# INTERMEDIATE

# VOCATIONAL COURSE
# SECOND YEAR

# CONSTRUCTION MANAGEMENT AND ACCOUNTS

***FOR THE COURSE OF***
***CONSTRUCTION TECHNOGY***

**STATE INSTITUTE OF VOCATIONAL EDUCATION**
**DIRECTOR OF INTERMEDIATE EDUCATION**
**GOVT. OF ANDHRA PRADESH**

**2006**

**Intermediate Vocational Course, 2nd Year:**
**CONSTRCTION MANAGEMENT AND ACCOUNTS**
**(For the Course of CONSTRUCION TECHNOLOGY)**
Author: **Sri L.Murali Krishna.**
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**AUTHOR**

**LINGAMPET MURALI KRISHNA M.Tech.**
**Junior Lecturer in Vocational, (C.T)**
**Govt. Junior College, Ibrahimpatan**
**Ranga Reddy Dist.**

**EDITOR**
**P. VENKATESHWAR RAO, M.E (Structures)**
**Junior Lecturer in Vocational, WS & SE**
**Govt. Junior College, Malkajgiri,**
**Secunderabad.**

IVC

SECOND YEAR

*Construction Management and Accounts*

# CONSTRUCTION MANAGEMENT AND ACCOUNTS

STATE INSTITUTE OF VOCATIONAL EDUCATION
DIRECTOR OF INTERMEDIATE EDUCATION
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# REFERENCE BOOKS


1. **Construction Management and Accounts by V.N.Vazirani.**
2. **Construction Management and Accounts by Sharma.**
3. **Construction Management and Accounts by Harpal Singh.**
4. **Entrepreneurship and Construction management by N.Srinivasulu.**

# MODEL PAPER

**SUB: CONSTRUCTION MANAGEMENT AND ACCOUNTS**

**II YEAR CONSTRUCTION TECHNOLOGY**

**TIME: 3 HRS** **MAX MARKS: 50**

## SECTION – A

**Note: 1) Attempt all questions**

**2) Each question carries 2 marks**

1. Define contract planning.
2. Define Scheduling.
3. What is meant by a contract?
4. Define Tender.
5. What is a job lay out.
6. Define Stock.
7. Write types of Organisations.
8. What is Bin Card.?
9. Define Issue Rate.
10. Define earliest event time.

## SECTION – B

**Note: 1) Attempt any five of the following**

**2) Each question carries 6 marks**

11. Explain functions of construction management.
12. Define Scheduling and write advantages of scheduling.

13. Explain different types of organisations.
14. Explain about the following.

    (a) Minimum Wages Act  (b) Compensation Act.
15. Explain major items requiring Quality control.
16. What is meant by ‘stock’? What are the subheads of stock?
17. Explain the methods of payment of wages.
18. Write about the following.

    (a) Work order

    (b) Write off.

* * *

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# CHAPTER 1
# INTRODUCTION

## 1.1 Construction in India

India has a great heritage of construction work. The earliest known organised structures at Mohenjo Daro date back to 3000 B.C. Skills in construction work is evident in the structures such as Meenakshi temple at Madurai, cave temples at Ellora and the Tajmahal. During the period of British, construction was confined to certain irrigation schemes, and to the development of urban areas.

After the independence, the Government adopted different plans for fast development of the country. The Government spent crores of rupees for the construction of dams, irrigation, and power projects, heavy industries, urban development, communication etc.

At present the construction work in India is one of the most widespread activities, involving a range of people from the small builder in villages and towns to large private companies, public undertakings and various state agencies. A broad category of agencies which initiate and execute construction works are given below:

(i) The Government and its agencies, such as the central and state public works departments, the military engineering services, municipalities etc.

(ii) Public under takings, such as the Railways, National Building Construction Corporation etc.

(iii) Private companies.

(iv) Individuals.

## 1.2 Classification of construction work

Construction works can be classified as:

a) **Light construction**: Light construction work is the work with light structural members. Heavy machinery usually not required for these works. E.g. residential buildings, schools, village roads, light industry sheds etc.

b) **Heavy construction:** Heavy construction works are the works with heavy structural members on massive foundations, requires heavy machinery and equipment and large quantities of material, labour and finances. E.g. Bridges, railways, hydroelectric power generation plants, etc.

c) **Industrial construction: I**ndustrial construction works are the works related to industries which needs special equipment and skill e.g. Oil refineries, Steel mills, Atomic reactors, etc.

## 1.3 Stages in construction work

Following are the stages in construction

(i) Conception

(ii) Study and Evaluation

(iii) Design

(iv) Contract

(v) Construction and

(vi) Utilisation and Maintenance.

## 1.4 Construction team

The construction team includes the owner, engineers and builders.

The owner is an individual, group, private or public body that promotes the work and provides finances and facilities for its execution.

The engineer is responsible for the economical and safe design and construction of the work under his supervision. The builder may be any one from a small contractor to a large construction company undertaking projects worth crores of rupees.

## 1.5 Resources of construction work

The resources needed for the construction industry are:

1) Men, skilled and unskilled.
2) Material such as cement, steel, bricks, aggregates, etc.
3) Machines such as trucks, cranes, etc. to facilitate construction.

Limited resources have to be utilised with in a given time to get maximum benefit in terms of construction output.

## 1.6 Functions of construction management

The aims of management in construction work are to execute the construction work in a planned and efficient manner. Following are the functions of management to achieve its aims.

(i) Planning.
(ii) Organising.

(iii) Directing.

(iv) Controlling

(v) Coordinating

**(i) Planning:** In execution of construction works, deciding what to do, when and how to do, is known as planning. In planning of a construction work, various alternative methods of executing the work are studied and decisions are taken regarding the time of starting and completion, labor, materials, machines and finance needed for the provision of construction facilities from time to time.

**(ii) Organising:** This function relates to the creation of an organisational set up capable of execution of planned activity. The type of organisation depends on the type of work, volume of work as well as the method of execution of work.

**(iii) Directing:** Directing involves motivating, guiding, supervising and leading the employees of an organisation. The function can be achieved by establishing good communication between the employees and the management.

**(iv) Controlling:** Controlling is the function of monitoring the progress achieved in comparison with the planned program and identifying areas of deficiency, if any, so that remedial steps can be taken.

**(v) Coordinating:** Coordinating is the management function of harmonising the action, approach of various employees, and groups of employees to achieve a common goal.

## 1.7 Scientific Methods of Construction Management

Scientific methods are adopted in construction management to carry out the construction work in a systematic and economical manner. Scientific management is an approach to management, where in procedures followed are not based on traditional thumb rules but are carefully planned and analysed.

The aim of scientific management is to organise and execute the work, results in maximum productivity out of each worker.

Scientific methods of management are depends on network techniques which involves graphical representation of inter-relationship among the elements of a project.

Uses of network techniques:

(a) Helps the management in planning, scheduling, and controlling the activities.

(b) Helps in guiding and directing the team more effectively.

(c) Permits advance planning, indicates current progress, and warns trouble spots when there may still be time to avoid them.

(d) Helps in handling uncertainties regarding time schedules, co-ordination of different activities.

Following are the Scientific methods of management.

1. CPM 2. PERT

**Critical Path method**: CPM is a network technique used for the planning and controlling the most logical sequence of operations for completing a project. The project is analysed in to different activities whose relationships are shown on the network diagram. The network then utilised for optimising the use of resources and, progress of the management project.

**Program Evaluation and Review Technique:** PERT is a network technique used for scheduling and controlling the management projects, whose activities are subjected to considerable degree of uncertainties in the performance time. The method of start and finish, critical path and project time are similar to CPM method. CPM is an activity-oriented method and PERT is the event-oriented method.

* * *

## SYNOPSIS

1. Construction work is classified as
   (i) Light construction (ii) Heavy construction (iii) Industrial construction
2. Light construction works are works with light structural members E.g. Residential buildings, Schools etc.
3. Heavy construction works are the works with heavy structural members on massive foundations and these require heavy machinery and equipment E.g. Bridge, Dams, Railways etc.
4. Industrial construction works are the works related to industries, which needs special equipment and skills. E.g. Oil refineries, Steel mills, Atomic reactors etc.
5. Stages of construction
   (i) Conception (ii) Study and evaluation (iii) Design (iv) Contract
   (v) Construction and (vi) Utilisation and maintenance
6. Construction Team: (i) Owner (ii) Engineer (iii) Builder
7. Resources of construction work
   1. Men 2. Material 3. Machines
8. Functions of management
   (i) Planning (ii) Organising (iii) Directing
   (iv) Controlling and (v) Coordinating
9. Planning: In execution of works deciding what to do, when and how to do is known as planning
10. Scientifics methods of management (i) CPM (ii) PERT

## SHORT ANSWER QUESTIONS

1. Write classification of construction work.
2. What is light construction?
3. What is Industrial construction?
4. Write stages in a construction work.
5. Write Resources of construction work.
6. Write the functions of management.
7. Mention the scientific methods of construction management.

## ESSAY TYPE QUESTIONS

1. Explain the functions of construction management.

* * *

# CHAPTER 2

# CONSTRUCTION PLANNING

## 2.1 Job Planning

While planning a construction project usually it is needed to divide the entire project for phasing out the sequence of construction, and for dividing the operation of one phase into number of jobs.

Each job has to be planned with respect to the following:

1. Method of execution of the work: Whether the work is executed departmentally or through contract.
2. Duration of the job: This depends upon the urgency of the work and availability of the resources of the construction work.
3. Planning of resources: The job should be planned such that the resources of construction i.e. man power and material should be used economically.

## 2.2 Technical Planning

Technical planning is done by the engineers for economical execution of the construction work.

### Objects of the Technical planning

Following are the objects of Technical planning.

(i) Preparation of layout plan.

(ii) Finalisation of design and specifications.

(iii) Preparation of detailed drawings.

