UPPSC-AE 2025

Uttar Pradesh Public Service Commission

Combined State Engineering Services Examination

Assistant Engineer

Civil Engineering

Construction, Technology, Planning and Management

Well Illustrated **Theory** *with*
Solved Examples and **Practice Questions**

MADE EASY PUBLICATIONS

Construction, Technology, Planning & Management

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CHAPTER 1

Project Management

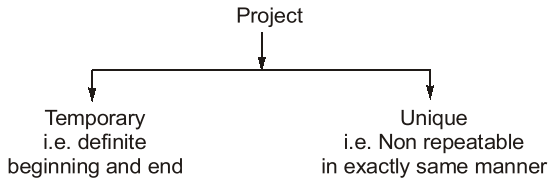
1.1 What is Project?

Project is a temporary endeavour undertaken to provide a unique product, service or result.

- A project involves a series of activities which consumes resource and time.

Examples of Project:

- Development of a software for a business.
- Construction of building.
- Setting up a power plant.



1.1.1 Objectives of Project

1. The project should be completed in minimum time period.
2. Project should use available manpower and local resource as far as possible.
3. Project should be completed without delay and minimum investment cost.

1.2 Project Management

Project management is an application of knowledge, skills, tools and techniques to meet the project requirement.

$\boxed{\text{Skills}} + \boxed{\text{Knowledge}} + \boxed{\text{Tools and Techniques}} \Rightarrow$ Project management

1.2.1 Element of Project Management

A. Planning

1. Defining objectives of the project.
2. Listing of jobs that have to be performed.
3. Determining gross requirements for materials, equipments and man power and preparing estimates of costs and duration for various jobs.
4. To bring about the satisfactory completion of project.

Planning is important because:

1. It provides direction and unifying frame work.
2. It helps to reveal future opportunities and provides performance standards.
3. It minimizes costs by utilizing available resources in best way.

B. Scheduling

Scheduling is the allocation of resources such as time, material, space, equipment and human and technological effort.

It involves:

1. Finalizing the planned functions mechanically.
2. Assigning starting and completion dates to each activity to proceed in a logical sequence and in a systematic manner.

C. Controlling involves

1. Determination of deviations from basic plan and their effects on the project.
2. Replanning and rescheduling of activities to compensate for the deviations which is called "updating".

   It should be noted that planning and scheduling are accomplished before the actual project starts while controlling is operative during execution of the project.

NOTE: Planning and scheduling are done before the start of a project whereas controlling is performed after the start of a project.

1.3 Method of Project Management

1.3.1 Bar Chart

Firstly introduced by Henry Gantt around 1900 AD.

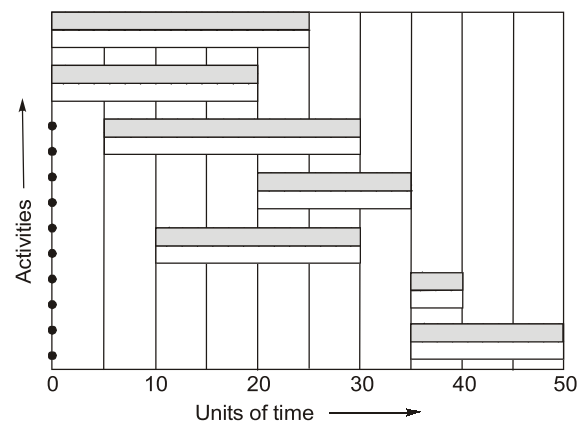


Fig. *Bar Chart*

Features of bar chart are:

1. It is a pictorial chart
2. It has two coordinate axes, the horizontal coordinate represents the elapsed time and vertical coordinate represents the job or activity to be performed.
3. The beginning and end of each bar represents starting and finishing time of a particular activity respectively.
4. The length of bar shows the time required for completion.

   Jobs can be concurrent or can be started one after other. So some bars can run parallel or overlap each other or may run serially.

Limitations of bar chart:

1. **Lack of degree of details:** Only major activities are shown in bar chart and sub-activities can not be separated out. Hence effective control over the activities in big projects can not be achieved.
2. A bar chart does not show progress of work and hence it can not be used as a control device.
3. A bar chart is unable to depict interdependencies of various activities clearly.
4. Bar charts are not useful in the projects where there are uncertainties in determination of estimation of time required for completion of various activities such as in R&D projects.
5. Bar chart can not distinguish between critical and noncritical activities and hence resource smoothening and resource levelling can not be done.

Bar chart diagrams are useful for only smaller and simpler conventional projects, especially construction and manufacturing projects, in which time estimates can be made with fair degree of certainty.

1.3.2 Mile-Stone Chart

- It is a modification over original Gantt chart. Milestones are key events of main activities represented by bar. Therefore they give idea about completion of sub-activities.

