stock.
(iii) To check losses in inventory due to pilferage, improper storage or misplacement, deterioration etc.
(iv) To correct and update store records.

(v) To calculate the values of the stock carried for the balance sheet and profit and loss account.
(vi) To calculate the rate of turn-over of an item.
(vii) To ensure maximum economy in stock carrying.
(viii) To effect insurance covers.

Method of Physical Stock Verification:-

- Annual physical Verification
- Perpetual Inventory and Continuous Stock Taking System.

Annual physical verification

The following procedure is adopted for carrying out the annual physical verification.

(i) By the end of the year, the stores are closed for a few days; no material etc. is issued to any project work/shop in the plant. In case it leads to plant shut down, the activities such as repair and over hauling of equipment and machineries are resorted to.

(ii) A team of stores inspectors or stores verifying officers physically check and count each and every item lying in the entire store. It is tallied with the quantities marked on bin cards and store ledgers.

(iii) Step (ii) above may lead to the formation of a list of surplus and short items. Damaged and obsolete items may also be traced and recorded.

(iv) Inspectors check a number of items every day as per a pre-planned schedule and finish the complete work within a few days.

(v) In this method all the items are checked at one time, so there is no confusion about any item being left unchecked.

Perpetual inventory and continuous stock taking

Perpetual inventory and continuous stock taking system is a more appropriated method for large plant with huge inventories which records store balances after every receipt and issue and facilitates regular checking.

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

(ii) Discrepancies found if any, owing to in correct entries, breakage, pilferage, over issue, placing of items in the wrong bin etc. are investigated and corrected accordingly.

• This method is less costly

• In this method only few items are required to check every day as compared to annual physical verification.

Procedure for write off :-

• The articles of tools and plants get worn out by continuous use and become unserviceable. They can be written off only with the approval of the competent authority. A survey report of all the unserviceable articles is prepared on D.F.R. (P.W.)-15 giving full particulars of their value, date of purchase and reasons for their becoming unserviceable.

• The survey report is submitted to the competent authority for approval. As a general practice, the articles which are written off are destroyed in presence of a gazette officer.

• As regards the articles of stock, which get deteriorated, an estimate for the loss of stock is prepared. The tools and plants articles are written off after preparation of survey report.

• DFR- Document Filing and Retrieval Form

Example

Prepare a Write off in respect of following Articles of tools and plants.

• Name of the sub division- Killamaidan

• Name of the Division and Circle-Cuttack

• 10 nos, of metallic tapes 30m purchased on 6.5.2004 for Rs. 5000/ • 04 nos. of brass pad locks 7.5cm size purchased on 2.6.1999 for Rs. 1200/

• 1 time piece (Ajanta Make) purchased for rest house OMP square on 3.10.2006 400/ These articles became unserviceable through fair wear and tear.

CH-4 - CONSTRUCTION SITE MANAGEMENT

4.1 JOB LAYOUT- Objectives, Review plans, specifications, Layout of equipment:-

JOB LAYOUT:-

• Job layout is drawing the prepared plan of construction site by the site engineer in-charge of the project. The arrangements made at the construction site for different camps and the area around it is known as job layout.

OR

• Job layout is a scaled diagram of the proposed construction site showing all the relevant features such as, Entry point, Exit point, Storage areas of materials, Temporary services like Contractor's site office, Areas for keeping equipment such as mixers Bar, bending area, Labour Housing etc.

Objective of preparing job layout:-

Following are the objective of job layout.

• It saves time in delivering the construction materials at the site.
• The best method of working may be adopted.
• It helps to complete the work within the minimum use of equipment.
• The maximum output from labour and machines can be taken.
• It provides safety to the workers.
• It helps to avoid damage to the nearby properties due to construction work.

• It plans for the construction materials to be placed as near as possible to the work Following are the objective of job layout.
• It saves time in delivering the construction materials at the site.
• The best method of working may be adopted.
• It helps to complete the work within the minimum use of equipment.
• The maximum output from labour and machines can be taken.
• It provides safety to the workers.
• It helps to avoid damage to the nearby properties due to construction work.
• It plans for the construction materials to be placed as near as possible to the work.

REVIEW PLAN :-

• Before preparing a job layout the details of different plans for the execution of the work should be studied carefully.
• Site plan
• Working drawing
• Specification

Site plan

The site plan shows
• The boundaries of the site
• The adjacent area of the boundary of the construction site.
• Location of any existing building standing near site.
• Space left around the building to secure verification or free air condition.
• Space left around the building for cleaning and admission of light.
• Position of any natural drains, rivers, Wells located near the site.
• Any other information which are considered to be necessary.

Working drawing

• The working drawing consists of the building plans and other works to be constructed at the site. The working drawings include;

• Floor plan of the building with covered area, size of the room, opening of doors & windows, structural members, staircase, lifts etc.
• Elevation of all sides is shown.
• Indication of direction of North line in the plan of buildings.
• Indication of rejected persons beyond the permissible building line.
• Locating exactly of the essential services like Water closet, sink, bath etc.
• Showing sectional details drawing of footing thickness of world current slabs with their material.

Specifications

Specification indicates the details of the types and grade of the material to be used in construction work which was signed duly the authority or engineer and shall be available at the working place before start of any work.

Specification is an important document in the construction industry which helps the designer to come and get It is thought and ideas to the other construction team members.

Type of Specification:-

i. Standard Specification:-The Specification prepared for the general use of trade e.g. Indian standard specification.
ii. Outline Specification:- These are the specifications used at the time of biding & prepared usually to accompany the preliminary drawings of the work. It provides the basic information about the type & grade of the materials to be used for construction work.
iii. Project Specification:- These are the specifications which are prepared for a particular project taking into account for the special requirement.
iv. Guide Specification:- These are prepared to guide the specification which is prepared the project originally.

v. Manufacture's Specification:- These are prepared by the manufactures to specify the quality of the products manufactured by them.

Use Of Specification:-

- To prepare the estimate for submission of tender.
- It is useful for the contractor to order the materials for executing the work.

Factors affecting selection ,design & layout at construction site:-

i. Nature of project
ii. Location of project
iii. Services
iv. Availability of material & equipment
v. Availability of manpower
vi. Medical facility
vii. Availability of space
viii. Other miscellaneous factors

I) Nature of the project

The nature of the project plays an important role in its layout process. The camp layout depends on the nature and types of project. For example the layout of camp for a highway construction project will differ from that of a building.

II) Location of project

Location of the project also plays an important role in job layout plans the location project should be properly chosen such that there will be no difficulty for any type of climatic situation and transportation. So transportation facility to the construction site is an important factor for job layout.

IV) Services

There should be proper service of water supply ,sanitation and electricity. If these services are not available then it will be badly affect the job layout.

V) Availablity of Material & Equipments

There should be sufficient availability of materials and equipment at the construction site. If the materials and equipment are not available locally then it will create problem in storage which will affect the shape of job layout.

VI) Medical facility

If the project is for a long time it is essential to have a field medical aid facility for the workers.

VI) Availability of man power

Man power is an important resource in any construction site. The arrangement of manpower at construction site should be made locally otherwise it will be a great difficulty for their shelter. So labour should be arranged locally.

VII) Availability of Space

If less space available at the construction site, then it will be difficult for job layout because the storage should have to be located nearest the regular supply of material & equipment.
Urgent availability of material may not possible as required.

VIII) Other miscellaneous factors

There should be availability of education facilities like schooling for the children of labours and staff, daily necessities of life and other welfare facilities for the workers. If these facilities are not available then it will also tend to change the layout of the project.

Layout Of Equipment

These are the some points which are to be considered at the time of preparing layout of equipment,

i. The equipments should be placed as near as to the place of materials.
ii. The maintenance, repairing & fuel filling of equipments should be arranged at the construction site.
iii. There should be arrangement of security staff for the safety of machinery.
iv. For removal & shifting of equipments to the work place, there should be availability of sufficient space.
v. There should be adequate space available for parking of transport vehicle.
vi. Temporary sheds should be provided as safe guard for the costly equipment form any type of weather condition.
vii. The main entrance of project work and the main office of the establishment should be nearer to each other, so that no visitors have to cross the work site.
viii. No material can pass out of the project work without the proper check by the security check posts.
ix. There should be provision of adequate safety measures and fore prevention equipment at in the work site.

4.2 Location of equipment, Organizing Labour at Site:-

Location of equipments

Why equipments required?

As there is an increased cost of labour, the use of more & more mechanical equipments becomes necessary for construction work very often the available manpower is not sufficient for the completion

of construction work with in stipulated time, so it is essential to use mechanical equipments along with the available manpower for the construction activity. So there should be a careful consideration for correct choosing at right equipment. For a construction project to be completed within the scheduled time economically, it is essential to choose the correct and well-operated equipments.

For the location of equipment following points are to be considered.
(i) Equipments should be nearer to the construction work.
(ii) Equipment should be near to the materials.
(iii) The owned equipments may be provided near the entrance so that there will be no requirement of any additional guard.
(iv) The hired equipments should be placed in suitable places and the vacant place may be left where it can be accommodated.
(v) The maintenance, repairing and fuel filling of equipment should be arranged at the construction site.
(VI) There should be adequate space available for parking of the transport vehicles like trucks tractors etc.
(VII) Temporary sheds should be provided to safeguard the costly equipments from any type of weather condition.

Organising labour at site

Organizing labour properly at the working site is an important responsibility of the supervisory staffs.
The labours are divided into different groups by the supervisor under the guidance of effective leader who has the quality to control the labours.
Proper way of organising of labours results the completion of work within the stipulated time period.
So it is very essential to organize the labours at the construction site.

For example Suppose 10 labours and one supervisor are put for beam casting the division of the labour may be.
(i) For bringing the aggregates, three labourers are put.
(ii) For mixing the ingredients one labour is put.
(iii) Four labourers are put on some other work.
(iv) For compaction purposes two labours are put.
There are some points which are to be considered while organising labour at construction
(i) Re-handling of material unnecessarily should be avoided.
(ii) Supply of material should be sufficient as per requirement of labour.
(iii) Labour supply should be uninterrupted.
(iv) The materials should be taken once for the whole day from the go-down. It reduces the frequent movement of labour.
(v) There should be some permanent labours as it is economical.
(vi) Increasing and decreasing of labour should be done as per necessity.
(vii) To avoid wastage of time of labour, minimum facilities should be made available
(viii) Also to save wastage of time of labourers, drinking water facility should be made available at the site.
(ix) A record should be maintained about the progress of the labour.
(x) Record maintain once will help to compare the progress of work with the completion of work at right time at the site.

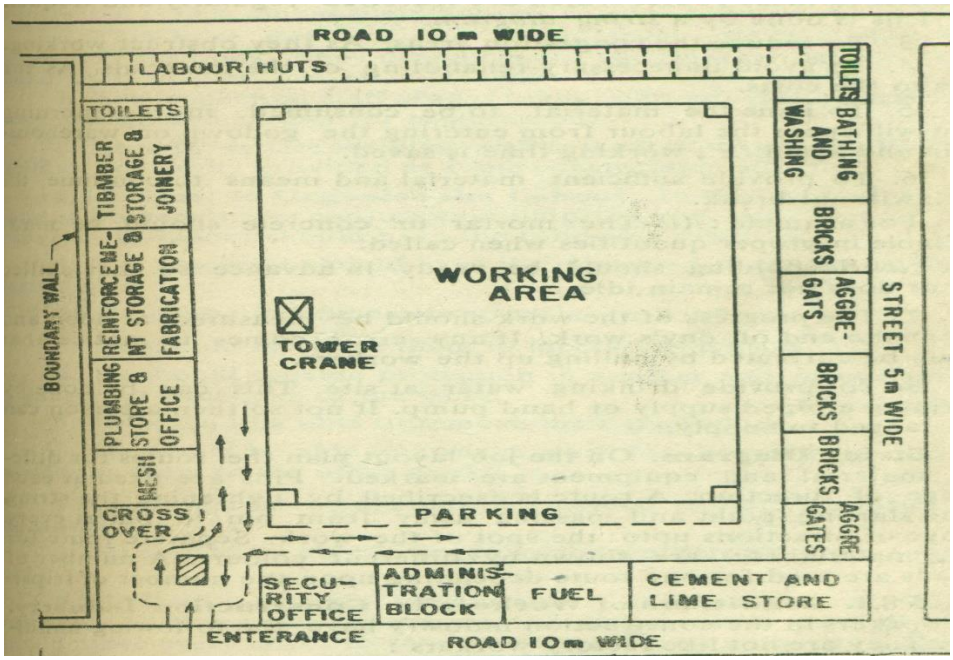
4.3 Job Layout for Different Construction Sites:-

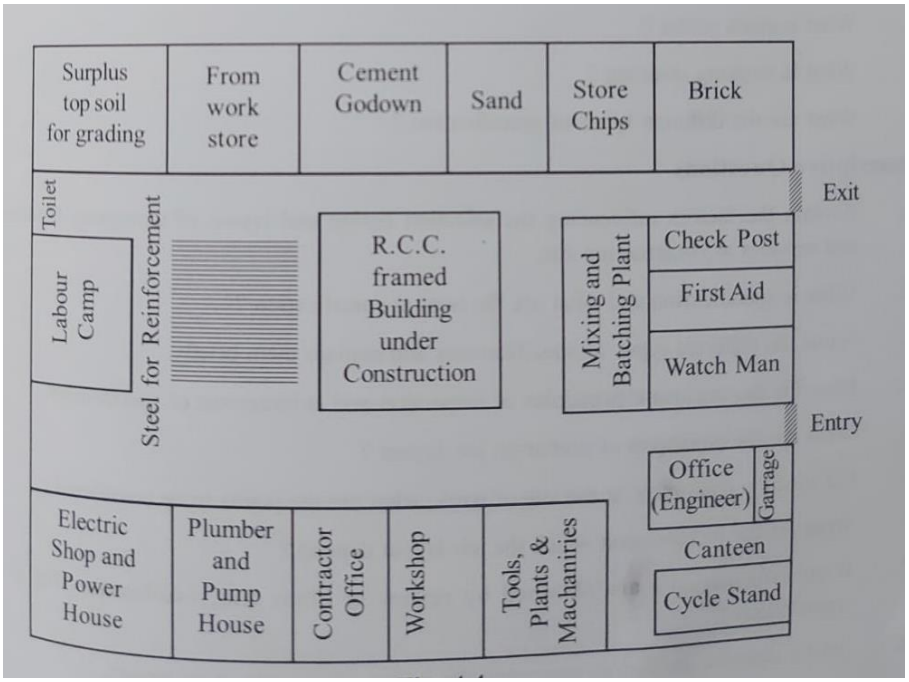
Preparation of job layout

• The construction plans, specifications, contract documents and other available material describing the job should be studied carefully in order to get the idea of the nature and extent of the work.
• A scaled drawing with a scale of 1 in 100 should be prepared showing the outline of the work or job to be constructed.
• Also the position of entry and exit points as well as the areas of temporary facilities should be marked on it.