(iv) Preparation of detailed estimates.

(v) Finalising method of execution of work and initiating procurement action.

## 2.3 Pretender planning

The contractor does pretender planning after receipt of tender notice and before submitting a bid. This helps the contractor in making a proper bid for the contract.

Pretender plan includes the following steps.

(i) Careful study of the drawings, time limit and other conditions of the work

(ii) Working out the quantities of required material, labour, equipment and their availability etc.

(iii) Studying the bidding trends of other competitors.

(iv) Considering the profit margin and limits of risks that could be taken.

## 2.4 Contract planning

After the tender has been accepted and the work is allotted to the contractor for execution of the work, the contractor has to undertake further intensive planning. This planning at this stage is known as contract planning.

Contract planning involves the following steps

i) Studying alternatives to the construction methods decided at pretender stage to arrive at the most economical method and deciding about the sub contracting.

ii) Working out the quantities of material, labour, equipments at various stages of work and locating the sources of supply of material, equipments etc. and comparative cost from the various sources.

iii) Planning location of camp offices, layout of the site, service roads, facilities for labour and their accommodation and other related matters.

iv) Studying inter dependencies of the different items of work.

v) Finalising the work program for each item of work and fixing dates for the start and completion of each item of work.

## 2.5 Scheduling

Scheduling means the preparation in advance of a list of different activities and their order of sequence to carry out any work as per the planned programmme.

For completing a project as per the plan, scheduling should be known to not only to the project managers, but also to all the links in the system namely engineers, supervisors, contractors and other coordinating agencies.

Scheduling includes the following:

1. Determination of the amount of work to be done.
2. The order in which the work is to be performed at each stage
3. The time when each part of the work will start.
4. Allocation of the quantity and rate of output of departments.
5. The date of starting of each unit of work at each stage along the route to be followed.

## 2.6 Need for scheduling

A project usually is a one-time effort. Every project will have its own features and they are of non-repetitive nature. In

order to complete a project efficiently, the project manager must plan and schedule. During the course of project he will have to re plan and schedule due to unexpected progress, delay or due to technical conditions. The main aspect of project management will be scheduling different activities in an acceptable time span and finally with controlling the progress of scheduled work.

## 2.7 Advantages of Scheduling

For construction work of any importance, planning and scheduling is indispensable the following advantages are obtained thereby.

1. Alternative methods of construction and the effects of likely constraints can be examined at the planning stage and the most economical methods identified.
2. The time of starting each activity is known and therefore prior and adequate arrangements for the provision of resources, such as men, material, machines and money at each stage of construction can be made.
3. Resource utilisation can be optimised and the available resources directed towards various activities to the best advantage.
4. The actual progress of each activity can be monitored with reference action in speeding up the work taken up, before it causes a hindrance in other related activities.
5. The effect of any changes that takes place due to variations in productivity errors, whether geological conditions or modifications made in the original plans can be properly evaluated and the program suitably amended.

6. The inter-relationship of various activities and the relative importance of each at any stage of construction are known and this help in fixing priorities properly.
7. The ultimate advantage to be gained by scheduling is that the construction work can be executed in an efficient manner without wastage of any of the inputs, resulting in maximum possible economy.

## 2.8 Procurement of labour, material and equipment

In any construction project, it is necessary to estimate the required labour, material and equipment required for completion of the project. This can be done with the help of construction schedules. Separate schedules are prepared for labour, material and equipment.

These schedules help in procurement of labour, material and equipment at proper time and their efficient usage and storage.

**Labour:** Labour schedule, helps in providing future labour requirements and efficient and optimum deployment of labour force where ever necessary.

**Material:** Material schedules helps in providing types of material required along with their quantities and the actual time by which the materials are kept ready so as to avoid any delays in completing a construction project.

**Equipment:** Equipment schedules are prepared to find the type of equipment required, time and period for which particular equipment is needed. It helps in avoiding the equipment keeping it idle.

## 2.9 Programme of work

Programming is very important and essential for completing a project successfully. It guides and controls the execution of work.

Programming involves in

1. Identifying the various outputs.
2. Fixing accountability to carry out contribution.
3. Preparing detailed schedules for the construction resources.
4. Controlling the quality and quantity of work.
5. Minimising the time required to complete the project.

## 2.10 Scheduling by bar charts

A construction project consists of a sequence of various activities like preparation of the site, foundation, substructure, super structure, fittings, finishing, and other activities. Some of the activities may be of critical nature and if the activity is not completed in estimated time, it delays the entire project. The sequence of activities in the construction of a building is given below.

1. Earth work in excavation.
2. P.C.C bed and BW in foundation
3. D.P.C
4. Precasting RCC lintels
5. Casting RCC columns
6. BW in super structure
7. Sanitary work
8. RCC roof slab
9. Door panels
10. Plastering
11. Flooring
12. Electricalworks
13. Sanitary works
14. White washing
15. Sanitary fittings
16. Clearing up site

The bar chart lists various activities involved in a construction project and the period of time that each activity takes for completion. Indicate in the form of a horizontal bar plotted to a suitable time scale against each activity.

The conventions commonly used in bar chart are shown in the fig below.

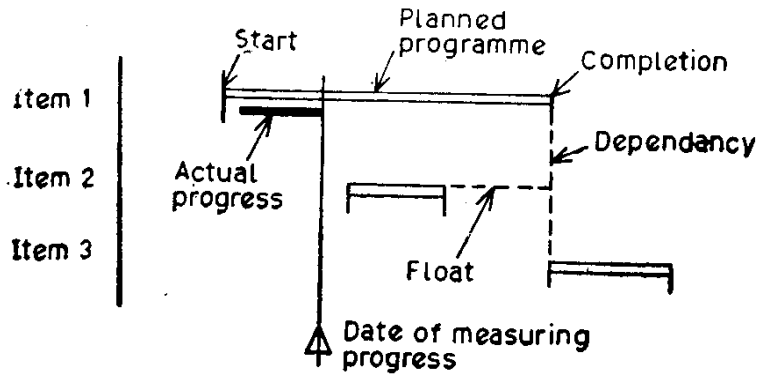



**Fig. 2.1**

The planned program is shown by a thick or double line with the planned start and finish by short vertical lines. The float is shown by a hyphenated horizontal line and indicates that, although the item is scheduled to be completed by a certain date, yet subsequent items are not likely to be held up in case of delay up to the period represented by the hyphenated line. A hyphenated vertical line, connecting the start of the item with the completion of the item on which it is dependant, indicates the dependency of one work on another. In fig 2.1, item 3 is

dependent on item 1 and cannot be started till item 1 is completed. The actual progress shown in single line drawn below the line showing planned program.

Bar charts are suitable for determining the resources, such as materials, labour, machinery and finance, required for construction work. Figure 2.2 shows the resource aggregation chart for RCC work.

Bar chart is simple, easily understandable and widely used method of scheduling. However it has certain limitations, firstly it is difficult to depict complicated interdependencies of various items of work. It does not give actual progress of the work. It is not possible to know the peak rate of work necessary for timely completion of a project. The bar chart, there fore, is a static representation and does not respond to the dynamic happenings on the construction site of a complex project.

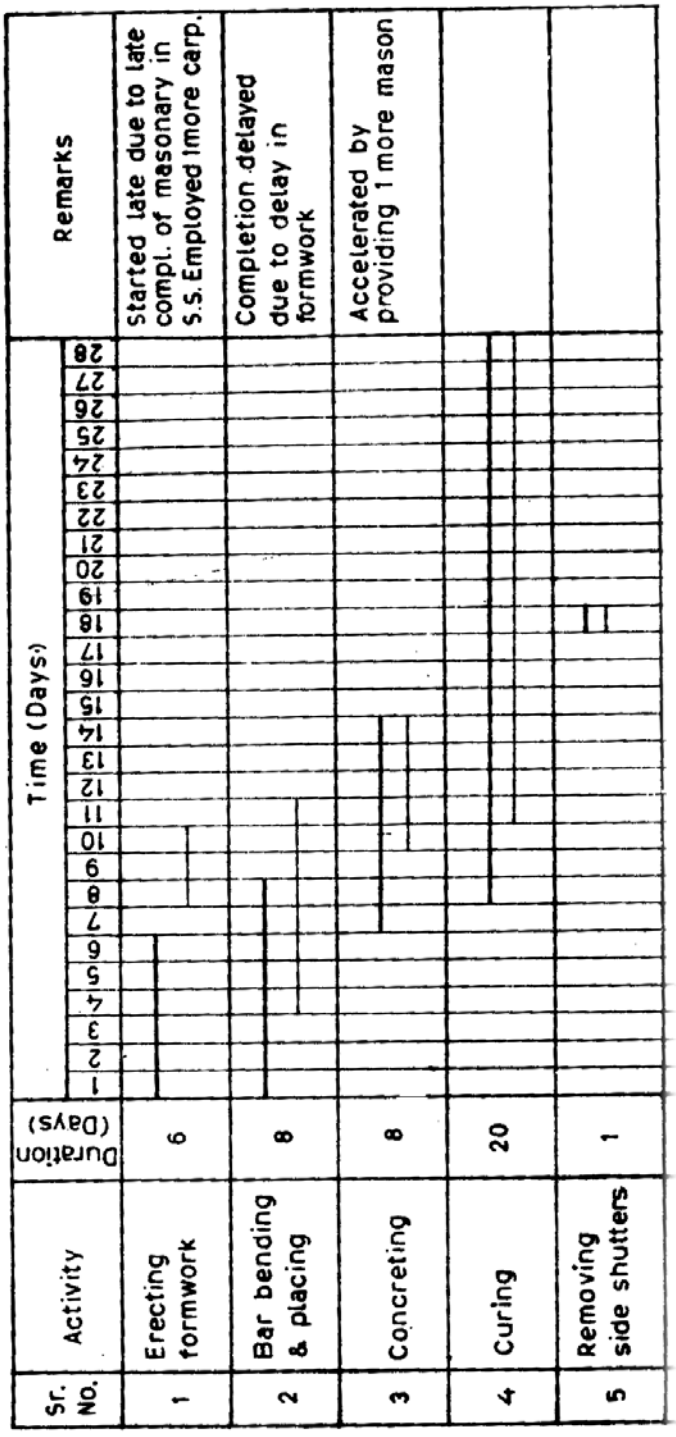

Sr. No.
Activity
Duration (Days)
Time (Days)
Remarks
1 Erecting formwork 6 Started late due to late compl. of masonary in S.S. Employed 1more carp.
2 Bar bending & placing 8 Completion delayed due to delay in formwork
3 Concreting 8 Accelerated by providing 1 more mason
4 Curing 20
5 Removing side shutters 1

**Figure 2.2**

## 2.11 Critical path method of scheduling

Critical Path Method is a network method. In CPM the project is analysed into different activities whose relationships are shown on the network diagram. The limitations of the bar charts can be over come with the Critical Path Method. CPM is widely used in construction industry by a number of private and public organisations.

