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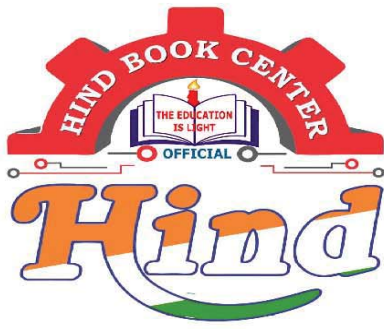
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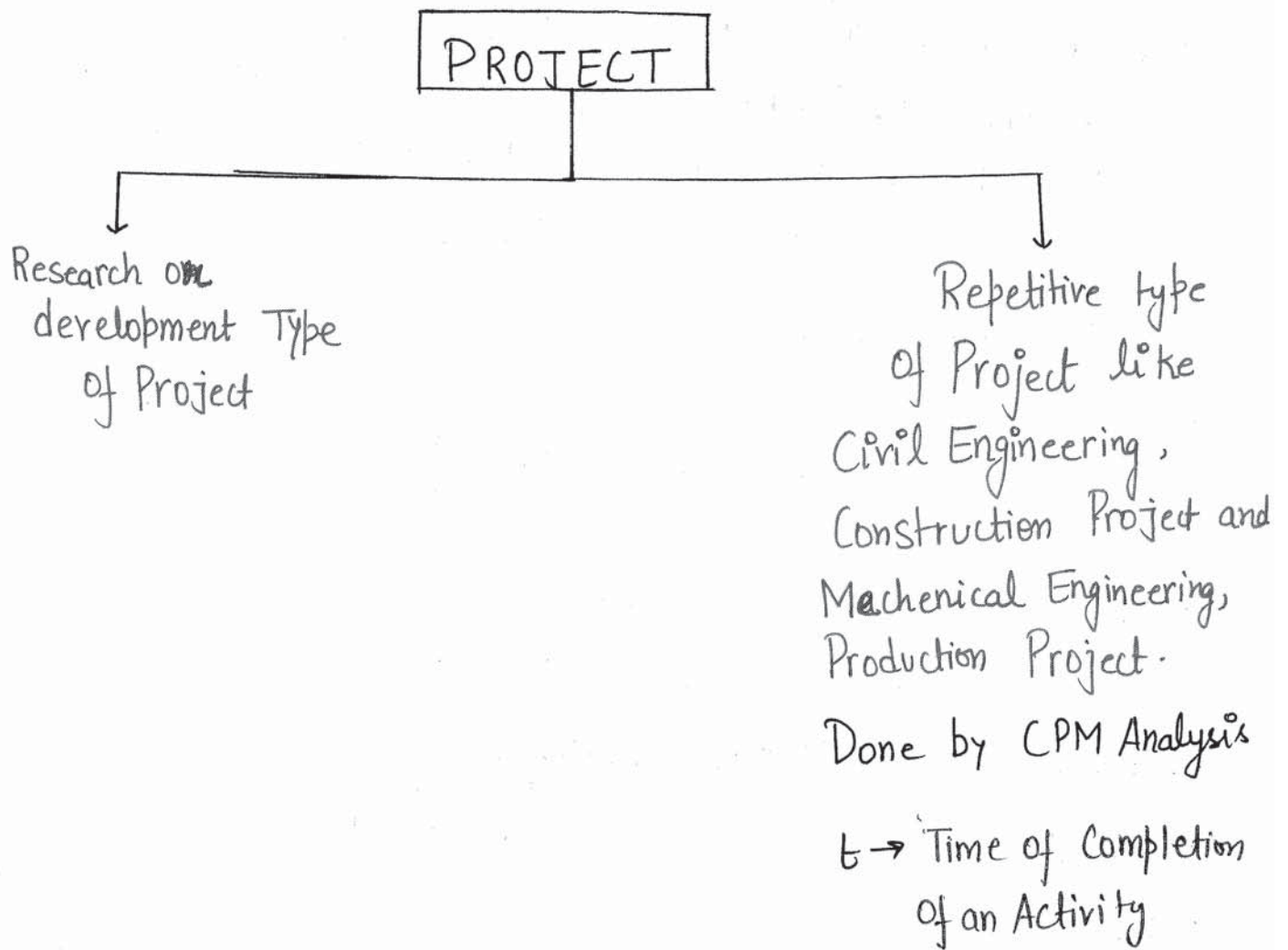
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CONSTRUCTION PLANNING & MANAGEMENT

SYLLABUS:

- CH. 01: Basics of Project Management and Network Rule.
- CH. 02: PERT Analysis
- CH. 03: CPM Analysis
- CH. 04: CPM Cost Model Analysis (crashing and updating of a CPM network).
Resource Allocation, Resource levelling, A-O-N Network, and Ladder Network.
- CH. 05: Engineering Economy [IMP.]
- CH. 06: Construction Equipment ESE only
- CH. 07: Contracts and Tenders. ESE
- CH. 08: Quality Control, Safety and Welfare. ESE only
- CH. 09: Estimating Costing. ESE only
- CH. 10: Site investigation and Management and, Productivity and operations. ESE only
-

INTRODUCTION:-



Proposed Plan:

Construction of Village Roads.