Moreover following information should be collected from the above study,
• Area needed for accommodation: This area includes the area required for office. Stores and residential accommodation for officers, staff and labour.
• Area required for machines, sheds, repair shops and workshops etc.
• Area for security and fine fighting facilities.
• Area required for construction work.
• Area for miscellaneous amenities such as canteen, toilets, dispensary etc.
• Length of period for which area may be available.

Job Layout plans of multi storeyed building:-





4.4 Principles of storing materials at site :-

The materials should be stored in proper manner at the construction site. The following are the important principles which are to be considered for storing materials.

• Materials should be stored at the construction site so as to prevent mixing of foreign matter.

• Materials should be stored in such a manner as to protect it from any weathering agent like rain, sun and wind.

• Materials which are suspected to get fire easily should be prevented from fire hazards i.e. the products like petroleum and explosives should be stored properly.

• Precast beams pieces of timber and slabs which are likely to be affected by the soil or support should be stored with properly adopted measures.

• Materials like cement bags which are easily affected by the contact of the moisture are to be stored with special precautions.

• The material regularly used is to be placed relatively nearer to the place of use.

• There should be proper arrangement of fire extinguisher and fire buckets wherever necessary for the safety measure.

Ch – 5 Construction Organisation

5.1 Introduction – Characteristics, Structure, Importance

ORGANISATION:-

For any successful business, a sound organisation is highly essential.

Better the organisation, the more is the achievement of the common business objectives.

Organisation is the foundation upon which the business management is dependent.

Organisation is a large group human association united together for the attainment of business objective.

Man, material and Machinery so that are the three elements which have importance for every business.

An organisation maintains co-ordination between man, material and machinery so that maximum output is achieved.

It is one of the major tasks of the chief executives to build an organisation, and also to fit the right person in the right place so that it will help the organisation to achieve the goal efficiently and economically.

Administration, management and organisation are the three factors which are needed for the executing a construction project.

Characteristics of Organisation:-

I. The organisation should have a common business objective.
II. It is a group of small or large number of people.
III. It should be executed by a proper leadership manner.

IV. It should have a clear cut show of responsibilities and duties for the people associated with it.
V. It maintains relationship between the administration and management.
VI. It should have a definite and fixed boundary of fixation of duties and responsibilities among employees.
VII. It should be flexible nature.
VIII. The organizational structure should be clear to have coordination between different departments in it.
IX. Organisation should have a central coordination system of imposing collective decisions.

Structure of an organisation:-

Organisation structure specifies the various job tasks and shows how job tasks are formally divided; grouped and co-ordinated.

Organisational structure covers the overall arrangement of an organisation.

It provides an appropriate framework for intra relationship and also indicates the hierarchy of authority and the reporting relationships.

So organisational structure coordinates the relationship between the various positions in the organisation.

There are some elements with which each member of the organisation should be familiar with. Following are the main elements:-

- Members of the organisation should understand about the well-defined goal of the organisation.
- They should be familiar with the rules, regulation, policies, and procedures of the organisation.
- They should know with whom they have to work.
- They should understand their duties and responsibilities towards the organisation.
- They should understand the delegation of the authority and responsibility.

Importance of organization:-

- For a successful business, a sound organisation is highly important.
- Organisation enables a large group of people working effectively together for a common goal.
- Only a sound and well-designed organisation can maintain the co-ordination between the management and administration.
- Organisational diversification or expansion of organisation can only be possible by a well-planned & well-designed organisation.
- Effective use of man power can also be possible by a sound organisation.
- A sound organisation makes an optimum use of raw materials and resources.
- Wastage and expenditure is less in a sound organisation.
- A sound organisation always stimulates the people for better, creative and innovative ideas.

5.2 Organisation Type- Line and Staff, functions and their characteristics

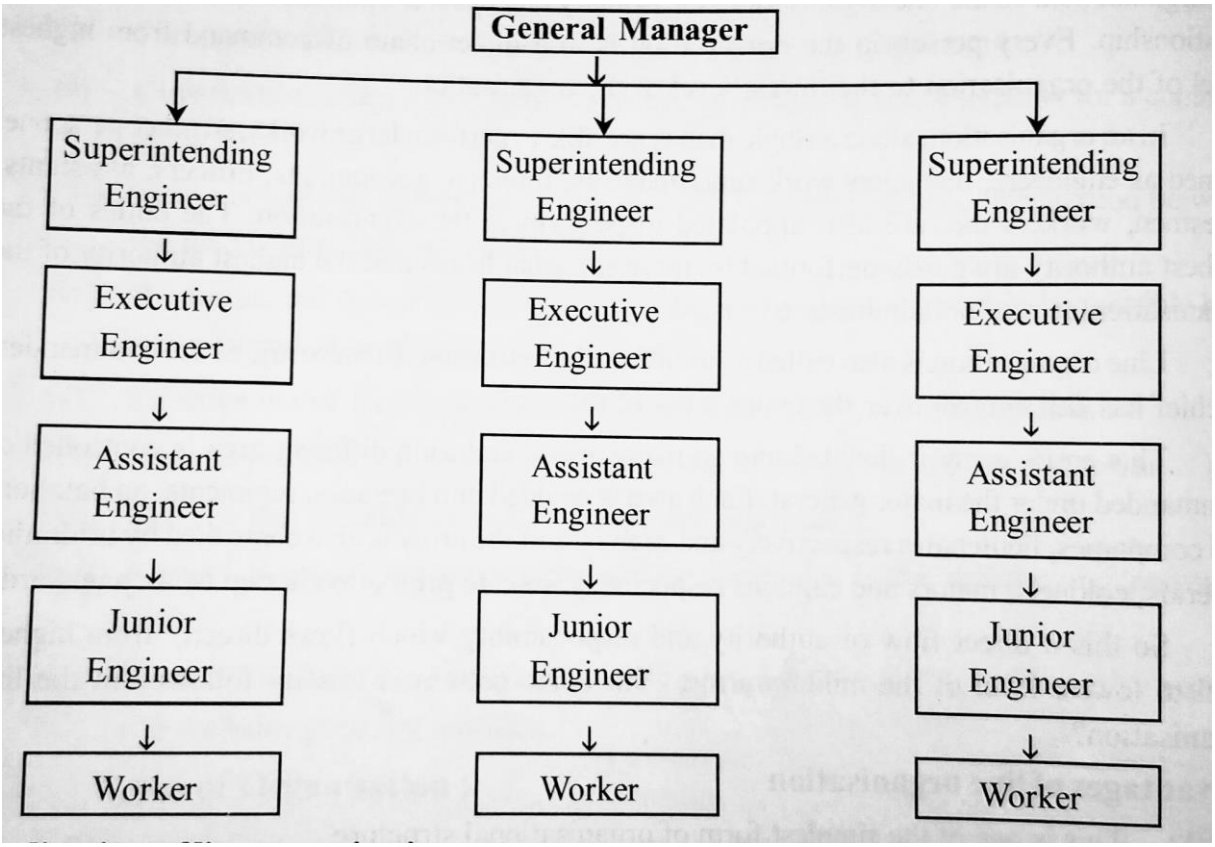
Types of organisations:-

There are different types of organise structure have been developed and the following are more common

1. Line or military organisation
2. Functional organisation
3. Line and staff organisation
4. Matrix organisation.

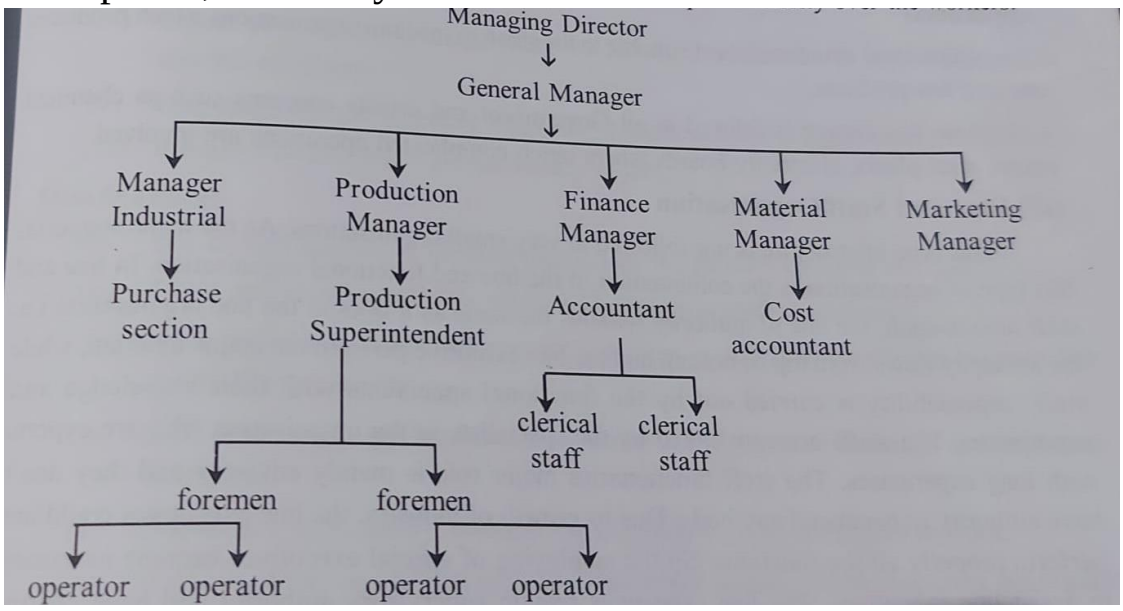
1. Line or Military Organisation:-

- Line or military organisation is the simplest and earliest form of organisation.
- This system of organisation is based upon the scalar principle.
- According to this principal when the level of authorities arranged in the structure from the chief executive at the top to the workers at the bottom the system is known as scalar principle.
- In this line structure the authority and the responsibility flows directly from the manager to foremen and from foremen to workers.
- In other words authority and responsibility should flow directly in a line vertically from the highest level of the organisation to the lowest level of the organisation.
- Line organisation is also called as military administration or military organisation.
- This is suitable for small and medium size factories, Continuous process industries like paper, sugar, textile etc. and automatic plants.



2. Functional Organisation:-

- In functional organisation the work of the management is divided in such a way that each man in organisation should have a few functions as possible to perform.
- It is widely used because of its simple logic and common sense appeal.
- Here the tasks are grouped together on the basis of common function, so that all the productive activities or all financial activities are grouped into a single function and each person is fully responsible for the function assigned to him.
- This is suitable for small and medium organisations and all Govt. and private concern like Chemical plants, steel plants, electricity board.



3. Line and Staff Organisation:-

- As the name suggest this type of organisation is the combination of the line and functional organisation.

- Here the line of authority remains the same as it does in the line organisation i.e. authority flows from top to bottom and the line executive perform the major function while staff responsibilities carried out by the functional specialist with their knowledge and experiences.
- The staffs are constituted by the specialists in the organisation who are expert with long experience.
- In this system staffs are divided into functional staff and line staff as shown in the figure below.

Advantages:-

- Line and staff organisation possesses all the advantages of the line and functional organisation
- Discipline is maintained by the line authority.
- It improves quality of product.
- It enables availability a greater variety of jobs.