The concept of CPM is that only a small number of critical activities take most of the estimated project time. Speeding up the rest of the activities has no effect on the completion of work. Only these critical activities need to be speeded up and the rest of the activities can be allowed to proceed normally. The work can then be completed by the target date.

## 2.12 Basic network construction

A network diagram is a graphical representation of the sequence in which various activities of a project are under taken and the relationship among them. The method of construction of network diagram is given below

1) **Listing the activities:** All the activities of which the work is composed of are listed.
2) **Arrow:** Individual activities such as excavation, plastering, brickwork, plumbing etc. which consumes

time are denoted by arrows. The direction of the arrow indicates the general flow of the work, tail representing the start and the head the completion of the activity. The length of an arrow does not have any significance.

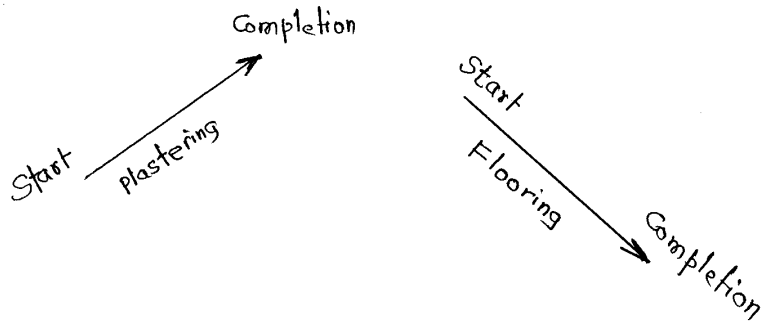



**Fig.2.3**

3) **Events:** The head and tail of an arrow represent events which are represented by a circle, square or a triangle. An event is just a point of time and it is not a time consuming element.

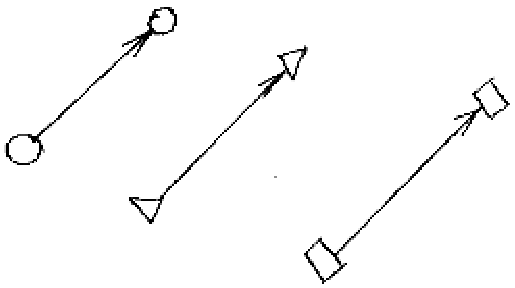


**Fig.2.4**

**4) Activity Identification:** All events are given unique numbers which may or may not be in serial order. Activity is identified by the event numbers preceding and following it; or by letters A, B, C etc.

The activity, Excavation is identified by number 1-2 or A, 'Plumbing' by 8-12 or B.

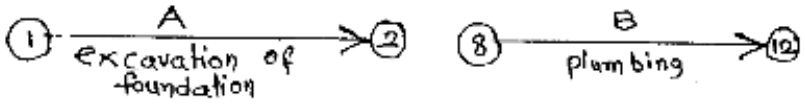



**Fig.2.5**

**5) Sequence convention:** All activities shown as entering an event must be completed before those emerging from it can be started. In fig (2.6) the activity emerging from event 2, i.e 2-3(laying foundation concrete) can not be started before activity 1-2(excavation of foundation) entering in to event 2 has been completed.

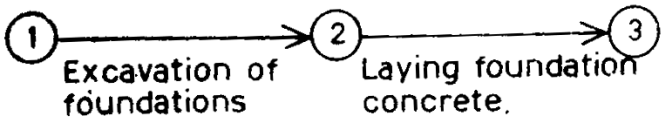



**Fig. 2.6**

**6) Net work logic:** The following points have to be considered before deciding where an activity fits.

**i)** Which activities must be completed before this activity can be started?

**ii)** Which activities cannot be started before this activity is completed?

**iii)** Which activities can be started simultaneously?

Some commonly occurring network situations, along with their bar charts are given below:

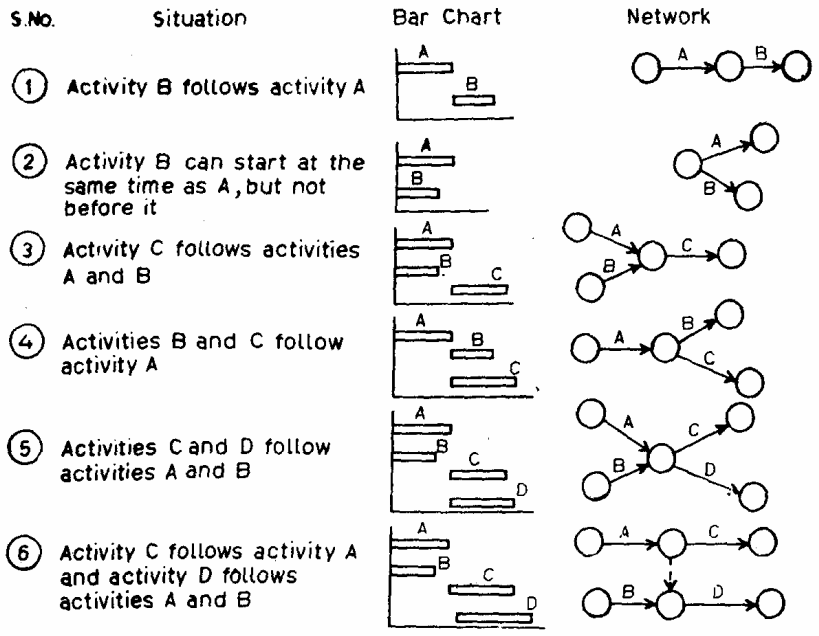



**Fig 2.7**

## 2.13 Terms used in CPM method

**Dummy Activity:** Dummy Activity is an activity, which do not consume any time. Dummies are used only to ensure separate activity numbers and maintain the correct logic of the network. This activity is represented by dotted arrow.

**Duration:** Duration is the estimated time, required to complete an activity and is shown on or under the activity in the network.

**Earliest start time:** It is the earliest possible time for the activity to start without changing the sequence of the activities in the network. It is denoted by E.S.T.

**Earliest finish time:** It is the earliest time by which the activity can be completed and is denoted by E.F.T. EFT of an activity = EST + Duration of activity (T).

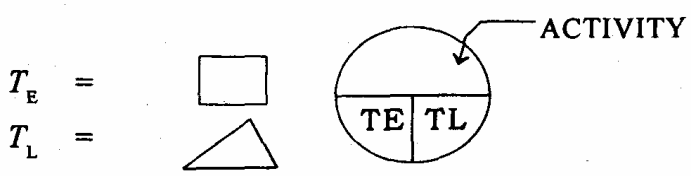
**Earliest event occurrence time:** It is the earliest time that the event start can occur. It is denoted by TE.

**Latest start time:** It is the latest time by which an activity can be started without delaying the project. It is denoted by L.S.T.

**Latest finish time:** It is the latest time by which an activity can be completed without delaying the project. It is denoted by L.F.T.

**Latest allowable event occurrence time (TL):** It is the latest time, the event can occur.

**Symbolic Representation:**




**Total float:** It is the difference between the maximum time allowed for an activity and its duration time. It is also called total activity slack or spare time and is denoted by (TF).

$$TF = LST - EST$$

$$= LFT - EFT$$

$$= TL - EFT$$

**Free float:** The free float of an activity is an amount of time by which the activity completion time can be delayed without interfering with the start of succeeding activities. It is denoted by F.F.

$$F.F. = TE - EFT$$

**Critical path:** The events which have no float or slack are the critical events i.e., If TE = TL. These events must be completed on schedule, if the project is to be completed in the minimum total time. The path joining such critical events is called the critical path of the network.

**Critical activities:** The activities lying on the critical path are called critical activities. Critical activity has a zero float

## 2.14 Steps in Critical Path Scheduling

Before applying the critical path method of scheduling to a construction project, it is necessary to follow the given steps.

1. Prepare a list of activities for the project.
2. Estimate the durations of each activity.
3. Determine which activity or activities immediately follow each activity.
4. Determine which activity/activities immediately precedes each activity.

5. Draw a network with the activities and events properly interconnected.
6. Assign number to the events and make sure that the number at the head of each arrow is larger than the number at the tail of arrow.
7. Prepare a chart with vertical columns and horizontal lines on which to list each activity with an appropriate designation. Duration, earliest start, earliest finish, latest start, latest finish, and total float are to be mentioned. A column of free float may be included if this information is required.
8. Determine which activities lay on the critical path.

## 2.15 Determination of project schedule and Critical Path

After estimating the performance time for each activity, scheduling of activities is begun to determine the network critical paths. The basic scheduling computations involve a forward and backward pass through the network. Based on a specified occurrence for the initial network event, the forward pass computations give the earliest start and earliest finish times for each activity and also the earliest occurrence time for each event.