- Desk Study via Map
- Field Survey and Transmit Work for verification of Alignment
- Formations of DRR. (detailed Project Report).
- TA (technical Approval) by Head quarters engineers Signalled by PIU. [JE, AEE, AEE].
- AA (administrative Approval)
- TS (Technically Sanctioned by -
STA: State Technical Authority
CTA: Central Technical Authority.
- NT: (Notice inviting Tender)
Published in leading newspaper.
- Formation of BOQ (Bill of quantity).
- Uploading of BOQ on Website of department.
- Tender
- Submission of Tender by bidder including 2% Earnest Money (EM) With Paper Cutting of NIT. → To avoid unnecessary Competition.
- CS Comparative Statement
- Tender Awarded
- Contractor and Engineers will visit site to stand the work.
- Work started by Contractor
- Payment Made to Contractor after deduction of 10% of SD inclusive of E.M from each running bill.
SD
Security
deposity

1 cr Running Bill
↓
2% EM = 2 Lac. → Already deposited at the time of tender.

Now 8% SD has deducted i.e. 8 Lac Rupees from Running Bill.

EM → To avoid unnecessary competitions.

S.D → As a Security when Contractor will not complete the work or any defect in work

S.D will Refund after six Month (or) one Monsoon Season v of completion of work ~~of~~ after.

1. BASICS OF PROJECT MANAGEMENT AND NETWORK RULE.

Project Management :- It deals with Material and human resources both to increase productivity and efficiency.

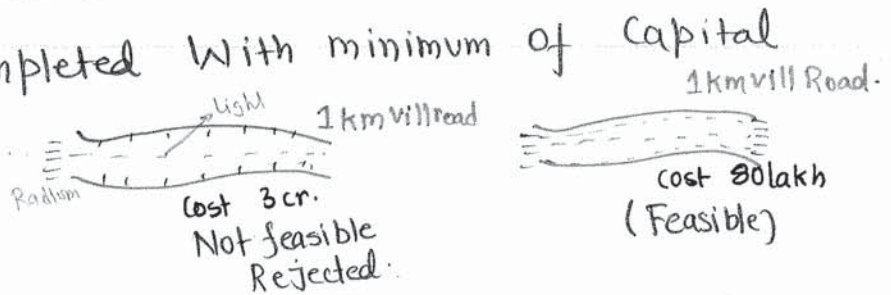
The Project should be completed in Minimum time by using Optimum resources.

For Completion of a Project, two basic things are required:

- (1) Material Resources
 - (2) Manpower Resources.
- } Active Resources \Rightarrow Money is passive Resources.

Every Project whether it is big(or) small has three objectives:

- (1). It should be completed in Minimum time. (Optimum time).
- (2). It should use available Man power and material resources as far as possible without delaying in completion of a Project.
- (3). It should be completed with minimum of Capital investment.



If Man Power is available locally when contractor labour is not available then use Man Power available locally even little price higher. These price is later adjusted.



1 km State Highway

time of completion: 9 Month.

↓
Min^m duration for completion of a project.

There are 3 important Phases of Project Management :-

(1). Planning (or) Project Planning :

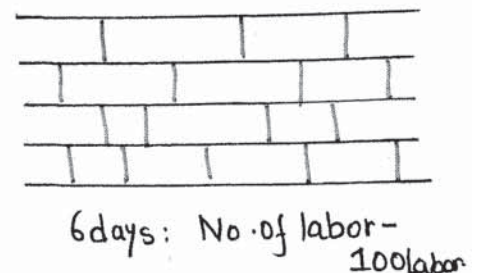
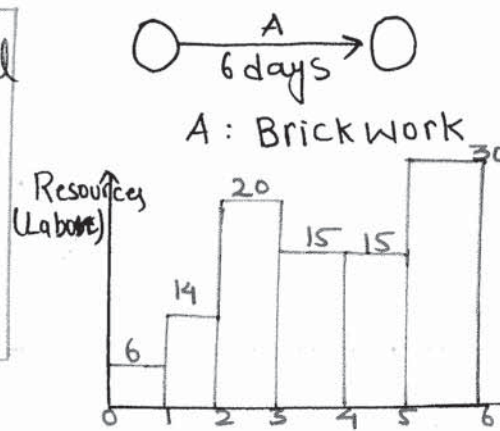
This is most important ~~Phase~~ of Phase of Project Management. Planning involves defining the objective of a project, listing of job or ^{activity} arrangement of jobs that must be performed, determining gross requirement for material, equipment, man power and preparing estimate of Cost and durations for completion of Project.

(2). Scheduling (or) Project Scheduling :

Scheduling is the allocation of resources such as material resources equipments, Man Power resources in appropriate manner such that it results in efficient Working.