Disadvantages:-

- Due to high salary of the staff executive the product cost will increase.
- There may develop jealousy between staff executives.

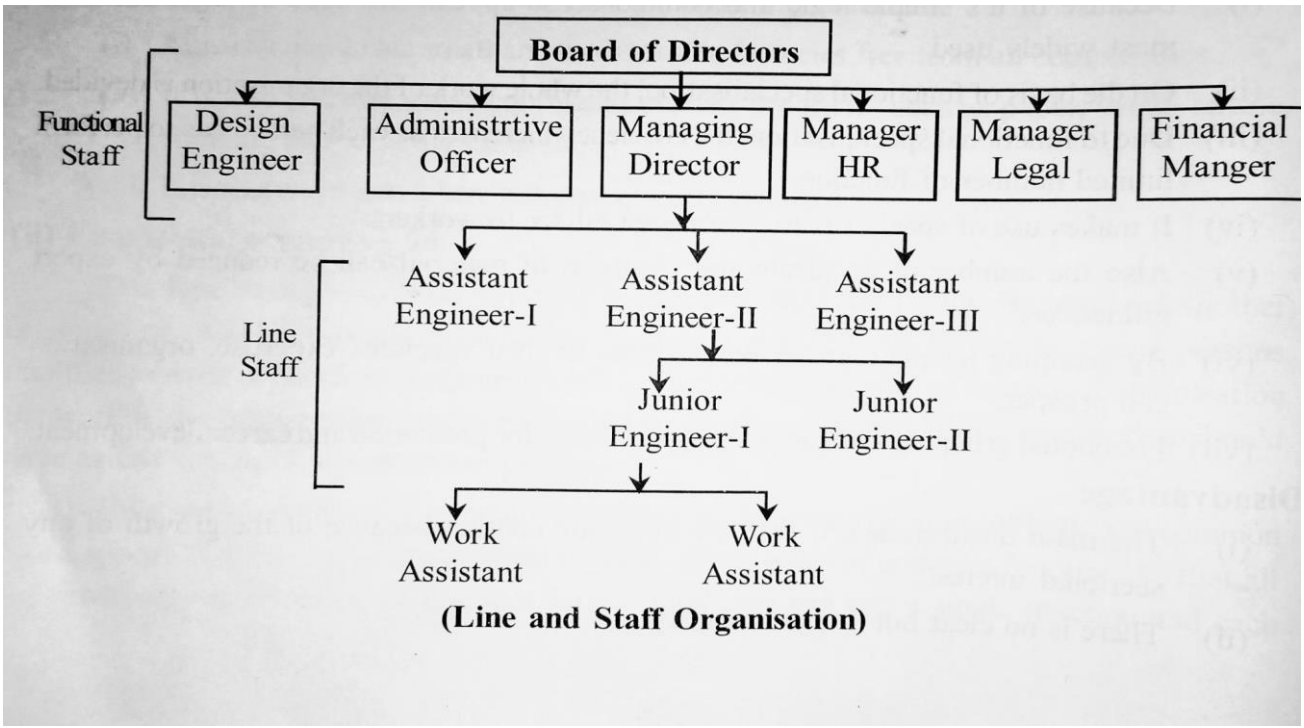
- Line staffs do not have direct authority to enforce their decision and implement their ideas.

Application of Line & Staff Organisation:-

- This organisation is best suitable for medium and large scale industries.
- It can be applicable for automobile and other intermittent industries depending upon their internal structure.

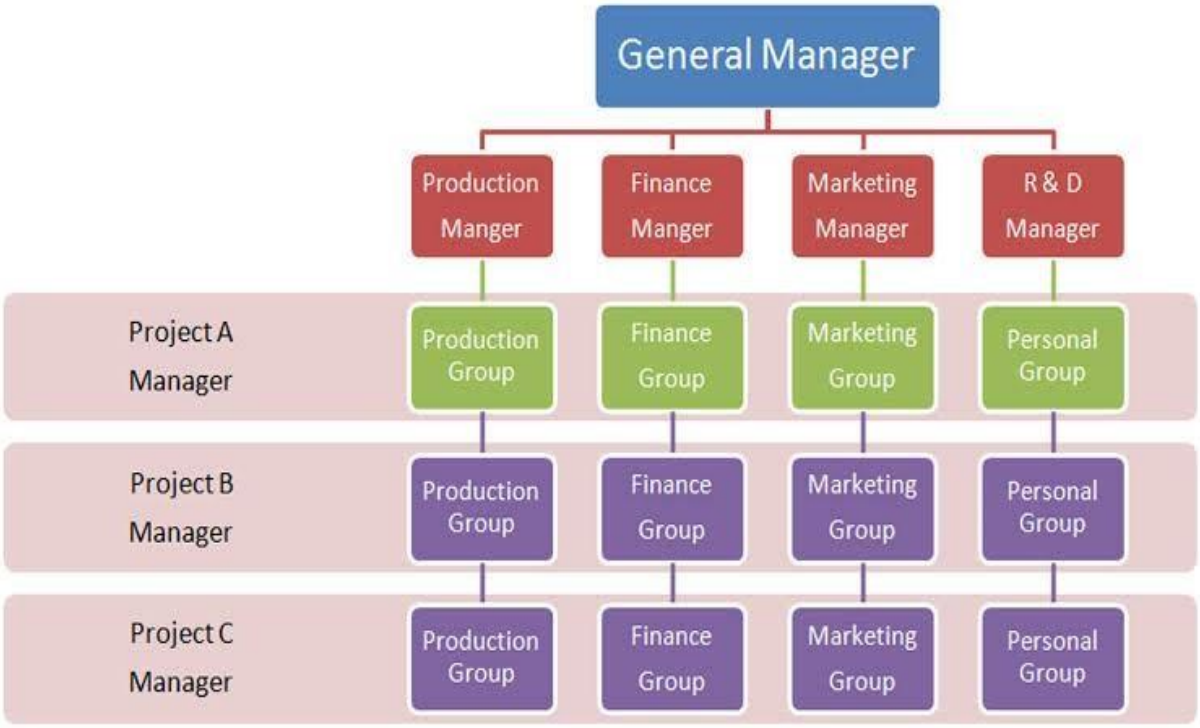
4. Matrix Organisation:-

- Matrix structure is the combination of two departments. One is functional and another is product responsibilities. Product manager is also known as project manager.
- In this system every group of employees have two bosses one is there functional department manager and another is there project manager.
- The matrix structure allows for an efficient use of resources because teams include specialists from various departments.
- These are applicable in Advertising agencies, aerospace firms, research & development laboratories, construction companies,



(Line and Staff Organisation)

hospital, insurance, banking, Govt. agencies, management consulting firm, entertainment companies.



5.3 Principles of Organisation- Meaning and Significance of terms-control, authority, responsibility, job and Task:-

Principles of Organisation:-

- Principles mean rules and regulations which can be applied under similar conditions.
- For a successful organisational relationship and achieving the basic objectives of the organisation, there are many principles which are designed with regards to the organisational need.
- Following are some common principles which are designed for organisation:-
    i. Principle of objective
    ii. Principle of division & distribution of work

iii. Principle of coordination
iv. Principle of efficiency
v. Principle of delegation
vi. Principle of authority and responsibility
vii. Principle of span of control
viii. Principle of balance
ix. Principle of communication
x. Principle of basic component of the organisation
xi. Principle of definiteness
xii. Principle of unity of command
xiii. Principle of scalar chain

Authority:-

Meaning & Significance of Authority:-

- Authority is the right to give orders and the power to exact obedience.
- Authority means the right enjoyed by any individual to make a subordinate to do the work.
- In an organisation everybody possesses some authority from top to bottom of the management.
- Authority is the right person which influences the sub ordinates to get the work done through them.
- Authority is used as per rules, regulations, policies and norms of the organisation.
- It is essential for a manager to get his work done through others.
- It is just like a chain in which the individuals act as seniors, juniors and sub-ordinates.

- An individual with an authority can force a person to do the work.
- Authority is a legal power of an individual to do certain work through sub-ordinates.
- If the sub-ordinate refuse to do a work or the sub-ordinates refuse to follow instructions given by superiors, then the superiors have the power to discharge the sub-ordinates or he may take any disciplinary action over the sub-ordinates.
- Without Authority, there will be indiscipline in the organisation.

Characteristics of Authority:-

i. Authority is a legal power or legitimate tool because it is provided by the organisation.
ii. The limit of authority is specified by the organisations, so it is limited.
iii. There may be centralised or decentralised authority.
iv. It is provided to a particular position in the organisation not to position holder.
v. It may be equal to responsibility.
vi. It must be utilised for awarding punishment to the disobedient sub-ordinates.
vii. It also utilised for the reward to the effective and efficient worker.

Responsibility:-

Meaning & Significance Of Responsibility:-

- Responsibility indicates the duty assigned to a person.
- When an individual perform the duty which is assigned to him due to his position.

- It is not a burden but an obligation to carry out the activity of an individual.
- The superior gives the responsibility to sub-ordinate to complete the assignment.
- So it is the responsibility of sub-ordinate to complete the assign the task they can satisfy their superior with their performance so delegated to them.

Characteristics of Responsibility:-

- Obligation of the sub-ordinate in the performance of the duty assigned.
- It is in the form of a continuing obligation.
- It cannot be delegated.
- The person accepting responsibility is accountable for performance of assigned duties.
- It is hard to conceive responsibility without authority.

Accountability:-

- It is the obligation of an individual to report formally his superior about the work he has done to discharge the responsibility.
- Every employee/manager is accountable for the job assigned to him.
- Accountability is the liability created for the use of authority.
- It is the answer-ability for performance of the assigned duties.
- If the sub-ordinate does a poor job, the superior cannot evade the responsibility by stating that poor performance is the fault of the sub-ordinate.
- A superior is normally responsible for all actions of groups under his supervision even if there are several layers down in the hierarchy.

- It means that the sub-ordinate should explain the factors responsible for non-performance or lack of performance.

5.4 Leadership-necessity, styles of leadership, role of leader:-

LEADERSHIP:-

- Leadership is defined as that quality is the behaviour of the individual in the guidance of the people on the desired activities.
- Leadership is the ability of a manager to build up confidence among the subordinates.
- Leadership is a process of influence a group in specific setup circumstances which encourages workers to work willingly to achieve organisation objective.
- The leader must be able to influence the behaviour, attitude and belief of his followers or sub-ordinates.
- A leader should have the qualities like influencing, motivating and enabling others to contribute towards the success of an organisation in which they are working.
- Leader should have the responsibility of arrangement for work environment of the employees so that they can achieve their effective objective more easily.
- When a group of employees in a project have a common goal performance objective then some sort of leadership is essential there to build up confidence among the employees.
- Success of leader largely depends upon his qualities and characteristics. Leaders are both born and self-made.

Necessity of Leadership:-

- It leads the group to a higher level of performance.
- It implies a motive power to group efforts.
- Leadership acts as a way of influencing, inspiring, taking actions by the authority.
- It influences the behaviour of the sub-ordinate towards achievement of organisational goals.
- Leadership plays a vital role at all levels of management because management can't achieve the goal without presence of effective leadership.
- Effective leadership creates a better understanding between the subordinates and the management.

Styles of Leadership:-

According to the attitude and behavior patterns, leaders are classified as the following

1. Autocratic or authoritarian style
2. Laissez-faire or free-rein style
3. Democratic or participative style leader
4. Paternalistic style leader.

Autocratic or authoritarian style

- This type of leader is the absolute power with him.
- Here the subordinates are completely obedient to the leader and the leader also centralized all the powers decision making in him.
- Here the subordinates have to follow the leader's orders, rules and regulation blindly or forcefully without any question.

- There is a threat of penalties and punishment to the subordinates in case of deviation.
- The most important problem is that the subordinates only do what their leader orders but they can question is as why.
- In this type there is no priority on the subordinate's opinions and suggestions or initiative.
- Such leaders give orders; assign duties and responsibilities without consulting the employees or caring for their opinion.
- So these types of leader are not a real leader.
- In this style leadership produces hostility towards their leaders and the production drops to a minimum in the absence of the leader.

Laissez-faire or free-rein style:-

- This type of leadership maintains a good relationship between subordinates and its leader because under these type of leadership the subordinates allowed there maximum freedom.
- They are given the capacity to decide their policies and programs with their own style and take their independent decisions.
- While decision making, if the subordinates require the help of the leader, then the leader provides help, otherwise the leader doesn't interfere in their work.
- But this type of leadership rarely exists because in this type of leadership the subordinates must be required to be competent, sincere and self-disciplined.
- This type of leadership creates a self-confidence and encouragement among the subordinate and also creates an opportunities to develop their talents.
- But it is not possible to work under all situations with all type of workers.

Democratic or participative style:-

- This type of leadership is the exactly middle position between two extremes of the autocratic and free rein style of leader.
- Under this style, authority is decentralized after consulting with sub-ordinates and based upon their feedbacks, the decision are taken.