By specifying the latest allowable occurrence time for the terminal network events, the backward pass computations will give the latest allowable start and finish times for each activity, and the latest allowable occurrence time for each event. After the forward and backward pass computations are completed, the float can be computed for each activity and thereby critical and the sub critical paths through the network are determined. When an

activity has float, there is more time available to do it than it requires.

In initial stages it is convenient to begin with zero as the starting time of the initial project event and estimate the activity performance times in working days. Finally these computational results are converted to calendar dates. It is also assumed that there is only one initial event and one terminal event. Also the latest allowable finish time for the project is equal to the earliest finish time computed in the forward pass computations.

**The rules in forward pass can be summarised as:**

(i) The earliest occurrence time of the single initial event of the network is taken as zero

$TE = 0$

(ii) Each activity begins as soon as its predecessor event occurs

$EST = TE$ for

Predecessor event

(Where T = time duration for the activity) Also

$EFT = EST + T = TE + T$

(iii) The earliest event occurrence time is the largest of the earliest finish times of the activities merging to the event in question

TE = largest of

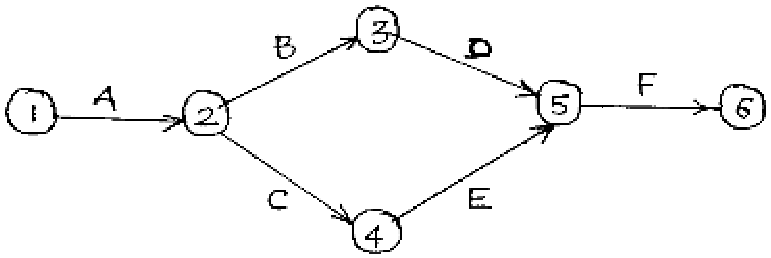
$EFT_1$, $EFT_2$ ....etc

**The rules in backward pass can be summarised as:**

| | |
|---|---|
| (i) The latest allowable occurrence time of the single terminal event of the network is set equal to the earliest occurrence time computed in the forward pass. | TL = TE for terminal event |
| (ii) The latest allowable start time LST for an activity is its successor event latest allowable time minus the duration time of the activity in question. | LST = LFT - T = TL - T |
| (iii) The latest allowable time for an event is the smallest of the latest allowable start time of the activities bursting from event in question. | TL = Smallest of $LST_1$,; $LST_2$ etc of bursting activities. |

**Example 2.1:** Draw a Network for the following logic:

Activities B and C depend upon activity A; Activity D depends upon Activity B; Activity E depends upon activity C and activity F depends upon activities D and E.




**Solution:** **Fig.2.8**

**Example 2.2:** Draw a Network diagram for the following logic:

B follows A, C and D follows A, D and E follow B, F follows C and D and G follows E and F.

**Solution:**

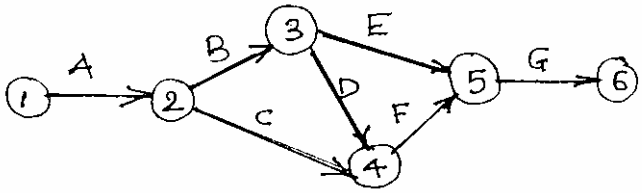



**Fig. 2.9**

**Example 2.3:** Draw a C.P.M. Network diagram for the following logic:

Activity B follows activity A.

Activities C and D follow activity B

Activities E and F follow activity C

Activity G follows activity D

Activity H follows activities F and G

Activity I follows activity E

Activity J follows activities H and I.

**Solution:**

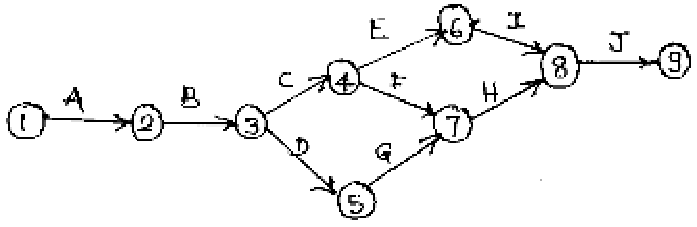



**Fig. 2.10**

**Example 2.4:** Draw a Network diagram and calculate earliest time for the event of the network diagram.

Activities A and B starts simultaneously

Activity C follows Activity A

Activity D follows Activity B

Durations of Activities A, B, C and D are 10, 13, 15 and 8 days respectively.

**Solution:**

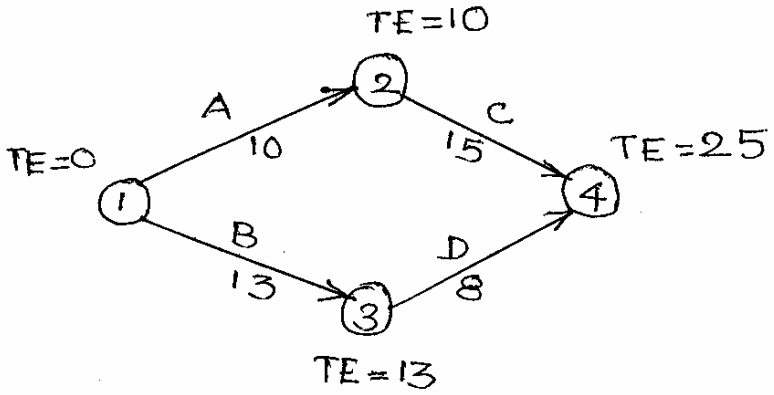



**Fig 2.11**

If event 1 is at work 0 (Zero) then even 2 has an earliest time of 10 days.

Event 3 has an earliest time of 13 days but event 4 has two paths leading into it

(i) 1-2-4 of duration (10+15) = 25 days

(ii) 1-3-4 of duration (13+8) = 21 days.

The earliest time for event 4 is determined by the longest path. In this case 1-2-4 has maximum continue duration time of 25 days. Hence the earliest time for the terminal event is 25 days

**Example 2.5:** Find the Latest allowable time for the events and prepare a time schedule and calculate float for each activity and show the critical path for the given network diagram.

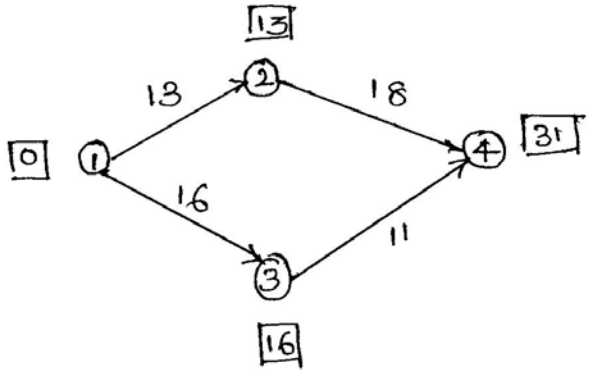



**Fig. 2.12**

**Solution:**

For the terminal event 4, the latest allowable occurrence time (TL) will be equal to the earliest occurrence time (TE)

Therefore .TL of event 4 =31

TL for event 3 = TL of event 4 – duration of activity (3-4)

= 31-11 =20

TL for event 2 = TL of event 4 – duration of activity (2-4)

= 31-18 =13

For TL for event 1 has two paths i.e. 2-1 and 3-1

TL for event 1 along path 2-1 = 13-13 =0

Or

TL for event 1 along path 3-1 = 20-16 =4

Least is to be taken i.e., 0.

| Activity | Duration | Earliest | | Latest | | Slack or Float |
|---|---|---|---|---|---|---|
| | | Start | Finish | Start | Finish | |
| 1-2 | 13 | 0 | 13 | 0 | 13 | 0 |
| 1-3 | 16 | 0 | 16 | 4 | 20 | 4 |
| 2-4 | 18 | 13 | 31 | 13 | 31 | 0 |
| 3-4 | 11 | 16 | 27 | 20 | 31 | 4 |

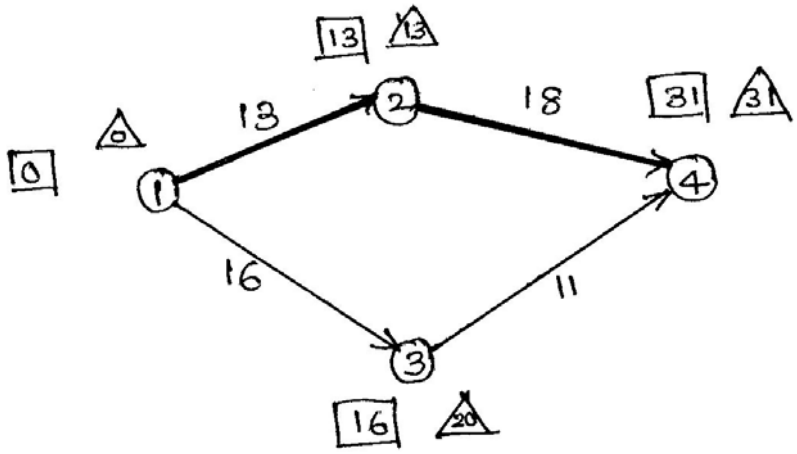



**Fig. 2.13**

In the network critical path is (1-2-4) and the duration of the project is 31 on this path the activities have no float (when TE=TL; then flow is zero)

**Example 2.6:** The table given below represents the activities of the network of a construction project. The durations for the activities for the network are also given.