Scheduling also involves Sequencing of Activities.

Note:- In traditional technique of design, Planning and scheduling are performed as single step.



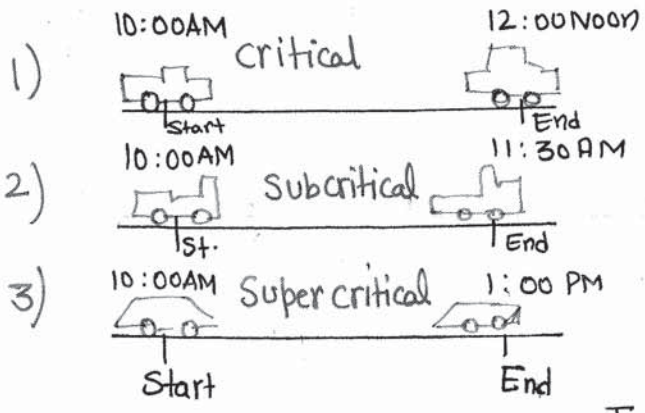
→ Resource allocation. (This Allocation is not good. Not uniform)

(3) Controlling (or) Project Controlling :

It is the Process to identify critical Activity (running on Schedule time), Sub-critical Activity (non-critical activity i.e. already completed before the schedule duration) and Super critical Activity (delayed activity i.e. completed after Scheduled duration of Projects).

Travel duration = 2hr allowed.

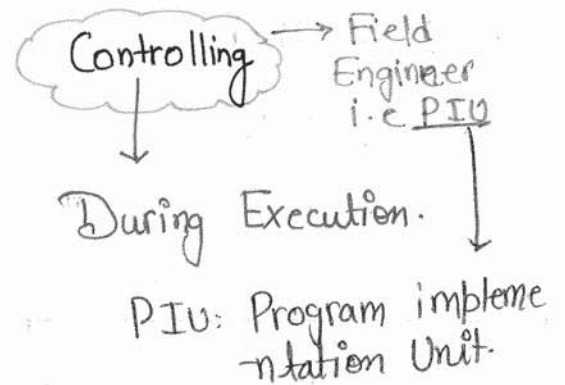
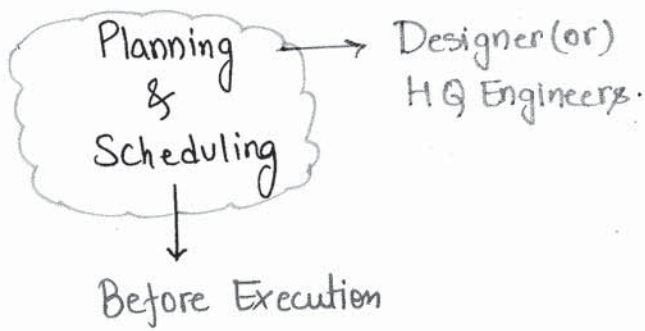
Critical and Supercritical activities are given extra attention in a project.



Therefore, of regular interval of times Network is updated and Project Progress is reviewed.

Frequency of updating Will increase towards completion of a Project.

Note:- Planning and Scheduling are performed before execution of Project Whereas Scheduling Controlling is carried on during execution of the project.