- By this process of decision making the subordinates are encouraged to make suggestions while taking decisions.
- Subordinates are given chance to explore their potential in strength to complete the challenging responsibilities.
- It creates a friendly working atmosphere and reduces conflicts like strikes, industrial unrest, employees' complaints etc.
- Due to long process this type of leadership may cause delay and may create indiscipline within workers, but this type of leadership improves job satisfaction in subordinates.
- In this type, the difference in production during the absence of the leader is negligible.
- This type of leadership tends to increase the production as it wins the confidence, co-operation, loyalty and initiative from his follower.

Paternalistic style or functional style:-

- Under this style of leadership the subordinates become dependent upon the leader.
- Here the sentiments and emotions are given more priority.
- And the leader looks after his subordinates like a father looks after his children and family.
- He is supposed to help, guide and protect his subordinates but there is no chance of growth individual.
- In this case, leaders lead because of their expert knowledge and win the confidence of their followers by their superior knowledge.

Role and Function of a Leader:-

Some important functions of a leader are as follows:-

1. **Setting goals**- It is important for a leader as a functional head to layout goals and polices and also to induce the subordinates to work with confidence and zeal.

2. **Clarity of goal**- an effective leader should have clarity about the goal, vision and knowledge of what is to be done and directs the organisation with an idea of sustainability.

3. **Organisation**- This is an important function of a leader to create and shape the organisation such that it can assign roles appropriate to individual's ability to operate towards the achievement of organisational goal.

4. **Clarity about Role**- It is important for a leader to identify and clarify an effective role for focusing the future for his sub-ordinates.

5. **Link between the management and workers**- An effective leader maintains a better link between the management and the sub-ordinates.

6. **Creativity and innovation**- It is an important function of a leader to develop new ideas, models, application of technology, so that it can differentiate the organisation and help it stand apart.

7. **Achieving the task**- Leader possesses clear idea about his task and understands how it fits into the objectives of the organization. He effectively plans to accomplish these tasks.

8. **Keeping group moral high**- The leader regularly briefs the group, provides genuine consultation wherever needed and makes effective the grievance redressal procedure.

9. **Getting the best out of each member**- A leaders see each person gets a sense of personal achievement in this job. He informs the members of the group having unsatisfactory performance and helps them to improve.

10. **Team building**- He is establish clear aims, guard against over ambitious targets at the start and also without false expectations. He prepares a realistic time board programme and ensures that everyone agrees to the programme.

5.5 Human relations-relations with subordinates, peers, Supervisors, characteristics of group behavior, mob psychology, handling of grievances, absenteeism, labour welfare:-

Human Relation:-

It refers to study of the behavior of the people in groups in particular work place and in field such as industry and organizations.

Human relations cover all types of interactions among people, their conflicts, co-operative efforts and group relationships.

It is the study of the reasons for beliefs, attitudes and behaviors of persons. Sometimes causing inter-personal conflicts in personal lives and work related situations.

Human relations are the relationship between groups of people, especially between different workers in an organization.

It is important in a work-place for reducing employees' turnover, increasing productivity and fostering creativity.

Relation with Peer: We respond and reciprocate with them very easily and very firstly. They are typically the same level as us either in intelligent quotient or status or family structure or in any other way at par with us. We normally tend to be comfortable with them in terms of talking and interacting. One more reason of a person being comfortable with peers is they have similar problems and they empathize very well with each other. For example colleagues in office, friends, cousins, acquaintances, social circles, etc.

Relation with Subordinates: They are lesser either by age, experience, knowledge or relationship and that's why we feel good dealing with them and sometimes even show them off our seniority. They are the ones who need our reciprocation for their growth but still our responses to them are important; if we have to take work from them or they are in our social circles or fall in as a team to achieve targets in professional fronts.

Relation with Supervisor: The teachers, mentors, bosses, family, etc. generally fall in this category. They are the ones who are higher than us as far as the knowledge or experience or intellect quotient or relationship goes. They expect a certain kind of respectful treatment from us, while we deal with them. We normally tend to take time to interact with them directly; more so, particularly because they also have an expectation barrier to break first with us. They are the ones from whom you learn effortlessly because we know that they know more than us. For example uncles, aunts, bosses, bosses of bosses, mentors, aged consultants, senior positions in any way, etc.

Group Behavior:-

Groups are composed of individuals. Hence, the group behavior implies behavior of its members.

Each member of the group affects the behavior of other members and in turn, is also attached by them.

The nature and pattern of reinforcement the members receive through their interaction with one another is also determined by group itself.

Characteristic of Group Behavior:-

Effective groups could be distinguished in terms of role structures, norms, cohesiveness, leadership, status, task and size. These Characteristics are responsible for understanding why some groups perform better than others.

1. **Role Structures**:- Each person in a group is normally assigned with a role or a pattern of expected behaviours associated with a certain position in the group.
   - Group members have an expected role for each individual.
   - Through verbal and behavioural messages, group members communicate their expectations.
   - The individual group member's perception of these communication results in a perceived role.
   - The group member's response, acting out the perceived role is the enacted role.
   - A group is most likely to be effective if it's members understand and accept the roles that are consistent with high performance.

2. **Norms:-** The standards that a work group uses to evaluate the behaviour of its members are its norms of behaviours. These norms may be written or unwritten, verbalized or not verbalized, implicit or explicit.
   - Norms may exist in any aspect of work group life.
   - They may evolve informally or unconsciously within a group, or they may arise in response to challenges.

- Norms reflects the culture of the particular group, so they vary from one group to another.
- The degree of which the norms have an impact depends on the extent to which group members comply with them and the group's enforcement of them.

3. **Cohesiveness:-** The commitment of members to a group and the strength of their desire to remain in the group constituted the group's cohesiveness.
   - It is the 'interpersonal glue' that makes the members of a group stick together, is known as group cohesion.
   - Group cohesion may enhance job satisfaction for members and improve organizational productivity.
   - Highly cohesive groups at work may not have many interpersonal changes away from workplace. However, they are able to control and manage their membership better than low cohesive group.
   - Strong motivation**,** maintain good and close relationships with other members generate high cohesiveness between group members.

4. **Leadership:-** A key role in determining the success of the group is the role of the leader.
   - Effective leadership can shape a group into a powerful force for accomplishing what individual members could not or would not do alone.
   - Organizations need to cultivate effective group leaders whose goals support the organization's objectives.

5. **Status:-** Status is the degree of worth and respects that other members of the group accord individual group members.
   - Status may arise from the person's job or behaviour in the group.

- A group member's status linked to the person's position in the organization.
- Status based on age, gender, education level, seniority, race or other characteristics.
- The status of group members can enhance effectiveness. High status members have the most to contribute to the group objectives.

6. **Tasks:-** The productivity and satisfaction of group members also depend on the kinds of tasks the group carries out.
   - Major ways to describe group tasks are in terms of type and performance requirements.
   - Task type:- It is carried out by a group is defined by the major kinds of activity involved. Different type of tasks are:-
   - Production task:- Tasks requiring the group to produce and present ideas, images or arrangements.
   - Discussion task:- Tasks requiring the group to evaluate issues.
   - Problem solving task:- Tasks requiring the group to decide on a course of action for resolving a particular problems.
   - Performing requirements:- These task may be following type:
   - Disjunctive tasks**:-**Tasks that can be completed through individual efforts of group members.
   - Convective tasks:- These are tasks where each person's efforts are tightly linked to the efforts of others. Group members are highly inter dependent.
   - Additive tasks:- Where productivity is measured by adding together the output of each group member.

Mob Psychology:-

- It is also known as crowd psychology which is a branch of social psychology.

- This field relates to the behaviours and the thought process of both the individual crowd members and the crowd as an entity.
- A mob is one of the most influential and also over looked forces in changing people's behaviour.
- Basic concept is the thought process and the behaviour patterns of the individual often vary from those of a larger group, although these some individuals often adapt to the expectations of the surrounding culture and modify individual traits in order to identify with the crowd.
- The convergence theory as applied to the crowd psychology is that the behaviour of the crowd takes on focus and form based on the input of the individuals who make up group.
- The Emergent-Norm theory approach to crowd psychology affirms that crowds are collections of individuals who usually come together around foundation of connected understandings but still retain many of their individual traits.
- It is possible for an individual to function as a leader at one point and later modify his or her expression to that of a follower or manager.
- As with any psychology theory, there are a number of other approaches to crowd psychology that tend to assign responsibility for group dynamics and individual reactions to a wide variety of situations and motivations.

Absenteeism:-

- Absenteeism is the term generally used to refer to unscheduled employees absences from workplace.
- Many causes of absenteeism are legitimate, for example personal illness or family issues, but absenteeism also can

often be traced to other factor such as poor work environment or worker who is not committed to their jobs.

- If such absence becomes excessive, they can have a serious adverse impact on a business's operations and ultimately its profitability.
- The labour department in India defines the absenteeism rate as total man-shifts lost because as a percentage of the total number of man-shift scheduled.
- It literarily means the procedure of regularly staying away from work or school without good reason.
- Employee absenteeism is one of the most common workplace problems facing employers in today's workplace.
- Legitimate illnesses as still count for majority of employees absences but studies have shown that less than 1/3rd of absences from the workplace are related to poor health.
- Therefore, most employers offer their workers vacation, sick leave, paid time off or other kind paid and unpaid leave.

Cause of Absenteeism:- The following are the major causes of absenteeism:

1. Child care:-This means that when a child is ill or when normal child care arrangements fail for any reason, one of the parents may have to call in sick to look after their child.
2. Accidents:- Accidents are inevitable in an industrial/working environment and every workplace has its own share of accidents.
3. Sickness and low vitality:- Epidemics like cholera, small pox, corona and malaria often break out in most industrial areas. The low vitality of the Indians workers makes them easy prey to such epidemics and bad housing or in-sanitary conditions of living aggravate the trouble.
4. Bullying:- It is due to harassment policy and is unwanted, aggressive behaviour towards employees that involves a real and perceived power imbalance.

5. Lack of flexibility:- Lack of consideration towards flexible working practices, like holiday banking or flexible working hours etc. leads to absenteeism.
6. Poor leadership:- It leads to lack of any real commitment of workers to their jobs.
7. Bereavement:- When people suffer a protracted bereavement, reaction problem arises. Bereavement reaction goes through four separate separate stages-disbelief, anger depression and reconciliation.
8. Change:- A changing work environment, caused by manager, poor economic climate or unforeseen circumstances, can make employees feel in secure and stressed, leading to absence.
9. Means of transport:- The rate of absenteeism is higher in the industries not having good transport facility than those having easy transport facility or provided by the industry itself.
10. Ergonomics:- Lack of good ergonomics design of workplaces may lead to stress and consequent absenteeism. Provision of open plan offices, for space and team building reasons, causes a lot of ambient noise and concentration problems besides the ventilation problems.
11. Hours of work, Night shift, Rural exodus, Social and Religious function etc. are other factors for absenteeism.

Handling Grievances:-

- Grievance handling is the management of employee dissatisfaction or complaints (e.g. favouritism, workplace harassment, or wage cuts). By establishing formal grievance handling procedures, you provide a safe environment for your employees to raise their concerns.

- A grievance is any dissatisfaction or feeling of injustice having connection with one's employment situation which is brought to the attention of management.

  1. Dissatisfaction is anything that disturbs an employee, whether or not the unrest is expressed in words.

  2. Complaint is a spoken or written dissatisfaction brought to the attention of the supervisor or the shop steward.

  3. Grievance is a complaint that has been formally presented to a management representative or to a union official.

Causes of Grievances:

1. **Economic**
2. **Work environment**
3. **Supervision**
4. **Organizational change**
5. **Employee relations**

The effects are the following:

1. On the production: Low quality of production, Low productivity, Increase in the wastage of material, spoilage/leakage of machinery, Increase in the cost of production per unit

2. On the employees: Increase in the rate of absenteeism and turnover, Reduction in the level of commitment, sincerity and punctuality, Increase in the incidence of accidents, Reduction in the level of employee morale.

3. On the managers: Strained superior-subordinate relations, Increase in the degree of supervision and control, Increase in

indiscipline cases, Increase in unrest and thereby machinery to maintain industrial peace

Labour Welfare:-

Labour welfare refers to all the facilities for labourers to improve their working conditions, provide social security, and raise their standard of living. Several state legislatures have enacted an Act exclusively focusing on the welfare of the workers, known as the Labour Welfare Fund Act.

5.6 Conflicts in organization-genesis of conflicts, types-intrapersonal, interpersonal, intergroup, resolving conflicts.

Conflicts:-

Conflict can be considered as an expression of misunderstanding, rivalry or antagonism. A conflict arises with the situation where two opposing groups involve in contradictory interests.

- Conflict is defined as misunderstanding or a disagreements between two or more individuals or groups or a struggle between individuals or groups for the same struggling needs, wishes or interests.

  Features of conflict:-

  i. When the individuals are not able to choose among the available alternatives actions, then conflicts occurs.

ii. As it indicates a series of events, so it is a dynamic process and is also made up of a series of inter-locking conflicts.
iii. No conflict exists in the organisation so long as no body is aware of the conflict.
iv. Conflict between two individuals implies that they have conflict in their perceptions.