(i) Prepare the network diagram

(ii) Find the Critical Path and time of completion of construction project

(iii) Prepare time schedule indicating total float and free float

| Activity | Duration of Days |
|---|---|
| (0 – 1) | 5 |
| (1 - 2) | 11 |
| (2 – 3) | 9 |
| (2 – 4) | 35 |
| (2 – 7) | 5 |
| (3 – 4) | 7 |
| (3 – 7) | 9 |
| (4 – 5) | 13 |
| (4 – 6) | 15 |
| (5 – 6) | 0 |
| (6 - 7) | 11 |
| (7 – 8) | 7 |

**Solution:** (i) Refer Fig. 2.14

(ii) Network diagram of Construction project

Finding the TE for events

TE for event 0 = 0

TE for event 1 = 0 + 5 = 5

TE for event 2 = 5 + 11 = 16

TE for event 3 = 16 + 9 = 25

TE for event 4 = (i) 25 + 7 = 32

(ii) 16+35 = 51

Highest among the above is to be taken

TE for event 4 = 51,

TE for event 5 = 51 + 13 = 64

TE for event 6 = (i) 64 + 0 = 64

(ii) 51 +15 = 66

Highest among the above is to be taken

TE for event 6 = 66

TE for event 7 = (i) 16 + 5 = 21

(ii) 66 + 11 = 77

(iii) 25 + 9 = 34

TE for event 7 = 77 (Highest value from the above three values)

TE for event 8 = 77 + 7 = 84

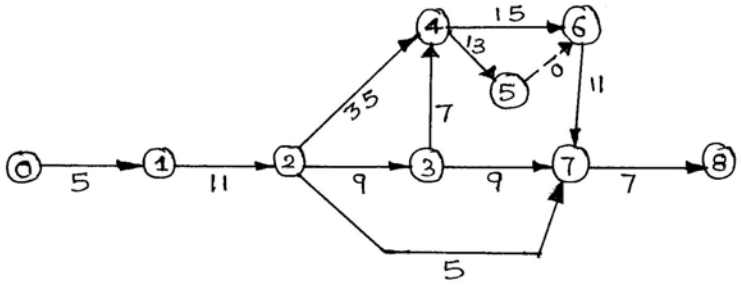



**Fig.2.14**

**Finding TL for events:** For the terminal event 8, the latest allowable occurrence time (TL) will be equal to the earliest occurrence time (TE) as calculated from forward pass and is equal to 84

TL for event 8 = 84

TL for event 7 = 84 – 7 = 77

TL for event 6 = 77 – 11 = 66

TL for event 5 = 66 – 0 = 66

TL for event 4 = (i) 66-15 = 51

(ii) 66-13 = 53 Least value = 51.

TL for event 3 = 51 – 7 = 44

TL for event 2 = (i) 51-35=16

(ii) 77-5=72

(iii) 44-9=35

Least among the above is to be taken, hence

TL for event 2 = 16

TL for event 1 = 16 – 11 = 5

TL for event 0 = 5 – 5 = 0

Total Float = LST-EST=LFT-EFT=TL-EFT

Total float for activity 0-1 0-0 = 0

for activity 1-2 5-5 = 0

for activity 2-3 35-16 = 19

for activity 2-4 16-16 = 0

for activity 2-7 72-16 = 56

for activity 3-4 44-25 = 19

for activity 3-7 68-25 = 43

for activity 4-5 53-51 = 2

for activity 4-6 51-51 = 0

for activity 5-6 66-64 = 2

for activity 6-7 66-66 = 0

for activity 7-8 77-77 = 0

Free Float = TE-EFT

Free float for activity 0-1 5-5 = 0

for activity 1-2 16-16= 0

for activity 2-3 25-25= 0

for activity 2-4 51-51= 0

for activity 2-7 77-21=56

for activity 3-4 51-32=19

for activity 3-7 77-34=43

for activity 4-5 64-64= 0

for activity 4-6 66-66 = 0

for activity 5-6 66-64 = 2

for activity 6-7 77-77 = 0

for activity 7-8 84-84 = 0

In the diagram 2.15 the critical path is shown by thick line and the activities along critical path will not have any slack time.

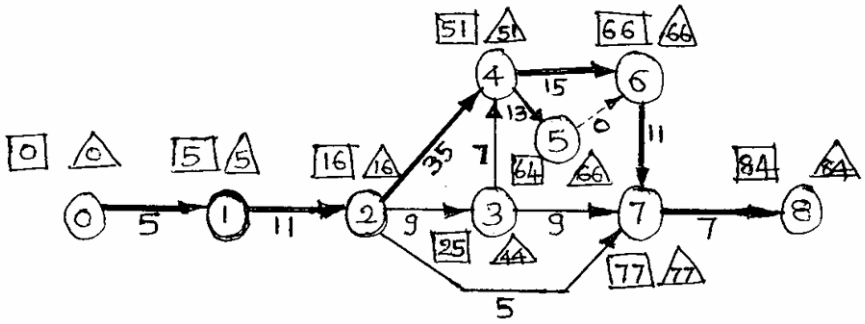



**Fig. 2.15**

Critical Path = (0-1-2-4-6-7-8)

Time of completion of construction project = 84 days

The Time schedule analysis is shown in the Table given below.

| Activity | Duration | Earliest | | Latest | | Total Float | Free Float |
|---|---|---|---|---|---|---|---|
| | | Start | Finish | Start | Finish | | |
| 0-1 | 5 | 0 | 5 | 0 | 5 | 0 | 0 |
| 1-2 | 11 | 5 | 16 | 5 | 16 | 0 | 0 |
| 2-3 | 9 | 16 | 25 | 35 | 44 | 19 | 0 |
| 2-4 | 35 | 16 | 51 | 16 | 51 | 0 | 0 |
| 2-7 | 5 | 16 | 21 | 72 | 77 | 56 | 56 |
| 3-4 | 7 | 25 | 32 | 44 | 51 | 19 | 19 |
| 3-7 | 9 | 25 | 34 | 68 | 77 | 43 | 43 |
| 4-5 | 13 | 51 | 64 | 53 | 66 | 2 | 0 |
| 4-6 | 15 | 51 | 66 | 51 | 66 | 0 | 0 |
| 5-6 | 0 | 64 | 64 | 66 | 66 | 2 | 2 |
| 6-7 | 11 | 66 | 77 | 66 | 77 | 0 | 0 |
| 7-8 | 7 | 77 | 84 | 77 | 84 | 0 | 0 |

* * *

## SYNOPSIS

1. Job planning is needed to divide the entire project for phasing out the sequence of construction and for dividing the operation of one phase into number of jobs.
2. Technical planning is done by engineers for economical execution of the construction work.
3. Pretender planning is done by the contractor after receipt of tender notice and before submitting a bid.
4. Contract planning is done by the contractor after getting the contract
5. Scheduling: Scheduling means the preparation in advance of a list of different activities and their order of sequence to carry out any work as per the planned program.
6. Bar chart lists various activities of a construction project and the period of time that each activity takes for completion, indicated in the form of a horizontal bar plotted against each activity
7. Activity is represented by an arrow
8. Event is just a point of time and represented by a circle, square or a triangle
9. Dummy activity does not consume any time and represented by dotted arrow.
10. Earliest start time (EST): is the earliest possible time for the activity to start without changing the sequence of the activities in the network.
11. Earliest finish time (EFT) is the earliest time by which the activity can be completed.

12. Earliest event occurrence time (TE) is the earliest time that the event start can occur.
13. Latest start time (LST) is the time by which an activity can be started without delaying the project.
14. Latest finish time (LFT) is the time by which an activity can be completed without delaying the project.
15. Latest allowable occurrence time (TL) is the latest time, the event can occur.
16. Total Float (TF) is the difference between the maximum time allowed for activity and its duration time.
17. Free Float (FF) of an activity is an amount of time by which the activity completion time can be delayed without interfering with the start of succeeding activities.
18. Critical events have zero float TE=TL
19. Critical path is the path joining critical events of the network.
20. Critical activities are the activities which lye on the critical path.

## SHORT ANSWER QUESTIONS

1. Define Job Planning.
2. What is contract planning?
3. What is pretender planning?
4. What is scheduling?
5. Write different methods of scheduling.
6. What is a bar chart?
7. Define an event.
8. What is dummy activity?
9. What is total float?
10. Define latest start time.
11. What is critical path?

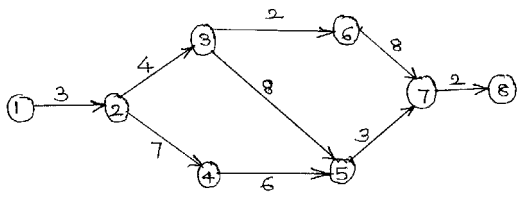
## ESSAY TYPE QUESTIONS

1. Describe the different methods of scheduling a construction project and explain the advantages and disadvantages of each.
2. What is meant by scheduling? What are the advantages of scheduling a construction job?
3. Draw a network diagram for the following logic: Activities B and C depend upon activity A; activity D depends upon activity B; activity E depends upon activity C and activity F depends upon activities D and E and activity G follow activity F.
4. Draw a CPM network diagram for the following logic: carry out the forward and backward pass for the network and determine the earliest start and the latest start times for each activity as well as critical path. Activity B follows activity A; Activities C and D

follow activity B; Activities E and F follow activity C; Activity G follows activity D; activity H follows activities F and G; Activity J follows activity E; Activity K follows activities H and J.

Duration of A,B,C,D,E,F,G,H,J,K are 3,5,6,10,8,6,10,3,7,3 days respectively.

5. Develop a network for a construction with the following activities and logical sequence
   - (i) A is the first activity
   - (ii) B and C are performed simultaneously and are the immediately successors to A
   - (iii) D,E and F follow B
   - (iv) G follows E
   - (v) H follows D, but it cannot start until E is over
   - (vi) I and J succeed G
   - (vii) F and J precede K
   - (viii) H and I precede L
   - (ix) M succeeds L and K
   - (x) The last operation N succeeds M and C
6. Carryout the forward and backward pass for the network shown below and determine the earliest start and the latest start times for each activity as well as the critical path.




* * *

# CHAPTER 3
# ORGANISATION

## 3.1 Introduction

Organisation can be defined as the managerial function of fixing the responsibilities of individuals and establishing good relationships with one another for effectively achieving a common goal in a group activity.