⇒ Work Breakdown Structure (W.B.S) :-

It is incremental and hierarchical decomposition of Project Phases

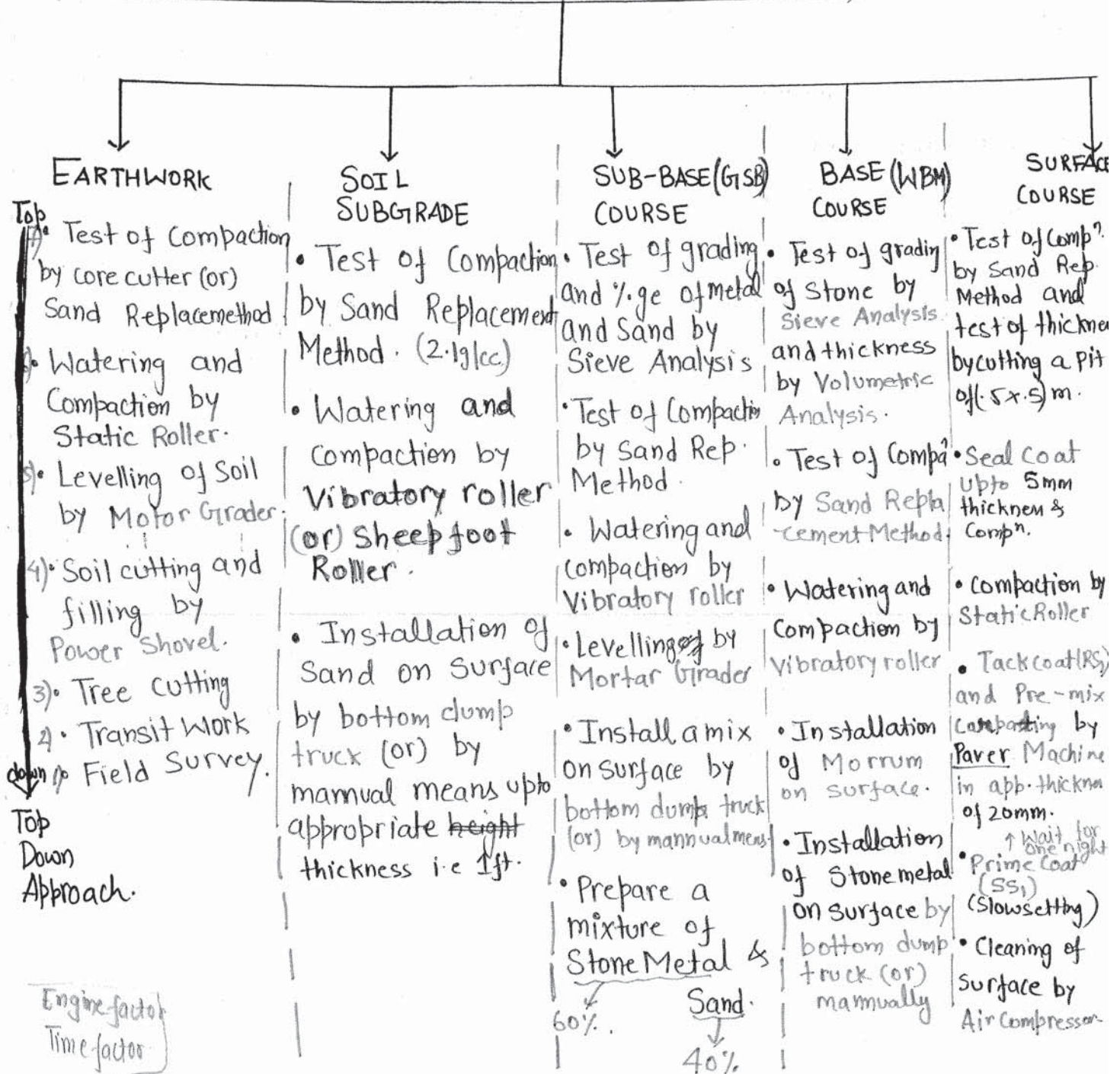
It is Top-down approach.

It is useful for big and Complex Project.

Ex:- WBS for Construction of 25 km long Village road (Flexible Pavement).

70-80 lakh
Rigid Pav-1 cr

W.B.S for Construction of 25 km long V.R
(Flexible Pavement).
(SP20 Manual)



⇒ Techniques used in Project Management:

(1). Bar chart / Gantt chart: (1 A, in ESE)

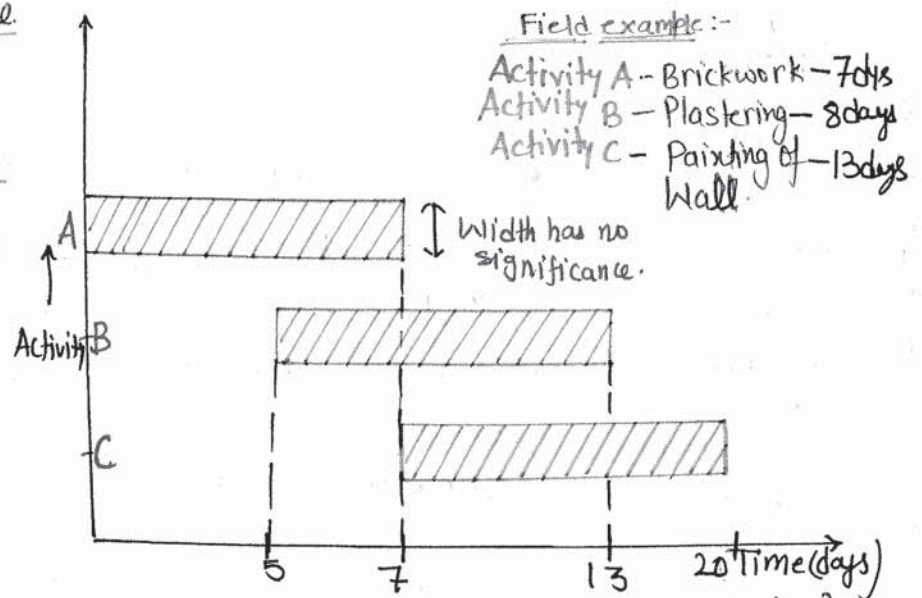
This is oldest technique of Project Management and It was developed by Henry Gantt around 1900 A.D hence it is called Gantt chart.

There are 2 co-ordinates in which horizontal axis represents time and vertical axis represents Activity.

Start of the Bar: ^{time} Start of Activity Whereas finishing of bar represents finishing time of Activity. i.e. Length of the bar

Represent activity Completion time.