Types of conflicts:-

Types of conflicts are:

1. **Interpersonal Conflict**:- When two or more individuals are involved in conflict, then that type of conflict situation is called interpersonal Conflict.

- It is the most recognised and most common conflict.
- Mostly, conflicts involve conflict between a person in one group in one organisation or a group and another person in group or organisation. So all conflicts are basically interpersonal conflicts.
- As every individual has a separate acceptable alternative cause of action, so different individual prefer different way.
- When opinions are highlighted rather than facts, this type of conflict can arise.
- As conflicting parties are not in a position to remain tense for a very long time, so interpersonal conflicts have tendency to resolve by itself.

2. **Intrapersonal Conflict**:-

- Intragroup conflict involves conflict between the individual and the group.
- As there are more than two persons in a group and they have the interaction with each other, they usually have a well-defined

structure of the rule regulations for the smooth maintenance of the group.

- Sometimes the individual may disagree with the group methods but he/she may want to remain in the group for social needs.
- When a group face new problem, interpersonal conflict may arises.

3. **Intergroup Conflict**:-

- When conflict arises between the different groups in the organisation, such type is known as intergroup conflict.
- As intergroup conflicts are due to factors inherent in the organisational structure, so the conflicts are not so personal in nature.
- For example:- Conflict between production and marketing department in an organisation. Suppose sales department promise their customer certain quantity and quality of product, which the production department may find difficult to make it. In that case conflict arises between them.

Resolving Conflict:-

There are two approaches for resolving the organisational conflict.

i. **Preventive measures**:- These are some preventive measures which the management can take to resolve the organisational conflicts. I.e.
   1. Establishing common goal
   2. Reduction in interdependence
   3. Trust and communication
   4. Co-ordination
   5. Use of superior authority
   6. Development of effective leadership

2. **Curative measures**:- There are following steps which can be taken in resolving conflict.

a) At first full details of conflict should be drawn out and stages of conflict is pointed out.

b) There are two stages of conflict:- preliminary & advanced. If the conflict is advanced stage, then there is requirement of more effort to resolve it.

c) There may be causes of conflict such as facts, goals, methods and values. There should be proper analysis about the issues involved in the conflict and it should be understood clearly.

d) Discussion by the management or mutually by the parties involved in conflict may be done for problem solving.

e) Management may attempt to sweep out and smoothen the affairs.

CHAPTER 6

Construction Labour & Labour Management

Introduction: Construction industry is one of the largest industries in India, where about four crores of workers are employed and most of them are unskilled labourers. In general construction Labourers are Classified as unskilled anal skill of and semi-skilled persons. The labourers employed in construction industry are paid wages on daily basis as the construction work is temporary. Hence the job in Construction industry is also temporary and workers have no job

security. Therefore, construction labourers can easily be shifted from one Place to another.

6.1 Preparing Labour schedule:

- A labour Schedule can be prepared from the construction Schedule and the objective of this Schedule is to decide the number of skilled and unskilled labour required for the execution of different operation on different dates.
- With the help of this schedule required labour can be arranged well in time.
- It is difficult and costly to arrange skilled labour as and when required.
- It helps in reducing the labour cost.

6.2 Essential steps for optimum labour output:

Labour output is a major concern for employers and it is desirable to have higher level of Productivity in any organization. For achieving this, a lot has to be done with the environment at workplace and the work conditions along with a series of factors that define the work couture. Labour efficiency or employee talent is a valuable asset for a company or organization and it needs to be tapped fully by keeping the employees motivated to perform and deliver the results they are qualified for and capable of.

A few factors that help to improve the employee Productivity on Labour output at the work place are:-

1. <u>Accountability</u>:

- Every employee needs to be well aware that he is accountability for this actions and decisions.
- He should not pass the bulk or pass the blame to someone else. This will help him to work more meticulously.
- He should take cautions rather than reckless decision, and not take advantage of his place, position or relationship with his superiors.

2. <u>Follow up:</u>

→ Every target on milestone set needs to be followed up as well, to see if the progress is sufficient and if not, whether any interim measures can be taken before it is too late to salvage a situation.

→It also keeps the employee on track.

3. <u>Management without micromanagement</u>:

- Of course, the pool of employees does need to be managed, provided direction and given assistance.
- But side by side, they must also be trusted, given freedom to operate in their own style and adopt measures which they think are the best to deliver results.
- Micromanagement is a human tendency; it is detrimental to achievement since it makes more puppets out of employees, who are expected to toe the base line and not to think for themselves.
- Employees need to think for themselves, analyse the consequences of every decision or action to be able to give their jobs.

4. <u>Encourage Motivate reward and recognize:</u>

- The employers must ensure that on this part he always has the words of encouragement for his staff.

- It helps them move forward and do even better and Make the worker feel happy.
- Innovative way of motivating them spurs them even more. E.g. holidays or conferences paid for by the company have been found to motivate employees immensely.
- Rewards and other ways of keeping the employees happy makes them feel that there is being recognized and that are needed greener pastures and new jobs.

5. Reach out to employees by seeking them:

- Every employee loves to feel he has the ears of the management who will recognize him and listen to what he says.
- Display of interpersonal skills in which the boss appears humane and one of them, rather than a larger than life, distant figure, helps to have employees warm up to him and feel happy working for him.

6. Demand realistic targets:

- Employers need to set realistic goals that are within the limits of achievement.
- While an aggressive employer may want his people to out stretch themselves to achieve far-fetched goals, it may also burn them out.

7. Team Work:

- Team work always helps in increasing workplace Productivity since there is more input in the form of more ideas and minds at work.
- Working alone is not always the happiest situation either, especially in the field.

- Successful team building and working together is bound to bring out the best out of the employees who may also then compete each other ensuring the business is the winner.

8. <u>Ensure that people enjoy their work</u>:

- The best performing employee is the happy employee and the employer has to find ways of making his people happy.
- Besides working conditions and the work culture implemented, he has to devise way of making the work seem challenging and interesting rather than mundane and boring.

9. <u>Break the monotony and rotate:</u>

- While employers assign tasks according to an employee's core competence, even with the task they are best at, can make an employee bored and his work seem monotonous.

- This Monotony can be broken with rotation and giving people new tasks and exposure to other divisions.

- This adds to their learning and helps them get a holistic view of the business.

10. <u>Courses and Improvement options</u>:

- Employees are delighted when they can enhance their skills and get additional learning opportunities sponsored by the employer.
- This help them learn feel indebted for the money being spent on them, which also adds to their resume and are obliged to perform better by applying all the knowledge gained in these courses.

11<u>. Spend less time on meetings and more an action :</u>

- The current trend to have more meetings and discussion more time in rather than spending more time in working to achieve results leads to precious productive time loss.
- Meetings for reviews and Sharing of ideas can be Limited and kept short. Employees should have more time to show results.

12. <u>Tool and equipments to raise Productivity</u>:

- The workplace should have the best of machinery devices and equipment that yield error free results in the minimum possible time.
- Efficient electronic equipment with no connectivity issues and breakdowns will help in saving precious time.
- They should take the place of paper work and yield fast results.
- These device help to reduce the response time, improve customer service and cutting costs, all imperative for work place productivity.

6.3 Labour Characteristics:

1. Labour is original and indispensable factor of production.
2. Labour is an active factor of Production.
3. Labour is Perishable than any other Commodity.
4. Labour cannot be separated from the labourer
5. Labour is less mobile.
6. Labour supply is inelastic
7. A Labour sells his labour and not himself.
8. Labour has weak bargaining power.
9. Labour is both the beginning and the end of Production.
10. Efficiency of labour differs.
11. Labour cannot be engaged continuously in production like machine.

12. Labour Creates capital: labour is more important in the process of production than capital because Capital is the result of the working of labour.
13. It is difficult to calculate the cost of production of labour.
14. Labour has no tangible form.

6.4. Wages & their payment:

- Payment made to labour is generally referred to as wages. It can be time-rated or piece rated. It can be rate per hour, per day, per week, per Month Or per year.
- This is the remuneration paid to the workers for the actual work they do.
- The wages can be paid to ordinary skilled, unskilled or semi-skilled workers as daily basis, or weekly basis.
- The wages are both monetary and non-monetary.
- The monetary wages are money paid to workers as wage. But non-Monetary payment may are known as fringe-benefits.

Types of wages:

Wages are generally of two types.
i) Time wages
ii) Real wages

i) Time wages:

When payment of wages made to labour is in the form of money for the work done on the basis of per hour, per day, per week, per month or per year, it is often called as time wages.

ii) Real wages:

- After satisfying the basic needs of a worker and for improving the standard or living of a worker wages given in the form of luxury and comfort or extra security, is often known as real wage.
- The real wages specify the amount of goods and. Services that the money wages will buy.

Method of wage Payment:

- Wages can be calculated on the basis of the output irrespective of the time taken in completing it.
- Efficiency may be a factor which varies from individual to individual.

- The efficient worker may create more output than other so wages can be calculated on the basis of the work irrespective of the time.

- Also a good wage payment system establishes a good relationship between worker and employer.

- The payment of wages can be classified into two methods.

i) Time on day rate system

ii) Piece work on piece rate system

i) Time on day rate system

- In this Method of wage payment, the worker is paid a fixed remuneration as per his unit of time which can be rate per hour, per day, per week, Pear month or per year.
- This is one of the oldest methods of wage payment adopted in India.
- As in this method, workers don't get extra benefits except their weekly leave; they have no special interest to work hard for the optimum profit of the organization.

Advantages

i) This Method is suitable work cannot be measured directly.

ii) By this method of wage payment, worker f ensures regular employment and greater security of service.

iii) Here Skilled, unskilled and semi-skilled all the workers get the same wages of one class.

iv) The calculation of wage can be done easily by this method.

v) Where measurement of output is not feasible, this method is especially useful.

vi) As workers have no tendency to show increased output the quality of work is good.

vii) Also this method can be understood by all class of workers easily.

Disadvantages

i) As the workers don't get extra benefits except their weekly leave, they have no such interest to work hand for the organization.

ii) There is no inspiration of competition among the workers and hence there is no chance of extra Profit.

iii) By this method, a skill employee becomes interest -less to produce more than the unskilled workers.

iv) A regular Supervision is required for this work to extract work from the labour.

v) The workers are assured of their wages to their output is low.

vi) Cost control can't be ensured effectively due to varying production.

ii) Piece work one piece rate system:

- In this system according to the worker's output, their payment is decided. Of course payment is made at the agreed rate.
- In this method, an efficient worker can earn Money by increasing his output.
- Here Payment is purely based on production on output of workers.
- Payment is decided at the actual quantum of work done by the worker.

Advantages

i) Suitable incentives are given to efficient workers in proportion of their output or production.

ii) There exists a healthy atmosphere among the employer and employees.

ii) Higher wages are given to worker with higher output or production.

iv) Less supervision is required.

v) In this system, a good worker can make more money by increasing his output.

vi) By this method, inefficient and unskilled employees are pointed out.
vii) As effort of workers increases, the overall Production of the organization increases.

Disadvantage:

i) Workers are not careful about the quality of work. They have to any how increase the output of the organization.

ii) Over time work causes sickness to health.
iii) Sometimes no work no pay situation arises because during the period of sickness or absence, there will be no payment as the output will be there.

iv) It causes a competitive & jealous atmosphere among the workers of organization.

6.5. Labour incentives

- Labour incentives refer to those incentives that supplement a salary and are given to the employees of a company for their excellent Performance.

- Most often than not, incentives are what attract the employees to keep working Company and go an extra mile to achieve something they are set to do.

6.6 Motivation:- Classification of motives, different approaches to motivation

Motivation:-

- Motivation is an important factor which encourages persons to gives their performance and helps them in reaching the enterprise goals. Motivation is one of the most important factor affecting human behaviour.
- It helps the individual towards the fulfilment of durable objectives.
- It is a complex force that is responsible for starting and keeping a person at work in an organization.
- Motivation is something that mobilises a person to work.

Definition

- Motivation is an inspiration that impels and person to expand energy to achieve a goal or reward.

- Motivation is acts as a driving force by which the human being achieves their goal.

- In other words Motivation is the stimulation of emotion or desire and an inner state that activates or directs the behaviour towards achieving the goals.

Classification of Motivation:-

When a Manager wants to get more this sub-ordinates, then he will have to motivate them improving their performance.

This motivation may be in the form of any incentive or bonus . There are two types of motivations.

i) Internal Motivation
ii) External Motivation

i) Internal Motivation:-

- Internal motivation motivates people internally and it refers to motivation by interest on enjoyment in doing the task itself.
- Internal motivation exists within the individual rather than any external influence.
- Need to get an accomplishment of good job, and the illusion of self- determination and freedom are the examples of the internal motivation.

ii) External Motivation

- External motivation comes from outside of the individual.
- Common external motivations are rewards like money, grades, pay, incentives, threat of punishment or praise.
- Also motivation can broadly be classified into two broad types as follows:
- A) **Positive Motivation**:- When the employees are offered the incentives, they try to improve their performance will willingly.
- Positive motivation or incentive motivation is based on reward.
- The incentives may be in the form of more pay, Promotion, recognition of work, more responsible job etc.
- Positive motivation is achieved by the co-operation of the employees and they have a feeling of happiness.
- B) **Negative Motivation**:- Negative motivation is based on force or fear.
- Fear causes the employees to do certain job.
- If they do not do accordingly then they may be punished with demotions on lay-offs.
- This types of motivation causes anger and frustration because the employees do not work willingly, rather they want to avoid the punishment.