## 3.2 Types of Organisation

Depending upon how responsibility and authority in any enterprise are distributed, the organisation can be divided into three main types:

a) Line Organisation

b) Line and staff Organisation.

c) Functional Organisation.

## 3.3 Line Organisation

This is the simplest form of Organisation where in responsibility is distributed from top to bottom. This pattern is borrowed from military organisation where a number of sepoys formed squads under the control of a squad leader. A number of squads are formed in to a company under the control of a commander. There is a single line of communication through the commanders and respective formations. An example of line organisation is given in Fig3.1.

The salient features of line organisation are

1) These are simple.
2) Responsibilities at all levels are defined and fixed.
3) It generates strong discipline
4) Decisions can be taken quickly

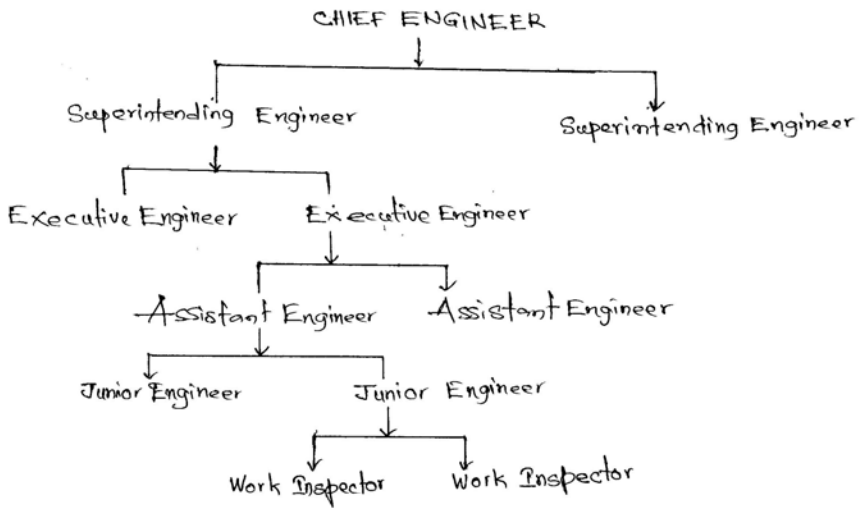



**Fig 3.1**

However it has following defects

1) The person in authority tends to get over loaded with work and the efficiency of the organisation depends upon the performance of the senior bosses.

2) There is inadequacy of communication from lower level to higher level.

### 3.4 Line and staff organisation

The main disadvantage of the line organisation is that the top executive has to take every decision related to the project. The system is therefore unsuitable for large and complex projects requiring services by specialists in different fields. In Line and Staff organisation the expert knowledge of the specialists is added to the line organisation. An example for line and staff organisation is given in fig.3.2

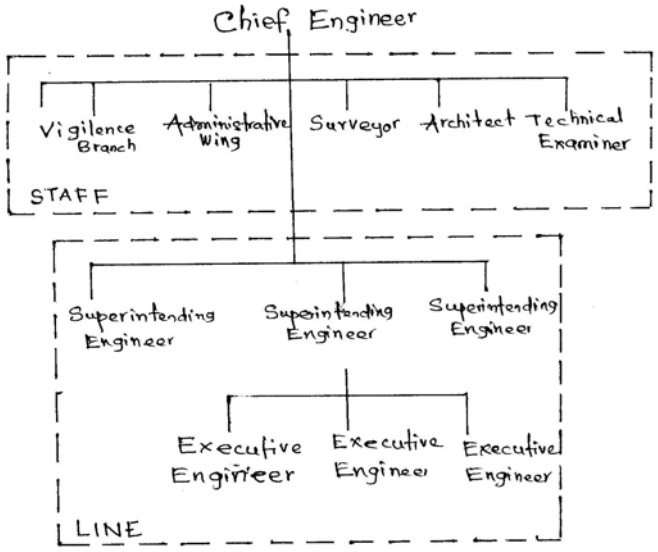



**Fig 3.2**

The salient features of Line and Staff organisation are

1) The advice of experts is available at all levels.
2) It results in increased efficiency and economy.
3) The staff at site is competent to take decisions and hence work is not delayed. The system however has the following demerits.

1) If the advice of experts is not properly defined, there may be confusion about the relationship between the staff and line personnel.

## 3.5 Functional Organisation

In Functional organisation, the work is divided in such a way that each person has to perform the minimum number of functions and he is fully responsible for that work.

An example for a functional organisation is given in Fig.3.3

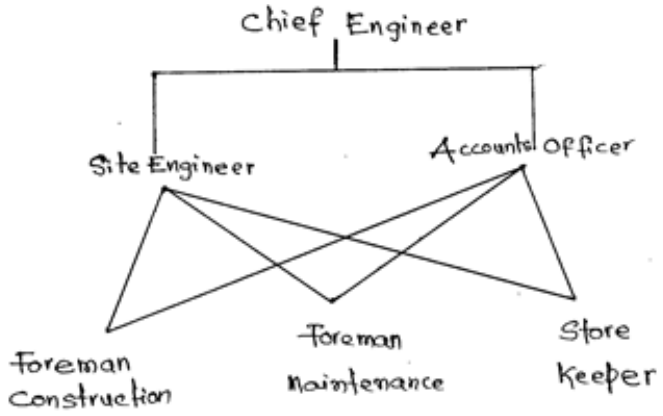



**Fig.3.3**

The merits of functional organisation are:

i. It enables division of labour on the basis of specialisation of functions.
ii. It enables increased efficiency.
iii. Manual work is separated from mental work.

The organisaiton having following demerits

i. It is unstable.
ii. It is too complicated.
iii. There is no clear-cut line of authority.

## 3.6 Principles of organisation

An organisation has to follow certain basic principles to be effective. Following are the important principles of organisation in the field of management.

(i) **Principle of span of management:** the number of persons that can be managed by one person is limited.

(ii) **Principle of command:** the subordinates should be responsible to a single person.

(iii) **The scalar principle:** A clear line of authority from the top to the bottom.

(iv) **Principle of delegation:** the delegation of authority with responsibility is essential to enable managers to carry out their duties efficiently.

(v) **Principle of division of work:** Each person is assigned work for which he is qualified.

(vi) **Principle of separation of work:** checking and control should be performed by persons other than those whose work is checked.

## 3.7 Organisation Suitable for the Construction Industry

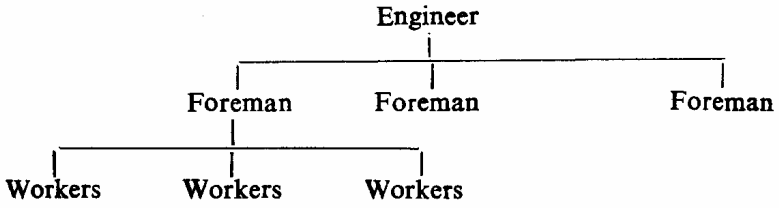
The type of organisation suitable for a small work is a simple line type of organisation. The engineer in charge exercises full authority and is responsible for the timely and economic execution of the work in accordance with the specifications laid down. Under him, there might be a few section officers and foremen, who are responsible for the execution of work at the site. The gangs of workers are subordinate to them. In very small works such as the construction of a private residential building, the contractor himself may perform the functions of the engineer and the foreman.

For medium-sized works, a more elaborate arrangement is called for and the organisation is generally of the line and staff pattern. The engineer in charge may be assisted by a team of experts, such as architects, design engineers, accountants, planning engineers and personnel officers. This constitutes the staff portion of the organisation. The staff is usually located at a permanent place, known as the head quarters. The construction work is carried out by field officers who are organised in a line form. The field staff receives guidance and instructions from the head quarter staff.

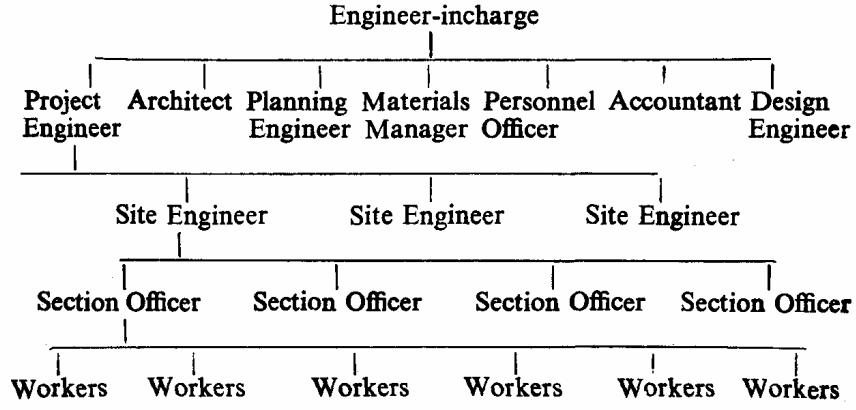
For large projects, the number of people involved may run into thousands and the staff portion of the organisation may be departmentalised. Each departmental head looks after a particular aspect of the work, such as design, planning, purchase of materials, personnel, etc. and is assisted by a team of subordinates grouped under the charge of different heads. The grouping of work in the field could be on the basis of the type of work, such as civil

works, mechanical works, electrical engineering works, piping or other specialised types of works. For works such as highways, canals, etc. which extends over large areas, field work may also be divided on the basis of territory and placed under the charge of a departmental head, assisted by a subordinate staff organised in a line form.

Typical organisational charts of small, medium and large construction organisations are indicated in Fig. (i) , (ii) and (iii)




(i) Organisation of a small construction firm.




(ii) Organisation of a medium-sized construction firm.