Whereas Width of the bar has no significance. It is only according to better Pictorial representation.



In the above network, it is clear that Activity 'c' will start after completion of Activity A.

Will start after completion of Activity A.

But whether Activity A, Activity B and Activity C are interconnected with each other are not determined by

Bar chart.

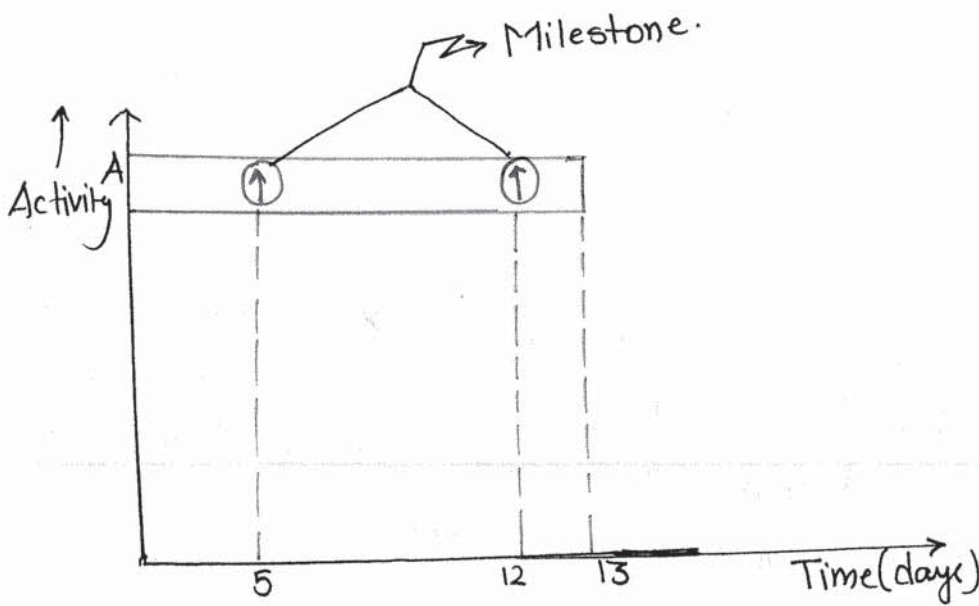
⇒ Limitations of Bar chart :-

(i). Lack of degree of details :-

In a bar chart only major activities are shown whereas Sub-Activities can not be represented in the bar chart hence it is difficult to carry out the effective control.

Remedy: Sub-activity of a Major activity are marked on the bar chart which is called Mile stone.

If one subactivity has completed then marked one mile stone on bar chart hence milestone represent Completion Stage of a Sub activity (or) Completion of intermediate Stage of an activity so that Milestone is an event.



Activity A → Casting of a Roof Slab. → 13 days

Sub activities:

Form work / Shuttering and Centering: 5 days

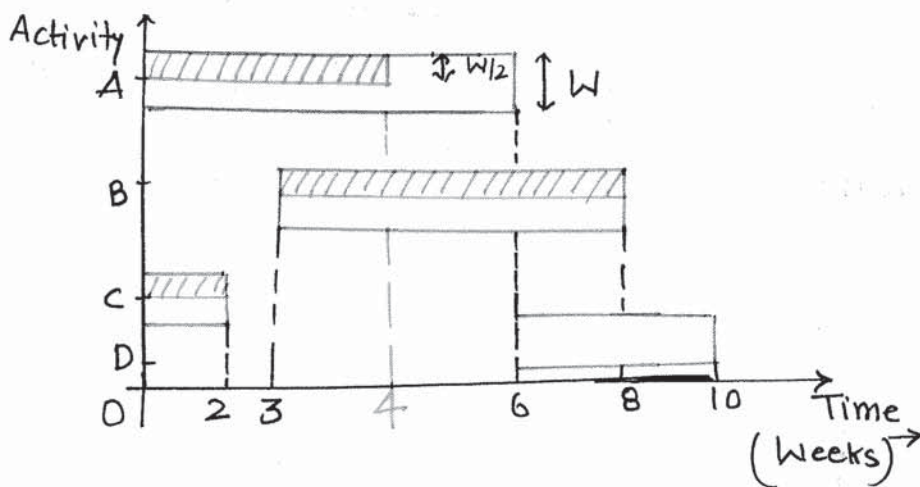
Bars bending i.e Reinforcement: 7 days

Casting: - - - - - → 1 day

(2) No provision to show Project Progress :-

Since Project Progress cannot be shown hence bar chart cannot be used for Controlling purposes.

Remedy: Controlling is essential for rescheduling the remaining activities. However an existing chart can be modified by hatching the bar in half of its width to show the project progress.