Different Approaches to motivation:-

- The Motivation differ from time to time, place, to place, situation to situation and person to Person.
- So it is difficult to set a specific theory which will be universally accepted.
- Different type of theories are:

1) Maslow's Need Hierarchy theory
2) Herzberg's two-factor theory.

3) Alderfor's ERG Theory

1. **Maslow's Need Hierarchy theory** :- This theory includes the hierarchy of need by Abraham Maslow.

- Maslow's theory is one of the most widely discussed theories of motivation.
- Motivation is influenced by the needs of a Person A.H. Maslow an American social scientists has developed the hierarchy of needs satisfied of five hierarchy classes.

Maslow categorised human needs into five categories.

i) Basic Physiological Needs

- These needs are most essential for the survival and Maintenance of human life.
- These needs include satisfaction of the needs of hunger, and shelter, drinking water, clothing, rest, etc.
- Once these needs are satisfied, this will cause to motivate him, and he will want to satisfy the other needs.

ii) Safety Needs

- Once Physiological needs are satisfied, the human being wants the assurance of maintaining a given economic level.
- These are the needs to be free from physical dangers, and fear of jobs Property, Sheller, etc.
- Every person would like to be free from worries like loss of job, sickness, old age pension, physical safety like accident and fire.
- Organisation can meet safety needs by installing safety devices at work place and can start pension scheme, insurance plan etc.

iii) **Social Needs**:

- Once the individual is satisfied with social needs, they are concerned about the next level.
- Being a social being people belong to be accepted by others.
- Therefore the man is interested in conversation, sociability, exchange of feelings and grievances, companionship and belongingness.
- In organisation social need play a vital role, because communication among workers should be encouraged to remove the irritants elements if the management tries to have a close supervision and control over them, the workers may revolt against such environment.

iv) **Esteem on Ego Needs**

- These needs are concerned with self-respect. Self-confidence, feeling of being unique, recognition etc.
- Satisfaction of these needs bring confidence, power, control and prestige, achievement, independence competence, knowledge etc.
- The individual have to learn on acquire these only through his intelligence and hard work.

v) Self actualisation

- Self-actualisation need is the need for self-fulfilment of wants of a person considered to be mission of his life.
- It is the highest need in Maslow's hierarchy.
- These needs, which helps an individual to develop his potentialities.
- Self-fulfilment give satisfaction to the person concerned and gives a tendency of capability of doing of self-development.

Maslow has categorised the needs in order to priority. When one need is satisfied, another need becomes the motivator. So all these needs are independent.

Maslow's hierarchy of needs

2) **Harzberg's Two factor Theory**:

- This theory was developed by Frederick Herzberg in 1959. Herzberg's two factor theory is also known as Herzberg's Motivation-hygiene theory of motivation.

- Herzberg and his associates concluded a of need satisfaction of 200 engineers and accountants in an Organisation. Study these person were asked to describe a few previous job experiences in which they felt exceptionally good or exceptionally bad about the jobs.

- The satisfaction of some need may not have positive effect on motivation but their non-satisfaction may act as a negative factor.

- These factors operate to build strong motivation and high job satisfaction and their absence affects both satisfaction and Motivation.
- Herzberg concluded that there were two sets of conditions- the first type of condition described as maintenance of hygiene factors and other is motivation factor.

i) **Hygiene factor**: These factors are responsible for reasonable level of satisfaction and are called Maintenance or hygiene factor.

- The hygiene factor is just like hygiene; the Presence will not make the employee healthy but its absence causes a deterioration of health.
- There are factors concerned with the company policy and administration, technical supervision, inter personal relations with supervisor, inter personal relations with peers, inter-personal relations with Subordinates, Salary, Job security, Personal Life, work relations with subordinates and status.
- These are the maintenance factors which are necessary to maintain a reasonable level of Satisfaction.
- These factors are not responsible for growth of motivation in workers but the absence of these factors creates problem.

ii) Motivation factors

- These factors create high motivation and job Satisfaction in their Presence.
- The absence of these factors does not cause dissatisfaction.
- According to Herzberg, there are six factors which give positive satisfaction.
- These six factors are recognition, advancement, Work itself, possibilities of personal growth, achievement and responsibility.
- It is essential to increase these factors for increasing the motivation of employees.

3. ERG Theory:

- This theory was introduced by Alderfer.

- Alderfer's ERG theory is the expanded form of Maslow's hierarchy of need theory and Herzberg's two factor theory of motivation.
- He found some over- lapping between Physiological need security need and social needs.
- He classified the various needs into three main categories. These are:-

i) Existence needs.
ii) Relatedness needs
iii) Growth needs.

i) <u>Existence needs</u>:

- This need of ERG Theory includes both Physiological and safely needs of an individual in Maslow's Model.
- These needs include the basic survival needs of human beings like food, clothing, shelter and drinking water.
- These are the Primary needs, human being first tryto fulfil this.

ii) <u>Relatedness Needs</u>:

- This need of ERG theory is the combination of the social need and esteem need of Maslow's Model.
- These needs are the emotional needs of the human being for love, affection, warmth and friendship.
- These needs give human being ego satisfaction.
- So combining these two needs of Maslow, relatedness need is derived.

iii) <u>Growth Needs:</u>

- These needs are same as the Maslow's self-actualisation needs.
- These needs satisfy the human being for his personal development and achievement.

- When the individual wants to do something challenging, the sense of achievement gives him a satisfaction.
- This need satisfies all desires of the individual to increase and develop his potential

6.6 Motivation:- Classification of motives, different approaches to motivation

Motivation:-

- Motivation is an important factor which encourages persons to gives their performance and helps them in reaching the enterprise goals. Motivation is one of the most important factor affecting human behaviour.
- It helps the individual towards the fulfilment of durable objectives.
- It is a complex force that is responsible for starting and keeping a person at work in an organization.
- Motivation is something that mobilises a person to work.

Definition

- Motivation is an inspiration that impels and person to expand energy to achieve a goal or reward.

- Motivation is acts as a driving force by which the human being achieves their goal.

- In other words Motivation is the stimulation of emotion or desire and an inner state that activates or directs the behaviour towards achieving the goals.

Classification of Motivation:-

When a Manager wants to get more this sub-ordinates, then he will have to motivate them improving their performance.

This motivation may be in the form of any incentive or bonus . There are two types of motivations.

i) Internal Motivation
ii) External Motivation

iii) Internal Motivation:-

- Internal motivation motivates people internally and it refers to motivation by interest on enjoyment in doing the task itself.
- Internal motivation exists within the individual rather than any external influence.
- Need to get an accomplishment of good job, and the illusion of self- determination and freedom are the examples of the internal motivation.

iv) External Motivation

- External motivation comes from outside of the individual.

- Common external motivations are rewards like money, grades, pay, incentives, threat of punishment or praise.
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7.4 INSPECTION AND TESTING OF EQUIPMENT

- Inspection is taken to mean observation of work environment, work practices, equipment used, work posture or reported hazard which may be generic or it may be specific to assess a particular risk, task or part of occupational health and safety management systems.
- Testing means use of standardised tests to check the equipment, plant operation, process control, and effectiveness.
- The purpose of inspection of equipment is to identify whether the equipment can be operated, adjusted and maintained safely with any deterioration detected and remedied before it results in the health and safety risk.
- Not all work equipment needs formal inspection to ensure safety and, in many cases, a quick visual check before use may be sufficient.
- However, timely inspection is necessary for any equipment where significant risks to health and safety may arise from incorrect installation, reinstallation, deterioration or any other circumstances.
- The result of the inspection should be recorded and such records must be preserved until the next inspection of the equipment. The records need not be necessarily in writing but if kept in any other from (e.g. on a computer), these should be held securely and made available on request by any enforcing authority.

- The scope of inspection will depend on the type of equipment, its use and conditions to this exposed. This should be determined through the risk assessment and take full account manufactures recommendation.
- The inspection should concentrate on those parts which necessary for the safe operation of the equipment and, in some cases; this may require sting and dismantling.
- The frequency inspection may vary depending on environmental conditions and your own experience.
- Intervals the inspection may be increased if the inspection history shows negligible deterioration a shortened where experience shows this is necessary to prevent danger.
- The equipment should be inspected by competent persons who has sufficient knowledge d experience of it. Agencies who conduct the testing of equipment must have required competency and certification in this regard.
- Persons responsible for coordinating inspection and testing of equipment are generally responsible for maintenance and security of such records.
- Inspection and test results should be made available to the manager of the area concerned.

7.5 EQUIPMENT MAINTENANCE

Maintenance of equipment is the operation of keeping its various components in their original form as far as possible with a view to ensure that safety as well as production in operation does not deteriorate. It includes servicing, inspection and adjustment, small repairs in field, major repairs and over hauls in main workshops and proper case of laid up machine.

The objectives of maintenance are:

i) To maximize the availability of machinery needed for smooth production.

ii) To minimize down time due to break down of machinery

iii) To ensure longevity of the machinery to avoid high rate of depreciation of capital.

Types of maintenance

There are mainly four types of maintenance:-

a) Reactive maintenance / Break down maintenance / Corrective maintenance (Failure based maintenance)

b) Predictive maintenance and Reliability centered maintenance (condition based maintenance)

c) Preventive maintenance/Schedule maintenance (Time based maintenance)

d) Pro-active maintenance (Advance maintenance technique)

a) Reactive maintenance

- Reactive maintenance is based on the principle of "run it till it breaks" mode of maintenance.
- No efforts are mode or no actions are taken to maintain the equipment as intended by the designer, either to prevent failure or to ensure that the designed life of the equipment is attained.
- Of course, reactive maintenance is still the predominant mode of maintenance in the Indian construction scenario, accounting for about 65 to 70% of the maintenance programme.

The advantages of reactive maintenance are:

(1) It has lower initial costs

(ii) It requires fewer maintenance staff

The disadvantages of this approach to maintenance are:-

(i) Cost escalation due to unplanned down time of the equipment.

(ii) Increased labour cost, especially towards over time for untimely repairs and replacement.

(iii) Increase in cost associated with sudden requirement of repair or replacement of equipment.

(iv) May result in possible secondary equipment or process damage from equipment failures.

(v) Leads to in efficient use of staff resources.

b) <u>Predictive maintenance</u>

- The predictive maintenance approach aims at detecting the onset of equipment degradation and addressing the problem as soon as they are identified.
- This allows stressors to be eliminated or controlled, prior to any significant deterioration in the physical state of the component or equipment.
- It leads to both current and future functional capabilities.
- Statistical evidence proves that these programmes, when properly minimize equipment and system breakdowns resulting in a major reduction in total maintenance and operating costs.
- It accounts for about 2% of the maintenance programme

- **The following are the six major diagnostic tools in the predictive maintenance programme regularly scheduled basis:-**

1) Oil and wear particle analysis
2) Vibration analysis
3) Infrared thermography
4) Electrical testing
5) Ultra sonic/acoustic
6) Process variables / inspections / non-destructive

- **The advantages of predictive maintenance are:**

1. Increased component operational life and availability.
2. Allowance for pre-emptive corrective actions
3. Decrease in equipment and/or process downtime
4. Lowering of cost for parts and labour
5. Better product quality
6. Improvement of worker and environmental safety
7. Rise in morale of the workers
8. Increase in energy saving

- **The disadvantages associated with it are:**

1) Increase of investment in diagnostic equipment.
2) Increase in investment of staff training.
3) Non-availability of immediate savings potential by the management.

c) <u>Preventive maintenance</u>

- It refers to a series of actions that are performed on either a time-based schedule or a schedule based on that of machine-run time.

- These actions are designed to detect, preclude or mitigate degradation of a system.
- The goal of preventive maintenance approach is to minimize system and component degradation and thus sustain or extend the useful life of the equipment.
- The basic activities involved in the preventive maintenance are :- i) Periodic inspection of equipment to uncoer conditions leading to production breakdowns or harmful depreciation and ii) Upkeep of equipment to minimize down time and break down conditions while they are still in a major stage. I
- t accounts for 30% maintenance programme in India.

Application of preventive maintenance technology

The preventive maintenance technology is applied in respect of the following:

a) Lubrication

b) Cleaning

c) Replacement

d) Inspection

Advantages

i) Cost effectiveness in capital intensive processes and equipment

ii) Flexibility in the adjustment of maintenance periodicity.

iii) Increase in component life cycle.

iv) Generation of energy savings.

v) Reduction in equipment and/or process failures.

vi) Cost saving (around 15%) over that found in a reactive maintenance programme.