**Fig 3.4 (i) & (ii)**

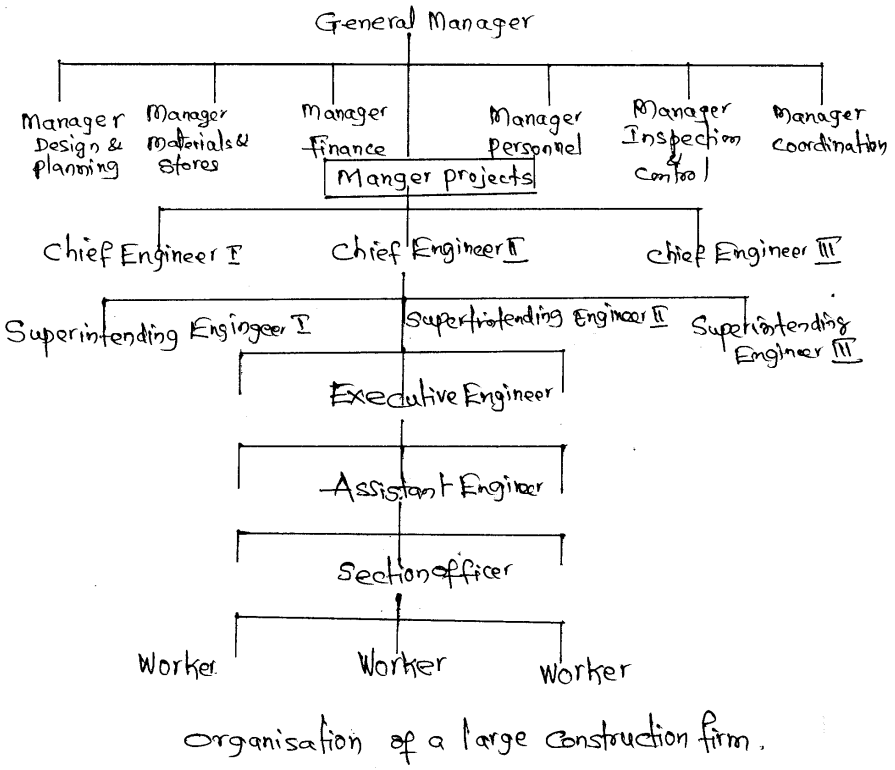



**Fig 3.4(iii)**

## 3.8 Job layout

A site drawing of the proposed construction showing the location of entry, exit, temporary services, material stores, plant and equipment and site office is known as job lay out. A job layout is prepared to ensure that the work proceed in a smooth and orderly manner that results in maximum efficiency.

In order to prepare a job layout, an overall idea of the nature and extent of work and the way in which it is to be carried

out must be known from a careful study of the construction plans, specifications and other documents. For preparing a good job layout, knowledge of the storing materials and placing equipments is necessary.

A job layout depends upon (i) the nature and type of work, (ii) the topography, location and size of the site (iii) the methods used for its execution.

## 3.9 Preparation of job layout

The first duty of a site engineer is to prepare a job layout. The construction plans, specifications, contract documents are carefully studied to get an idea of the nature and extent of the work. A drawing drawn to scale is then prepared showing the out lines of the jobs to be constructed. The entry and exit points, areas to be used for various temporary facilities, such as office, repair sheds, reinforcement structural fabrication, carpentry and form work fabrication, material stacks, and personal facilities such as toilets, canteen, labour huts, drinking water supply, first aid measures and other essential requirements for construction purposes are marked on the drawing.

When deciding the layout of equipment, the following points should be kept in mind.

(1) The equipment should be placed near the material it utilises.

(2) For costly equipment, temporary sheds should be provided.

(3) Provision should be made for repair and maintenance work.

(4) Adequate parking space should be provided for equipment.

(5) The main office should be located near the entrance so that visitors on business need not have to go across the work site.

(6) The location of security checkpoints should be such that no materials could pass in or out with out proper check.

(7) Fire prevention equipment and safety measures should be provided in the layout.

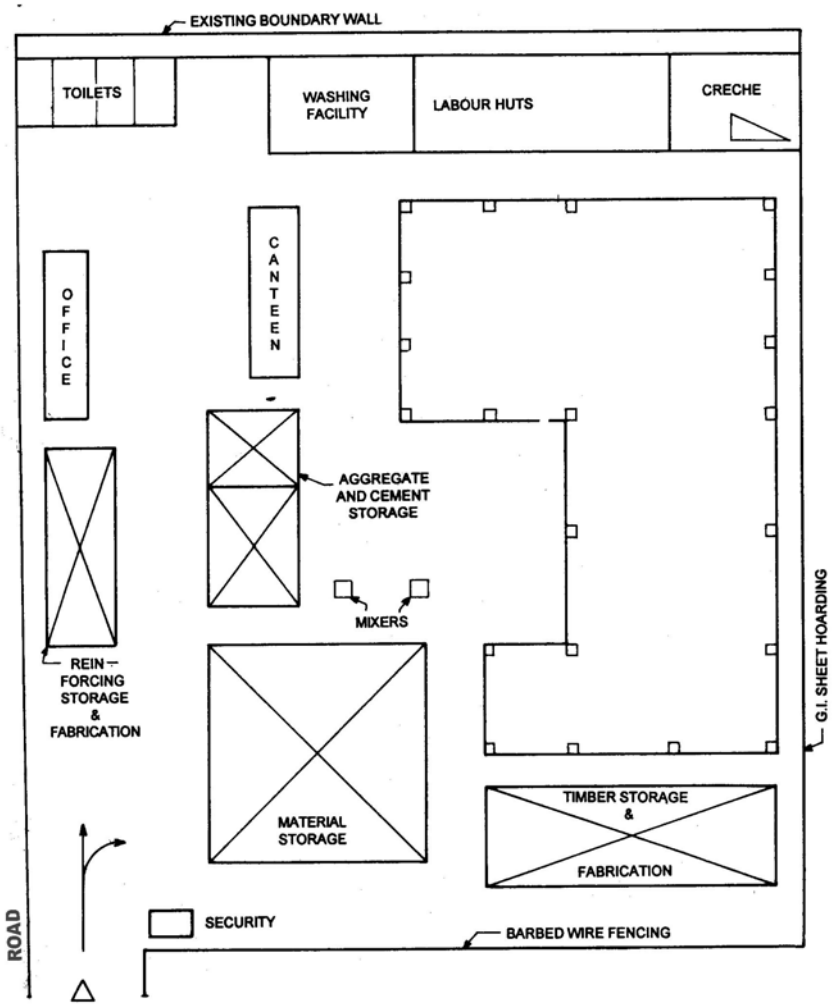



**Fig.3.7 A Job Layout for a Multi Storied Building**

## 3.10 Principles of storing material at the site

Large quantities of construction material have to be stored at the construction site. Correct methods of storing materials should be known so that the layout of a job at the site can be properly done.

Following are the important points to be considered while storing materials.

1. Materials should be stored in such away that they are not affected by impurities or by atmospheric agencies, such as the sun, wind or moisture. Cement and lime must be stored in covered sheds, Timber, which is affected by the sun and poor ventilation should be stored in a shady place.
2. Inflammable materials must be stocked separately from other combustible material and in an area protected from fire hazard.
3. Explosives should be kept in a safe place.
4. Bricks, tiles and concrete blocks are stocked at ground level limiting the height of the stack to 1.5m. 1m and 2m, respectively.
5. Aggregates are stacked on a clean hard surface in stacks of 2mx2mx0.5m.
6. Cement should be stacked in covered sheds on raised platforms at least 30cm. away from walls and in stacks of not more than 12 bags.
7. Reinforcing bars should be stacked in yards away from moisture, oils and lubricants.
8. Heavy items must be kept away from trenches preferably kept near the ramp for easy handling.
9. Cement and lime, which deteriorate with time, must be kept constantly moving by using the earliest arrivals first.

*** * ***

## SYNOPSIS

1. Organisation is the managerial function of fixing the responsibilities of individuals and establishing good relationships with one another for achieving a common goal.
2. Types of organization
   (i) Line organisation (ii) Line and staff organisation (iii) Functional organisation
3. Line organisation is the simplest form of organisaiton.It is unsuitable for large and complex projects.
4. Line and staff organisation: In these organizations, expert knowledge of specialists is available.
5. Functional organisation: In this each person has to perform the minimum number of functions and he is fully responsible for that work.
6. Principles of organisation:
   (i) Span of Management (ii) Unity of Command (iii) The scalar principle (iv) Delegation (v) Division of work (vi) Separation of work
7. Job layout is, a site drawing of the proposed construction showing the location of entry, exit, temporary services, material stores, plant and equipment and site office.
8. Job layout depend on (i) The nature and type of work (ii) The topography, location and size of the site (iv) The methods used for the execution

## SHORT ANSWER QUESTIONS

1. Define Organisation?
2. Write types of Organisations.
3. Mention the principles of Organisation.
4. Define Job Layout?
5. Write the factors on which Job Layout depend.

## ESSAY TYPE QUESTIONS

1. What is meant by Organisation? Explain line organisation with its salient features.
2. Draw out the line and staff organisation of a medium type construction firm.
3. Explain various types of organisations.
4. Explain the principles of organisation.
5. Explain the preparation of Job Layout.
6. Explain the principles of storing materials at the site.

*** * ***

# CHAPTER 4
# CONSTRUCTION LABOUR

## 4.1 Types of labour

Construction labour can broadly divided into two types

1. Casual labour 2. Regular establishment

**Casual labour:** Casual labour is employed as and when required for the execution of work, payment is made on the basis of the number of days the labour works. There is no provision of leave, except the weekly holidays. This is also known as daily labour.

**Regular Establishment:** Regular establishment generally includes supervisory personal that are required for more or less continuous period during construction. They are paid monthly wages and entitled to leave and other benefits. The employees may be temporary or permanent. Permanent employees have great security of service and may be entitled to more service benefits than the temporary employees.