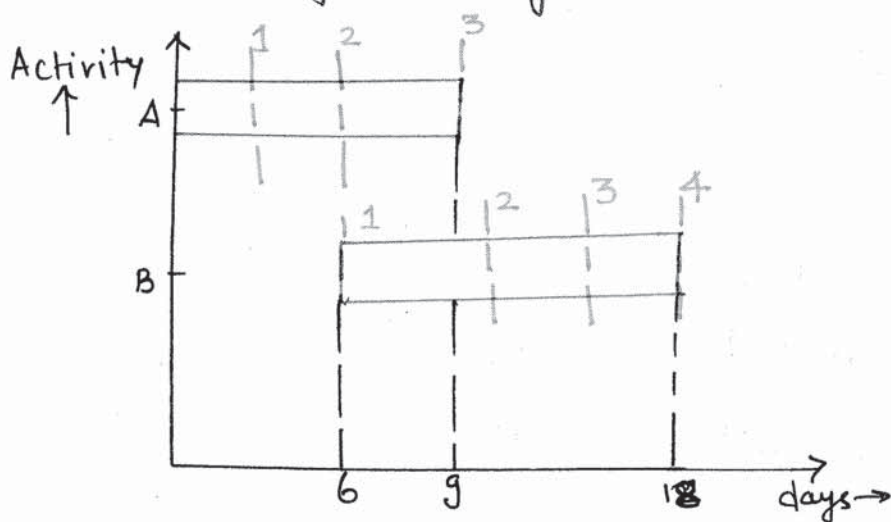
* Review after Six Weeks:-

- i) Activity A has not completed after six weeks and only 4 weeks has done and it requires 2 more weeks. Hence activity A has delayed by 2 weeks. Hence Activity A will complete at the end of 8 weeks.
- ii) Activity D will depend on completion of Activity A hence for satisfactory completion of Project, rescheduling of Activity D is required.
- iii) Activity B has completed before the scheduled duration hence it is sub-critical Activity.
- iv) Activity C has completed.

(3) Lack of Activity Interrelationship :-

In a bar chart clear picture between activity interrelationship is not available hence it is difficult to identify their inter dependency.

Remedies: This difficulty can be partially removed by breaking each activity into a number of sections so that start of succeeding section will depend on completion of preceding section.



Divide both activities (or all activities) into equal sections.

i.e. Activity A and activity B both will divide into three sections.

$$A \begin{cases} \rightarrow A_1 \rightarrow 9/3 = 3d \\ \rightarrow A_2 \rightarrow 9/3 = 3d \\ \rightarrow A_3 \rightarrow 9/3 = 3d \end{cases}$$

$$B \begin{cases} \rightarrow B_1 \rightarrow 12/3 = 4d \\ \rightarrow B_2 \rightarrow 12/3 = 4d \\ \rightarrow B_3 \rightarrow 12/3 = 4d \end{cases}$$

Section ① of Activity B will start after completion of section ① & section ② of Activity A.

Section ② of Activity B will start after completion of Activity A.

(4). No provision to account for time uncertainty
Hence Bar chart can not be useful for Research
and development type of Project i.e PERT based
Project.

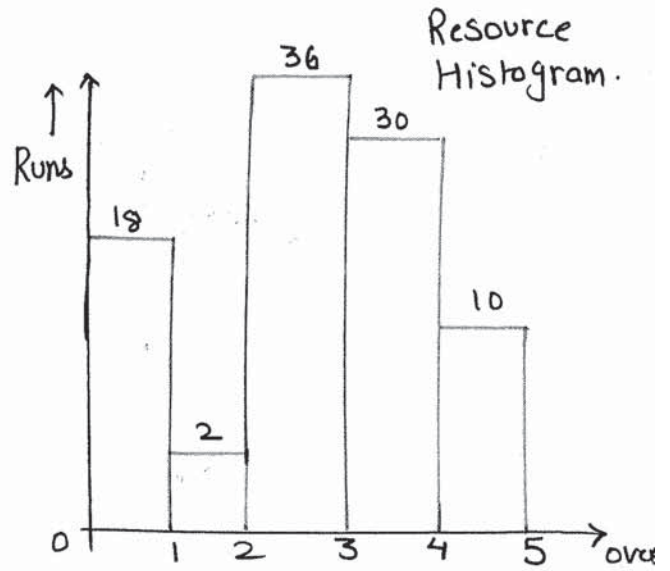
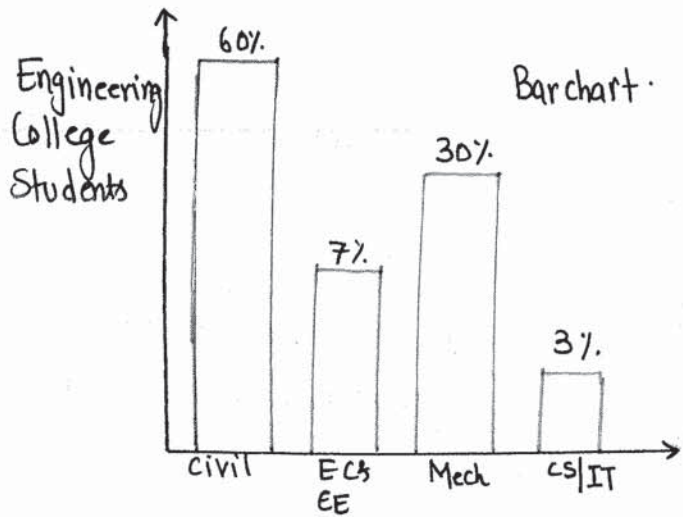
Note: Bar chart is useful only for CPM based
Project i.e only for repetitive project.