Disadvantages

i) Inability to eliminate catastrophic failures.

ii) More labour intensive.

b) Pro-active maintenance

- Although predictive maintenance uses online condition monitoring to help predict the occurrence of failure, it often fails to identify the root cause of failure.
- Proactive maintenance relies on information provided by predictive methods to identify problems and isolate the source of failure.
- Proactive maintenance methods have been able to save quite sizable amount on machine maintenance every year in various industries and construction organizations.

CHAPTER -8
QUALITY CONTROL

INTRODUCTION:

- Quality control in its simplest term, is ensuring quality aspect during manufacturing or production process.

- The aim of quality control is to ensure construction or production of items for their intended use without defects and variations from prescribed standards within allowable tolerance limits.
- In the current concept of quality control, the meaning of quality is closely associated with cost and customer needs or performance standards.
- So, quality may simply be defined as fitness of purpose at lowest cost and highest performance level.

8.1 CONCEPT OF QUALITY IN CONSTRUCTION:

The basic elements of quality in construction are as follows:

(1) **Quality characteristics** –

The properties that define the nature of a product for quality control viz. strength, colour, dimension and temperature etc. are called quality characteristic. Eg-Cement concrete which is a very common construction material now-a-days, the compressive strength, size of aggregate, water-cement ratio, slump, surface finish etc. are important characteristics which should be checked frequently for suitability of its use for structural purposes.

(2) **Design quality** –

It is a fact that no design can produce absolutely perfect results, whatsoever good design it may be. Thus, the desired standards for characteristics such as strength dimension etc. that define a product as well as the tolerance level for acceptable variations from the prescribed standards should be specified.

(3) **Quality of conformance** –

The degree of quality of work found in actual construction work is known as quality of conformance. As in the case of design quality, the degree to which the quality is to be enforced in the field has to be considered along with the cost necessary for quality control.

- **Factors affecting the quality of conformance:**

The quality of conformance is affected by the following factors:

1. Construction method in the field:

The quality of materials used, skill of the workers and efficiency of machinery and equipment affect the quality of conformance.

2. Field supervision level:

The managerial control exercised in directing the workers to conform to the plans and specifications and the level of supervision enforced affects the quality of conformance.

3. Inspection and quality control procedure:

The inspection and the quality control procedure adopted also greatly influence the quality of conformance.

8.2 Quality Standards- during construction, after Construction, destructive & non-destructive Methods:-

QUALITY CONTROL METHODS (During Construction)

In construction work, the following activities/works need effective quality control.

1. Concrete works

- Concrete is a very important construction material possessing high compressive strength, whose quality is influenced to a great extent by its constituent materials, water-cement ratio, size of aggregate and their grading, rate of loading and curing conditions etc.
- The supervisor should be well versed with the properties of concrete. So, to obtain a good quality concrete, the engineer-in-charge is required to be present throughout the operation of mixing, placing, compacting and finishing etc.

2. <u>Steel works</u>

- Steel is a costly item and constitutes a major item of expenditure in most of the civil works. In RCC structures, it is used as reinforcement to take up tensile stress.
- Hence its tensile strength, proper binding, binding and placing etc. should be checked carefully while using it. The reinforcing bars should be free from rust, scales, oil, grease and other harmful coatings.

3. <u>Form work</u>

- The shape and finished surface of concrete depends upon the form work.
- The form work must have smooth surface so that the finished concrete may require minimum amount of rendering.

4. <u>Masonry work</u>

- The bricks/stones to be used in masonry work should be of specified quality and grade, having requisite strength and water absorption capacity within permissible limits.
- The dimensions and verticality of masonry works are very important and care should be taken to maintain it.

5. <u>Water proofing</u>

- Provision of damp proof course at plinth level and water proofing of roof and expansion joints etc. are important.
- Hence proper care should be taken to have them properly installed.

6. Joinery and Timber work

- For wood work, timber of specified quality should be used. The workmanship of wood work should be properly checked and maintained as per specifications.

7. Services works

- Water supply, electric fittings, sanitary air conditioning etc. are classified under this category. Therefore, these works need special attention of quality control.

QUALITY CONTROL METHODS (After Construction)

The following are the important quality control methods

1. Inspection

Inspection is the function to judge the quality of a product. To be more precise, it is the process of measuring the quality of a product or service in terms of established standards. Any defect noticed must be got notified before proceeding to the next stage of construction.

2. Testing

Testing is the examination of the material or product to check its conformance to the specified standards. The testing may be either destructive or non-destructive and can be performed at site or in the laboratory.

3. Sampling

The process of determining the quality of a large group by examining a part of the group that will be statistically representative to the whole group is called sampling. The reliability of the test results of the sample is determined by the reliability number. The reliability of the information obtained increases with the size of the sample used.

(a) Reliability Number - The reliability number is taken as the reliability of the test results of the sample.
It is expressed as:-

Reliability number R = $100 - [\frac{No.Of\ Defective\ units}{No.of\ unit\ tested} \times 100]$

(b) Deviation

It is the root mean square of the deviation of all the results and is calculated as follows: Standard deviation σ =

Standard deviation $\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{N-1}}$

Where, N= No. of specimens used

x = Particular value of strength

$\bar{x}$ = Mean strength of specimens

(C) Coefficient of variation

This is an alternative method of expressing variation of results and is a non-dimensional measure of variation. It is obtained by dividing the standard deviation by the arithmetic mean value.

Co-efficient of variation =

$$V = \frac{\sigma}{\bar{x}} \times 100$$

However, in India, the standard deviation is taken as the most reliable method of quality control.

DESTRUCTIVE METHODS OF QUALITY CONTROL:

- Destructive testing is undertaken in order to understand a specimen's performance or material behaviour, these procedures are carried out to the test specimen's failure. Destructive testing procedures can either follow specific standards.
- Destructive testing methods are commonly used for materials characterisation, fabrication validation, and failure investigation.

The most common types of destructive testing methods are:

- Aggressive environment testing
- Corrosion testing
- Fracture and mechanical testing
- Fatigue testing
- Hardness testing
- Hydrogen testing
- Residual stress measurement
- Software testing
- Tensile (elongation) testing
- Torsion testing

NON-DESTRUCTIVE METHODS OF QUALITY CONTROL:

- The quality control tests or exercises conducted on a structure without causing slightest damage to whole or part of it are known as non-destructive methods.
- As per ISO-13822, the existing structure may be assessed for load bearing capacity and other structural properties by non-destructive testing and continuous monitoring process.
- The various stages of testing and monitoring are as under:

1. Load testing

It is done to test the structure or part thereof by external loading to evaluate its behaviour or properties or to certain its load bearing capacity.

2. Inspection

On site non-destructive examination may be done to establish the present conditions of the structures.

3. Monitoring

It is an act of acquiring, processing and communicating information about a structure under operational conditions over a period of time with a high level of automation. Monitoring of structures is done continuously or frequently for observing or measurement of structural conditions.

- Various Non-destructive Methods of testing of concrete structures have been developed as given below:-

(I)Surface hardness test -

These are of indentation type, include the William's testing pistol and impact hammers and are used only for estimation of concrete strength.

(ii) Rebound test-

The rebound hammer test measures the elastic rebound of concrete and is primarily used for the estimation of concrete strength as well as for comparative investigations.

(iii) Penetration and pull out tests-

These include the use of Simbi hammer, spit pins, the Windsor probe and the pull out test. They measure the penetration and pull out resistance of concrete and are primarily used for strength estimations. However, they can also be used for comparative studies.

(iv) Dynamic or vibration tests-

These include resonant frequency and mechanical sonic and ultrasonic pulse velocity methods. These are mainly used to evaluate the durability and uniformity of concrete including estimation of strength and elastic properties.

(v) Combined methods-

The combined methods involving ultrasonic pulse velocity and rebound hammer may be effectively used to estimate the strength of concrete.

(vi) Radioactive and nuclear methods-

These include the X-Ray and Gamma-Ray penetration tests for measurement of density and thickness of concrete. Also the neutron scattering and neutron activation method are used for moisture and cement content determination.

(vii) Magnetic and electrical methods-

The magnetic methods are primarily concerned with determining the cover thickness of reinforcement in concrete, whereas the electrical

methods, including, the micro wake absorption technique, have been used to measure moisture content and thickness of concrete.

(viii) Acoustic emission technique-

These techniques are mostly used to study the initiation and growth of cracks in concrete.

CHAPTER – 9

MONITORING PROGRESS

Introduction:-

Progress of any work may be defined as extent of achievement obtained at regular intervals of time compared to the planned or proposed activities of work. Monitoring is the managerial function of comparing the actual achievements with the planned target of work at each and every stage of construction and taking necessary action if required be so as to ensure the attainment of the planned goal.

Objectives of Progress Control:-

1. Provides information to the planner whether the work is going as per schedule or is running behind the schedule.
2. Helps to take corrective action in time to bring back the work to the schedule in case it is behind the schedule.
3. Progress record forms the basis of payments to be made from time to time.

4. Gives assurance to the owner regarding the extent of profit or loss i.e. how much he is getting back for what he is spending.

9.1 Programme and progress of work:-

Following are the different methods adopted for recording the progress of work:-

1. **By maintaining job diary:-**
   - Job diary is a very important document for any construction job, in which all important matters related to work, is meticulously recorded.
   - The attendance of workers, details of payment made, number of labourers employed, receipt and issue of materials to the work, maintenance of log book, inspection reports, progress of work done, etc. are regularly recorded at the site of work in the job dairy.
2. **By maintaining the register of instructions:-**
   - This register serves as a communication link between the engineer-in-charge and the contractor.
   - The site engineer records his observations regarding the quality and progress of the work in the register.
   - If at any stage changes required then required changes implemented by engineer.
   - It is also called site order book.
3. **By maintaining the progress report:-**
   - The site engineer prepares the progress report at regular interval to keep the owner and head office fully informed.

- The report may be submitted daily, weekly, fort-nightly or monthly as decided or agreed upon.

4. **By Keeping construction record:-**
   - The daily record of material use and progress of work are entered in a standard form.
   - The test results of specimen tested in the field laboratory and the inspection notes about the work are recorded in this register regular basis.

5. **By keeping abstract of qualities and cost**
   - The quantities of various items of work executed are recorded from time to time by the site engineer and the payments to the contractors are made on the basis of these detailed measurements of different subheads of work entered in measurement book.
   - The work abstract also reflects the expenditure of work including the materials issued to the work.

9.2 Work study:-

Work study is a major tool of productivity analysis by which productivity can be increased by eliminating factors responsible for inefficiency and wastage and by adopting better techniques for improving efficiency. Work study comprises of motion study or method study and time study or work measurements.

1. **Motion Study or Method Study**:-
   - It is a technique which can be applied for making optimum use of resources for the accomplishment of the job.

- The scientific study of motions of workers with a view to simplify and minimize the effort to be used to increase the productivity of workers is known as motion study.
- Following steps are involved in the motion study:-

i. Selection

- The job which requires improvement is selected after which the workers are encouraged to adopt such techniques as to improve the productivity.
- This could be achieved by announcing some incentive schemes for the workers.

ii. Recording

- All relevant information about each and every operation in the existing system is recorded. For simplifying the work, following questions may be put by the man conducting the work study:
  a. What purpose will be achieved by doing this job?
  b. What exactly is to be done?
  c. Where it is to be done and why?
  d. Where else it could be done?
  e. When it is to be done? When could it else be done?
  f. Who does it? Who else could do it?
  g. How it is to be done? How else it could be done?

iii. Analysis

- All the facts recorded are analysed to decide whether each operation in the work is necessary or they can be operated by alternative methods more easily / completely eliminated and replaced by other operations or methods.

iv. Development

- From the study of existing methods and available alternatives, new method which might be simpler and easier to adopt is evolved leading to higher productivity.

v. Adoption

- After approval of the management, the new technique is adopted. This may not be an easy task as usually the workers are found reluctant to accept the changes in methods or techniques they are used to working.

vi. Adherence

- New method must be adhered to have it accepted and adopted. Regular checking and though inspection at site so that it may not slip back to the old days.

2. **<u>Time Study or work measurements</u>**:-

- Time study is defined as a technique of observation and analysis of modes of performance of an operation by measurement and evaluation of time required for the performance of an operation and subsequent establishment of fair and equitable standards.
- Time studies are conducted for determining the least time consuming methods for performing a certain job.
- Following steps are involved in time study:-
  I. Selection of particular job to be studied and improved.
  II. Recording complete information about operation and surrounding conditions likely to affect the progress of work.
  III. Recording complete breakup of the operation into various elements.

IV. Recording time taken to complete each element of the operation.
V. Comparing observed time in with the permissible time for each operation.
VI. Converting the observed time into standard time.

9.3 Analysis and control of physical and financial progress corrective measures:-

- Analysis of progress of work is imperative for large projects that are executed departmentally. This study is carried out to keep a track whether the work is executed as per schedule and to ensure that the total cost remains within the limit of sanctioned estimated cost.

- In order to achieve this goal the analysis of progress of work is done at different stages as follows:-
  i. **Material account**:- This keeps proper account of material purchased and consumed on the work as per material schedule.
  ii. **Labour Record**:- This document records the member of labourers employed, payment made to them and their output which is compared with the labour schedule.
  iii. **Equipment Record**:- It is use to record the deployment of equipment and machinery for comparison with the equipment schedule. If the progress is less than the desired, the possible action may be taken out.
  iv. **Execution of work** :- The progress of construction is compared with the construction schedule and if the work is running behind the schedule, it causes must be investigated.