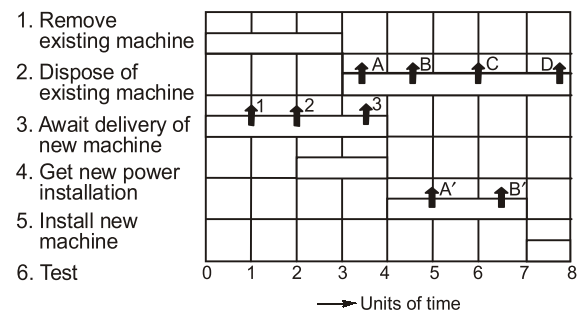


Fig. *Mile-stone chart*

1.3.3. Linked Bar Chart

- It is an important our original bar chart or mile stone chart.
- In linked bar chart, activities are linked with arrows and liners, indicating require and order of activities.

Do you know? Controlling can be better achieved with the help of milestone charts, but still activity interrelationship and accountability of time uncertainty can not be depicted which can be overcome in network technique.

1.3.4 Network Methods

It is a graphical and logical model of sequence of activities.

- This is improvement over milestone chart and all the limitations of bar charts are eliminated.
- It is an outcome of the improvements in the milestone charts.
- They are called by various names such as PERT, CPM, UNETICS, LESS, TOPS and SCANS.
- However all these have emerged from the two major network systems viz.:
  1. PERT
  2. CPM

Advantages :

1. Interrelationships between activities and events of a project are clearly shown.
2. The project can be treated as an integrated whole with all its sub-activities clearly related with each other. It helps in controlling the project.
3. Network method is useful for very complicated projects having large number of activities.
4. It indicates the time required in between two activities in which rescheduling of a project is possible.
5. Time uncertainty is accounted for and so it is also useful for research and development projects.

Types of network:

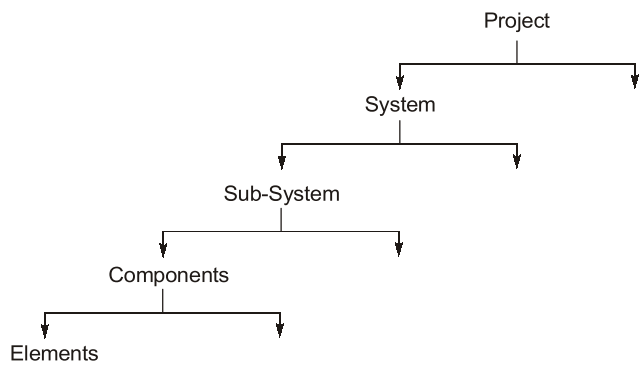
(i) A – O – A – Activity on Arrow diagram.

(ii) A – O – N – Activity on Node diagram.

1.3.5 Work Breakdown Structure

- Work breakdown structure is a graphical representation of functional elements of entire project.

- It follows top to bottom approach.
- It is a process of breaking the complex project into system, sub-system, component and element.



Student's Assignment

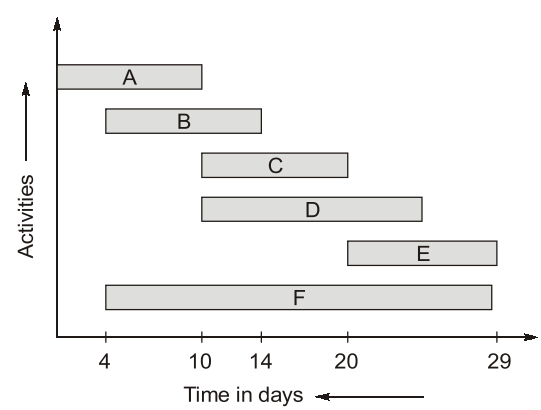
Q.1 In arriving at a resource based schedule bar-chart for a construction project, the following stages for planning of the work are involved.

1. Finalizing a network of activities.
2. Determining the optimal activity durations considering all the relevant parameters.
3. Computation of time and floats.
4. Developing the resource-based bar-chart and the corresponding histograms and mass curves of resources.
5. Identification of the critical constraining resource.
6. Deciding the criteria for optimization.

The correct sequence of these stages in the planning of the work will be

(a) 1, 6, 2, 3, 5, 4
(b) 6, 2, 1, 3, 4, 5
(c) 1, 2, 3, 6, 5, 4
(d) 2, 1, 3, 5, 6, 4

Q.2 Which of the following are critical activities of the bar chart shown below:



(a) Activities B and E
(b) Activities A, D and F
(c) Activities A, C and E
(d) Activities A and F

Q.3 Functional organization system of working was given by

(a) F.W. Taylor (b) Henry Gantt
(c) M.R. Walker (d) J.E. Kelley

Q.4 Gantt charts indicate
(a) comparison of actual progress with the rescheduled progress
(b) balance of work to be done
(c) progressive cost of project
(d) inventory costs

Q.5 A serious limitation of interdependencies between various activities is generally observed in
(a) Bar chart (b) Milestone charts
(c) Network analysis (d) Job layouts

Q.6 A linked bar chart is an improvement over a conventional bar chart, because
1. Resources for individual activities can be planned.
2. Floats will be available for utilization as needed.
3. Milestone events need not be specially monitored.