(5). It is difficult to identify critical activity,
Sub-critical Activity and Supercritical activity in the
bar chart. Also it is difficult to identify Critical
Path.

[Critical Path:- Path joining all critical activity
is called Critical Path.].

Hence it is difficult to carry on the effective
Control.

(2) Resource Histogram :-

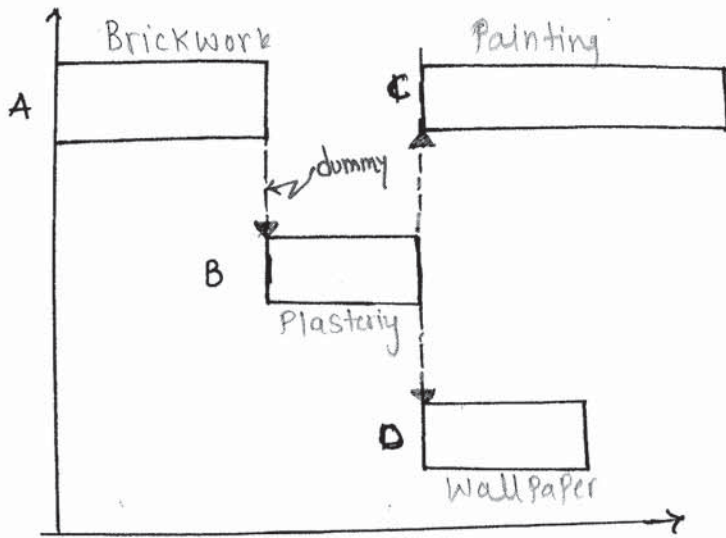


Both are similar, but histogram represents continuous data and each column represents quantitative variable of a group. Whereas bar chart represents a data in which each bar represent an activity.

(3) Milestone Chart :-

(4) Linked Bar chart: In linked bar chart, end of

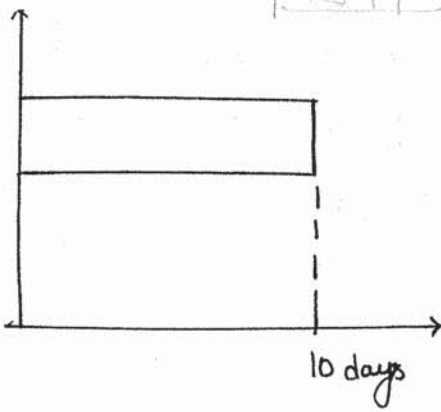
- 1) Preceding Activity is connected with start of Succeeding Activity.
- 2) It provides clear picture between Activity interrelationship.
- 3) Dotted Arrow (dummy) are used to show their interrelation.
- 4) Due to linking Activities, main limitations of bar chart are eliminated here. Such as:
 - i) Resources for each activities can be easily planned.
 - ii) Floats can be easily calculated. [Freedom of an Activity].
 - iii) No need to monitor separate Milestone.
 - iv) Easy to understand can be used for monitoring as well Controlling ~~Plan~~ ^{Program}.



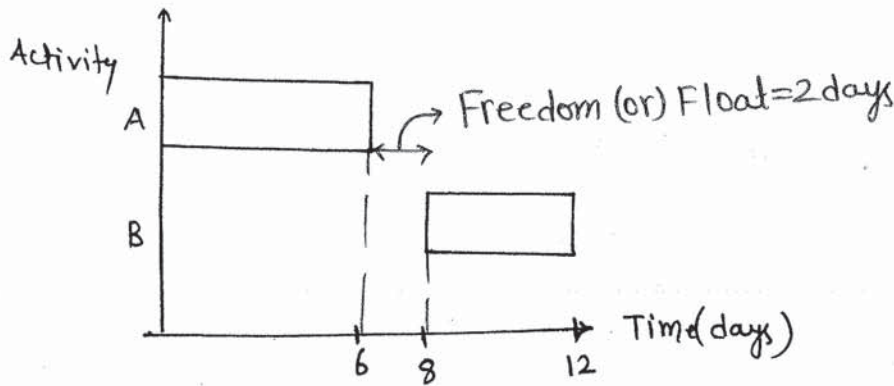
- (i) Activity B Will start after completion of Activity A.
- (ii) Activity C and D Will start after completion of Activity B.