- Possible causes could be lack of proper supervision, late arrival of construction materials and equipment at site etc. then proper corrective measures should be taken.

Corrective Measures:-

The analysis of progress of work exposes the drawbacks and inherent defects in the system. The site engineer is required to take the corrective measures promptly to bring the progress of work on track.

- Some steps for corrective measures are:-
  a) **Procurement of stores well in advance**:- Important construction materials must be procured well ahead of requirement, but not in such advance as to result in the deterioration of quality of material during long storage period.
  - If supply is not received in time, remainders must be issued immediately to the party concerned under intimation to the head office.

b) **Alternative arrangement and readiness of plants, equipment and machinery :-** If any essential equipment or machinery is not received in time, its alternative arrangement should be made promptly from other sources.

- Action should be taken to arrange for the replacement of spares and carrying out repairs, if any defective in equipment occurs.

c) **Proper watch and ward arrangements**:- To eliminate the chances of theft of construction materials and equipment, proper arrangement of watch and ward should be made at the site.

d) **Provision of Incentives**:- Some sort of incentives schemes should be introduced for achieving higher output and better efficiency.

Chapter -10

SAFETY MANAGEMENT IN CONSTRUCTION WORK

10.1 IMPORTANCE OF SAFETY:-

- Thus social concern and efforts are being made to adopt safety measures by creating safety consciousness among the workers.
- Form a survey of occupational injury and illness accident; it is found that up to 14.5% workers suffer from these injuries.
- So sufficient care & enough preventive measures should be taken for it, so that, accidents of any sort during the construction period can be avoided to some extent.
- With the advance of construction industry, the numbers of accidents are increasing and accident happens all of a sudden unexpectedly.
- The reason for safety measures may be humanitarian reasons, economic reasons, and organisational image reasons.
- From the humanitarian reasons, the injured workers along with his family suffer difficulty in economic terms.
- From economic reasons, the injured worker faces difficulty owing to medical expenses for the injury. It also causes the slowdown in progress of work and decrease in productivity.
- From organisational point of view, good safety measures enhance the public image of the organisation, because it

strengthens the morale of the workers resulting in higher productivity and better loyalty of the worker to the organisation.

10.2 Causes and effects of accidents in construction works:

There are many causes of accident in construction industry. These are classified broadly.

1. Physical
2. Physiological
3. Psychological

1. PHYSICAL CAUSE:

The following factors may be grouped under physical cause.

I. Causes relating to machines:

(i) Due to obstruction free movement of man & machine is not possible & there may be inadequate working space for the machines.
(ii) Due to improper placing or adjusting of machines.
(iii) Accident may be caused due to unsuitable machines being used for the job.
(iv) Accident may be caused due to improperly guarded machines
(v) Accident may be caused due to improperly insulated electric motor on the machine.

II. Causes relating to tools & equipment:

i) Accident may be caused due to constant use of tools, which has been blunt and worn out.
ii) Tools used for the job is being too small.
iii) Sometimes due to brittle nature of tools, it breaks suddenly, accident may be caused.
iv) The tools having handle too short or loose.

v) Use of unsuitable tools for the work may be a cause for accident.

III. Causes relating to materials:

i) Accident may be caused due to careless handling of explosives, petroleum products and brittle materials.
ii) At the time of use of road materials, there should be careful handling of too hot materials like tar or bitumen.
iii) Accident may be caused due to use of materials being poisonous & dangerous as acid and some salts.
iv) Due to not adopting proper precautions while handling materials emitting foul gases. e.g. sewage in the maintenance of sewers.

IV. Causes relating to uniform:

i) Uniform should not be loose.
ii) The slippery and loose shoes may be used during the work time.
iii) While working on welding job, no protective devices are being used.
iv) Sleeves of the shirt being out of buttons.

V. Causes Relating to Environment:

i) Poor lighting arrangement at the working site.
ii) Poor ventilation & unhygienic conditions at the working place.
iii) Loose electric cables & live conductors carelessly.
iv) Obstacles in the working area.
v) Floors being slippery.
vi) Use of unstable & unsafe ladder.

2. <u>Physiological Causes</u>:-

i. **Poor eye sight:** Proper eye sight is a very important factor for every worker. Poor eye sight may cause accident for workers handling machinery, automobiles and cranes etc.

ii. **Over work:** When over work is loaded on a tired worker then he may meet an accident.
iii. **Poor Health:** Due to poor health, a worker may not control his load of work and may meet an accident.
iv. **Old age:** Due to poor eye sight and poor hearing power of old man he may face an accident easily.
v. **Intoxication:** A worker loses control due dose of drug may cause accidents.
vi. **Physical Handicappers:** A physically handicapped person can easily have a chance of meeting with accidents.

3. <u>Psychological Causes</u>:-

i. **Mental Tension:** Due to mental tension, a worker can lose control over his mind and he may meet with an accident.
ii. **Emotional attitude:** A highly emotional man can loses balance of mind easily.
iii. **Impulsiveness:** When a worker acts under impulse without proper thinking, then the chances of meeting with an accident.
iv. **Nervousness:** When a worker gets nervous, loses control and may chance of meeting with an accident.
v. **Over confidence:** It also leads to accident.
vi. **Carelessness:** A worker when in careless mind may have the more chances for accident.
vii. **Fear:** When a worker gets feared and losses control over his mind, he may have the chances of meeting accident.

10.3 Safety measures in worksites for excavation, scaffolding, formwork, fabrication, erection and demolition:

Prevention of accidents is the prime concern at any construction site both from human life and financial considerations. Irrespective of the nature of construction projects, accidents are likely to take place resulting in physical injury, loss of property or even casualties.

(a) Excavation
(b) Scaffolding
(c) Form work
(d) Fabrication
(e) Erection
(f) Demolition

(a) Safety measures of excavation:

The following safety measures are required to be adopted at Excavation sites:

(i) The excavation work should be carried out under the supervision of experienced and competent supervisor having responsibility for enforcement of safety rules and prevention of the use of defective and unsafe appliances.

(ii) It is essential to have a complete knowledge of underground structures (such as sewers, Pipe lines, electrical conduits, gas mains etc.) before commencement of the excavation Work and proper precautions should be taken to ensure safety of workmen as well as Public.

(iii) The workers should be advised to make use of safety appliances whenever required and safety helmet must be invariably used by the workers where hazards from falling stores, timber and other materials exist.

(iv) During excavation trenches in soil, soft or fissured rock or hard soil exceeding 2m depth, the trenches should be adequately timbered and secure by shored.
(v) The excavated materials should be kept away from the edge of the trench so as to provide a clear berm width of root less than 1/3rd of the final depth of excavation.

(b) Safety measures for scaffolding:

The necessity of scaffolding/staging arises for all types of construction works carried out above ground level e.g. brick or stone masonry in super structure painting, repair mentainance of structures etc.
(i) To ensure safety and stability, every scaffold should be securely supported or suspended and properly strutted or braced. Thus, all scaffolds and working platforms should be securely fastened to the building or structure.
(ii) The vertical standards of scaffolds should be embedded into the ground sufficiently deep so that these are capable of withstanding loads. On pucca floors or on black topped pavements/streets, the standards could be supported in empty tar drums and packed with sand/stone bricks etc.
(iii) The member of scaffolds should be free from defects and particularly the wooden members should be free from dry rot & wet rot etc.
(iv)The members should be thoroughly tested for their strength and inspected before these are put to use for the second time or for any subsequent use.
(v) Also the sizes of different members are properly designed for the loads that are intended to be carried.
(vi) Lacings should be done securely for connecting the ledgers to standards and putlogs to ledgers. The rope used for tie, should be stout and thick.

(c) Safety measures for formwork :

(i) The material of the formwork should be carefully selected as per relevant Indian standard. The members should be properly designed for adequate strength and the sections are generally worked out in consideration of the loads that are likely to be taken up.
(ii) The formwork should be sufficiently strong and stiff to resist bending and deformation deflection after concrete is placed. Also, it should be capable of taking up all dead load, live load and the impact to which it may be subjected to.
(iii) Partially seasoned timber should be used for formwork to minimize the effect of shrinkage, warping, bending or bulging under loads whenever, green timber is to be used, due allowance for bulging and shrinkage should be made while preparing the surface.
(iv) Preventively treated water proof ply wood, generally manufactured by BWR adhesive bonding and confirming to relevant Indian standard should be used for shuttering that is durable under alternate wetting and drying conditions.
(v) The formwork should be constructed in such a manner as to be easily dismantled without causing any damage to the concrete or formwork itself which is normally intended for future reuse.

(d) Safety in fabrication and erection:

The following safety measures are adopted during fabrication and erection works.
(i) Periodical checking of all equipment required for fabrication such as gas cutter and welding sets, power hacksaws, drills, grinders etc. should be done to ensure their safe working.
(ii) All workers engaged in gas cutting or welding operations should wear safety gloves and aprons and use proper welding.
(iii) Moving parts of machineries or equipment should be invariably provided with safety guards.

(iv) Power cables of all equipment/machineries should be properly insulted and protected from damage and cuts against any mishap.
(v) Rubber/PVC connection pipes for oxygen and acetylene gas should be regularly checked for leakage and damage.

(e) **Safety measures for demolition :**

The following are the various safety measures to be adopted at the time of any demolition work.

(i) Before the start of demolition process, the manner in which various parts of the structure are supported and the extent of demolition effect on the adjoining structures should be thoroughly studied.

(ii) A site specific systematic plan for the step by step demolition work should be prepared and strictly followed under the guidance of experienced foreman.

(iii) The demolition work should not be taken up at night or during stormy weather or heavy rains especially when the structure to be demolished is situated in an inhabited area.

(iv) At the time of demolition work, the workers must use all safety appliances such as safety helmets, goggles made of celluloid lens and leather gloves etc. including safety belts while working at high levels.

(v) The power on all electrical service lines must be switch off and all such line disconnected before demolition work is started.

10.4 DEVELOPMET OF SAFETY CONSCIOUSNESS :

Safety programme on each construction project is highly important so as to reduce the total number of accidents. So safety consciousness should be developed in the construction work. Also safety programme

should be made an integral part of each construction company. Some important aspects of safety programme of construction projects are as follows:

(i) A safety committee should be set up to guide the operation of safety programme. Both worker and management should participate in it to give their opinion on safety measures.

(ii) The employees should secure full support of the top management, because the employers are not to be expected to maintain an interest in the safety programme.

(iii) Before starting construction on a project, the safety director should analyse with foreman and superintendent about the safety programme.

(iv) There should be strong publicity of safety programme. Each employee should know about the safety programme.

(v) There should be a system of awards to those supervisors who produce the best safety records.

(vi) A new worker should be instructed regarding the likely dangers of the work.

Safety Equipment :

The workers while performing their duties, particularly while preforming difficult or hazardous or dangerous operations, there are some safety accessories which the workers must use. By using these accessories the accident hazards can be reduced to a great extent. These accessory items are such as:

1. Safety shoes.
2. Goggles
3. Apron
4. Hand gloves
5. Helmets
6. Dresses
7. Gunboot

8. Safety belts.
9. Portable light & lantern
10. Fire extinguisher etc.

10.5 Safety legislation- Workman's compensation act, contract labour act :

Safety legislation

There are some laws or legislations in connection with safety & wellbeing of the workers. Among them the Workman's Compensation Act & Contract Labour Act are important.

Workman's Compensation Act:

- In India the workmen compensation act was passed for the first time in 1923. But it came into force in 1924, and it was amended in 1958, 1976.
- This act regulates the payment of compensation to a worker who had injured in the course of employment.
- But before this act the payment of compensation to the injured worker was a lengthy & costly process.
- In case any accident occurring at the site of work, this act provides the payment of compensation to the workers.

OBJECTIVES:

- The main objective of this act is to payment of compensation to the workers who had injured in the time of employment.
- Another aim of this act is protect the worker & his family from hardly caused by the accident.
- Also by result of accident, the worker losses his earning capacity. This act forces the worker to work carefully while dangerous situations and also this act forces the employer to

take all the safety measures which are to be provided to the workers.

Contract Labour Act:-

Aim of this Act:
In order to provide all the facilities and to protect the contract labourers from the contractors engaged in the government and private works, the Government of India passed contract labour act. As this act was enacted in 1970, therefore it is also known as 1970 contract labour act.

Contract labourers:

- Construction industry plays on important role not only in the development of infrastructure of our country but also it affects our economy.
- About five crores of labourers are employed under the construction industry.
- Most of the labourers employed in construction industry are unskilled. They are employed on daily wage basis. They are for carrying the constructional activities.
- The contractor who engages the labourers for construction of the government and the private works, decide the wages and other facilities to the labourers.
- When the construction work is over, then they are terminated.
- In order to seek employment, they are to shift to new construction sites.
- Thus, these labourers move from one site to another. They are paid wages and have to also work for long hours.