Which of these is/are correct?
(a) 1, 2 and 3 (b) 3 only
(c) 2 only (d) 1 only

Q.7 Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I (Bar chart)
A. Milestone bar chart
B. Linked bar chart
C. Gantt bar chart
D. Resource-based bar chart

List-II (Highlights : and is adapted for)
1. Computation of resource histograms
2. Activity relationships
3. Updating and re-railing
4. Activity duration
5. Monitoring and interfaces

Codes:

	A	B	C	D
(a)	3	2	4	1
(b)	5	2	4	1
(c)	3	4	2	5
(d)	5	4	3	1

Q.8 Which of the following is the correct sequence to analyze a project for implementation?
(a) Time-cost study, Network, WBS, Scheduling with resource allocation
(b) Network, Time-cost study, Scheduling with resource allocation, WBS
(c) WBS, Network, Scheduling with resource allocation, Time-cost study
(d) WBS, Time-cost study, Network, Scheduling with resource allocation

Q.9 Match **List-I** (Chart) with **List-II** (Precipitation) and select the correct answer:

List-I
A. Bar chart
B. Milestone bar chart
C. W.B.S.
D. Linked bar chart

List-II
1. Activity dependencies can be implied
2. Resources requirement can be depicted
3. Higher level of authority can effect monitoring and controlling
4. Trade base rite supercision can be assigned

Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	2	1	4	3
(c)	4	1	2	3
(d)	2	3	4	1

Q.10 List the following processes in their correct sequence, from earliest to latest, in project implementation planning :
1. Project duration
2. Resource histogram
3. Standardized input/performance for each activity including alternatives
4. WBS
5. Resource optimization considering constraints
6. Activities and their inter-relationships

Select the correct answer using the code given below:
(a) 2, 1, 3, 5, 6 & 4
(b) 2, 6, 3, 5, 1 & 4
(c) 4, 1, 3, 5, 6 & 2
(d) 4, 6, 3, 5, 1 & 2

Q.11 One of the main disadvantages of the bar chart in project analysis is that
(a) progress of the work cannot be monitored

(b) they do not show the interdependencies of the activities
(c) the time schedule is not shown properly
(d) the financial aspect is not shown

Q.12 The graphical representations wherein long duration jobs are broken down to key segmental elements, wherein events are shown in chronological order without attention to logical sequencing, and wherein interdependencies between the events is not highlighted, is referred to as
(a) CPM (b) Milestone chart
(c) GANTT chart (d) PERT

Q.13 A bar chart is commonly used because
(a) It is simple to draw and easy to understand.
(b) It indicates at a glance the overall progress of the project.
(c) It shows critical and non-critical activities.
(d) It incorporates uncertainties for delay in estimation of time required for completion of activities.

Q.14 Consider the following activities of a housing project:
1. Flooring
2. Wall-plastering
3. Conceal wiring
4. Fixing door-window frames
5. Fixing door-window shutters

What is the correct logical sequence of the above activities?
(a) 4-3-2-5-1 (b) 3-1-5-4-2
(c) 1-4-5-2-3 (d) 1-2-3-4-5

Q.15 The purpose of work-break-down structure in project planning is mainly to
1. Facilitate and improve the decision-making on procurement of resources
2. Relate activities under particular trade specializations to help in organizing for project staff
3. Co-ordinate regarding milestone events across trade specializations to improve the synergy between the trades

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

ANSWER KEY / STUDENT'S ASSIGNMENTS

1. (c)	**2.** (c)	**3.** (a)	**4.** (a)	**5.** (a)
6. (a)	**7.** (b)	**8.** (c)	**9.** (d)	**10.** (d)
11. (b)	**12.** (b)	**13.** (b)	**14.** (a)	**15.** (d)

HINTS & SOLUTIONS / STUDENT'S ASSIGNMENT

3. (a)

The concept of functional organisation was given by F.W. Taylor, who recommended the appointment of specialists at important positions. Functional organisation allows decision to be decentralised since issues are assigned to specialists or units, giving them the responsibility of implementing, equating, or controlling the given procedures or goals.

4. (a)

Bar chart gives comparison of actual progress to the scheduled progress.

7. (b)

A-5, B-2, C-4, D-1

Milestone bar chart → Monitoring and interfaces
Linked bar chart → Activity Relationships
Gantt bar chart → Activity Duration
Resources-based bar chart → Computation of resource histograms.

9. (d)

W.B.S. (Work Brendum Structure) is the process of breaking the project into easily identifiable major systems, their subsystems and discrete activities.

12. (b)

In Milestone chart the long duration jobs are broken down into key segmental elements completion of the segment is shown by event also known as milestone and interdependencies between the events is not highlighted.

13. (b)

Advantage of bar chart

1. It is simple to draw, easy to understand and can be drawn quickly.
2. No trained/skilled personnel are required to make the chart.
3. The progress achieved at site is expressed in terms of percentage.
4. It may be used for depicting the resource requirements of construction project.
5. But the most important benefit of using a bar chart is that it provides a visual representation of the entire project which shows exactly when each of the above activities is supposed to start and finish.

14. (a)

Door – window shutters can be fixed only after door – window frames.

Wall plastering cannot be done prior to conceal wiring.

Therefore, correct sequence is 4–3–2–5–1. i.e. (Fixing door – window frames) – (Conceal wiring) – (Wall Plastering) – (Fixing door – window shutters) – (Flooring).

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