Eg: 

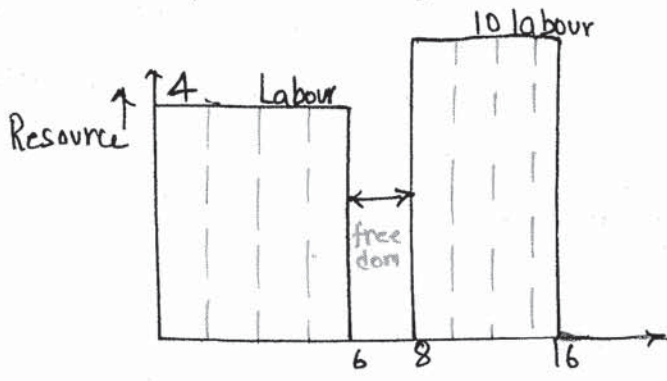
Window & framing which is to be done by carpenter



days allotted = 10 days
 But work completed in 8 days.
 So, Freedom of ^{this} Activity (Float) is 2 days



A - Plastering } work done by Architect
 B - Painting }

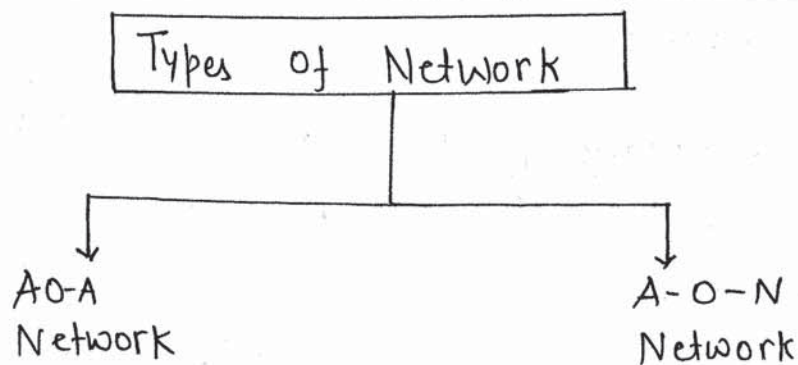


Drawbacks :-

- (i) Time uncertainty cannot be accounted hence it cannot be used for R&D Project (PERT based Project).
- (ii) Critical activities as well as critical path cannot be calculated.

(5) Network diagrams :-

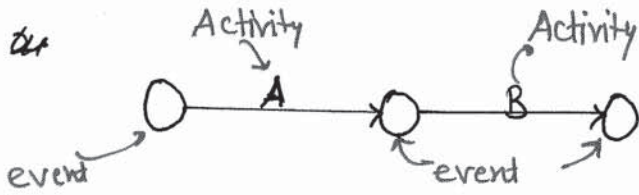
- i. This is improvement over milestone chart and it is to be used for big projects under Complex Conditions.
- ii. All limitations of bar chart are eliminated here.
- iii. Network is a pictorial representation between activities and their interrelationships during which activity are in Series (or) Activities are in parallel i.e. Serial and Parallel activities
- iv. Dummies can also be used if required.



Difference between AOA and AON Network:

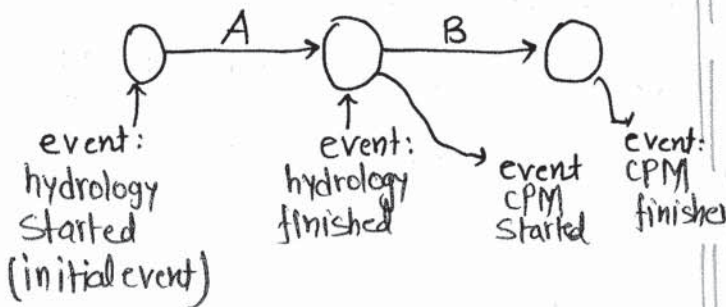
A-O-A Network

1. A-O-A stands for Activity on Arrow Network



Activity A and Activity B are represented on Arrows (or) represented by Arrows.

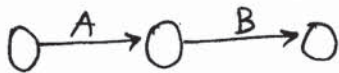
2. Event are represented by Nodes.



Activity A → hydrology is going on

Activity B → CPM is going on

3. No. of Arrow is exactly equal to number of Activity in a Network.

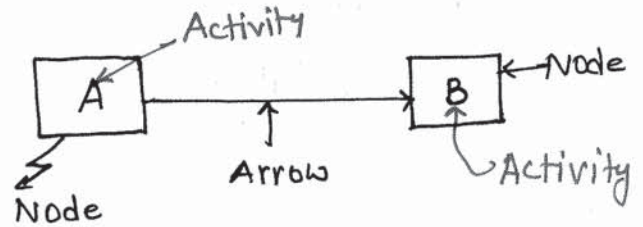


No. of Arrow = 2

No. of Activity = 2

A-O-N Network

1. A-O-N stands for Activity on node Network



2. There is no role of event. Only Activities are shown in the AON Network.

3. No. of Activity may not be equal to number of Arrows in AON Network.



No. of Activity = 2

No. of Arrow = 1