## 4.2 Labour welfare-Human relation

Construction is the largest industry in India and most of the employees who are working in construction industry are labours and skilled workers. As the nature of construction work is temporary the workers are recruited as and when required for the execution of work and are retrenched when no longer needed. Construction labour is migratory in nature, moving from one site

to another site, and the labour attached to big contractors tends to migrate to new work sites taken up by them.

Construction labour has not been able to organise it self to the extent that labour in factories and other organised sectors of trade has. This is mainly because the construction labours do not have a permanent place of work. Consequently construction labour has extremely poor bargaining power and this situation is fully exploited by employers. The construction labour beside low wages, they live in crowded unsanitary temporary huts built at the construction sites in unhygienic surroundings without basic amenities of life.

For the welfare of the labour, the Governments have, from time to time, brought out labour laws.

Labour laws are classified into the following types

- Laws concerning the working conditions of labour.
- Laws concerning wages and other payments to labour.
- Laws concerning the social security of labour.

These laws are proved very much helpful to the labour for improving their living conditions.

## 4.3 Labour Insurance

Insurance laws are applicable only to regular employees. In construction industry most of the labour is of casual nature and insurance laws are not applicable to them. For the welfare of

casual labour, different Acts such as Minimum wages Act, Compensation Act etc. are passed by the Government.

## 4.4 Payment of Wages

The remuneration given to workers for work performed by them is known as wages. Wages are of two types.

1. **Nominal wage:** This is the remuneration paid to the worker in the form of money, but it does not include the value of any other benefit that may be provided.

2. **Real Wage:** Labour is often entitled to different benefits, such as leave, medical care, house rent allowance, bonus etc. If the value of such benefits is added to the nominal wage, it is known as real wage.

Wages are paid to the labour based on two methods:

1. Depending upon time devoted to the work. This method is known as time rate system.

2. Depending upon the quantity of work performed.

   This method is known as piece rate system.

## 4.5 Time Rate system

In Time rate system of payment of wages, a suitable rate of payment is fixed per unit of time devoted to work by the labour. The unit of time can be hours, days, weeks or months.

The rate of payment for casual labour is fixed per day and that of regular employees per month in the construction industry.

The advantages of this system are:

1. It is simple and easily understood by labour.
2. The quality of work will be good.
3. The workers do not get overstrained.

There are, however, the following disadvantages in the system

1. Constant supervision is required.
2. Effective cost control can not be ensured.

## 4.6 Piece Rate System

In this system payment is made on the basis of the output of the workers. The work done by each labour is measured and payment is made at the agreed rate. Thus a worker can make more money by increasing his output. The rate of each item of work is fixed on the basis of the past record of output.

The piece rate system has the following advantages.

1. The overall productivity is increased.
2. The need of supervision is reduced.
3. Effective cost control can be ensured.
4. The system is fair to the workers and employers.
5. The better workers with higher outputs get higher payment.

However, the system has following disadvantages

1. The system is unsuitable for works which can not be measured.

2. The quality of work is lowered.
3. There are no guaranteed wages for workers.

What ever the system may be, there must be an adequate compensation for the labour put in and this is known as "fair wages".

## 4.7 Minimum Wages Act, 1948

The Minimum wages Act of 1948 was passed for the welfare of labour and provided for fixing the minimum rate of wages of labour. The Act aims at making provisions for the statutory fixation for the minimum rate of wages in number of industries where there are extensive chances for the exploitation of labour.

The main provisions of Minimum wages Act are:

1. The setting of advisory committees to collect information on which the minimum wages are based.
2. The wages of a worker in any scheduled employment shall be paid on a working day by:
   (i) The $7^{th}$ day after the last day of the wage period if the establishment has less than 1,000 employees.
   (ii) The $10^{th}$ day after the last day of the wage period if establishment has more than 1,000 employees.
3. The wages of an employee should be paid without any deductions except those items given below.
   (i) Fines in respect of acts of omission.
   (ii) Absence from duty.

(iii) Loss of goods directly attributed to the neglect of the employee.

(iv) House accommodation provided by the employer.

(v) Amenities and services provided by the employer.

(vi) Income tax

(vii) Subscription to the provident fund.

(viii) Recovery of advances.

(ix) Deductions ordered by the court.

(x) Payments to co-operative societies / Life Insurance Corporation.

## 4.8 Workmen Compensation Act, 1923

The Workmen Compensation Act passed to protect the victims of accidents and their families from hardships out of and in the course of employment. The Act covers workers employed in hazardous occupations as specified in the schedule but excludes those employed in clerical or administrative work. The Act provides for payment of compensation in case of accidents on work sites. The compensation, however, is not payable for injuries due to

(i) Disobedience or negligence, (ii) Non observance of safety measures (iii) consumption of liquor (iv) diseases which are not contracted as a result of the occupation. In the case of the death of a worker, compensation is paid under all circumstances.

Accidents are due to (i) Human causes such as poor eye sight, negligence, effect of intoxicants, (ii) Mechanical causes such as inadequate safety devices, live electrical equipment, unreliable scaffolding etc. and (iii) Environmental causes. Such as poor lighting, heat, noise etc.

The result of an accident may be:

1. Temporary disablement, which may be total or partial.
2. Permanent total disablement.
3. Permanent partial disablement.
4. Death.

The Compensation to be paid is depends on the result of the accident.

The Act provides for the appointment of Commissioner for the quick disposal of claims for compensation. The employers are required to notify fatal or serious accidents to the commissioner within seven days. Civil courts are debarred from considering cases rising out of the Act and these are under the jurisdiction of the commissioner.

## 4.9 Contract labour act, 1970

The contract labour Act, 1970 was passed to regulate the employment of contract labour in certain establishments. It also provides for improving the service conditions of contract labour. The Act is of importance to the construction industry where works are executed through contractors or by contract labour. The Act applies to every establishment and contractor employing

twenty or more workmen. The Act does not apply to establishments in which only work of an intermittent or casual nature is performed.

The Act provides for the constitution of a Central Advisory Contract Labour Board under the Central Government and of state Advisory contract labour Board under each State Government to advise the Central and State Governments on matters arising out of the administration of the Act and to carry out the functions assigned to it under the Act.

The main provisions of the Act are:

1) **Registration of Establishments:** Every principal employer of an establishment to which the Act applies is required to make an application to the registering officer on the prescribed form for the registration of the establishment.

2) **Licensing of Contractors:** Every contractor executing any work through contract labour is required to obtain a license.

3) **Welfare and Health of Contract Labour:** Under the Act, the following facilities are required to be provided for the welfare and health of the contract labour:

(i) For works likely to continue for more than three months, where labour is required to halt at night in connection with the working of the establishment, the contractor should

provide rest rooms. Separate rooms should be provided for women.

(ii) For works likely to continue for more than six months and employing more than 100 or more labour, an adequate canteen should be provided.

(iii)Latrines and urinals must be maintained in clean and sanitary conditions.

**4) Payment of wages:** Responsibility for the payment of wages rests upon the contractor.

* * *

## SYNOPSIS

1. Types of labour
   a) Casual labour b) Regular labour
2. Nominal wage is the remuneration paid to the worker in the form of money.But does not include the value of any other benefits.
3. Real Wage is the wage in which value of benefits is added to nominal wage.
4. Methods of wage payment
   (i) Time Rate system (ii) Piece Rate system
5. Time-rate system: In this system, the wages are fixed on the basis of unit of time devoted to work by the labour.
6. Piece Rate system: In this system, the wages are fixed on the basis of output of the workers.
7. Minimum Wages Act passed for fixing the minimum rate of wages of labour.
8. Workmen Compensation Act passed to protect the victims of accidents and their families from hardships out of and in the course of employment.
9. Contract Labour Act passed to regulate the employment of contract labour in certain establishments.

## SHORT ANSWER QUESTIONS

1. Write types of labour.
2. Mention methods of payment of wages to labour.
3. What is nominal wage?
4. What is real wage?
5. What is Piece Rate system?
6. What is Time Rate system?

## ESSAY TYPE QUESTIONS

1. Explain the payment of wages of contract labour.
2. Explain Minimum wages Act.
3. Explain workmen compensation Act.
4. Explain contract labour Act.

* * *

# CHAPTER 5
# INSPECTION AND QUALITY CONTROL

## 5.1 Introduction

Quality Control of construction is one of the important functions of management. It has to be ensured that the quality of work is in accordance with the prescribed specifications. This can be achieved by carrying out inspections of the work as it progresses through various stages. Inspection is the art of comparing the materials, performances or products with the laid down standards. The standards prescribed generally specify limits of permissible variability and the purpose of inspection is to find out by observations or testing whether the quality of work done falls within the acceptable limits of variability. If the work is got done through a contractor, it is the interest of the contractor to concentrate on quality control to satisfy the owner or the inspectors about the quality of work.

As it is very difficult to rectify a structure after its construction, it is necessary to inspect the structure during different stages of construction. For large projects, a separate inspection agency is generally appointed for effective inspection and quality control.

## 5.2 Methods of Quality Control

Generally quality control begins by inspecting the construction work at different stages like:

1. Sampling, examination and field testing of all the materials of construction.
2. Measurement and proportioning of material.
3. Examination of layout, form work, foundations etc
4. Testing the specimens in the laboratory.
5. Observation of construction equipment.
6. Skill levels of labour.

## 5.3 Functions of Inspection Department

The inspection department has to perform the following functions regarding the quality control of construction work.

1. Inspection of sub soil
2. Inspection of materials.
3. Inspection of equipment and
4. Inspection of works at each stage.

1. **Inspection of sub soil:** Inspection of sub soil is necessary to test the bearing capacity of the sub soil.

2. **Inspection of materials:** Supplies of materials for construction work need to be inspected before they are used. Field and laboratory tests may be conducted for this purpose.

3. **Inspection of Equipment:** Supply of equipment must be inspected before the items are recorded in books.

Thereafter, regular periodical inspections are necessary to ensure that the equipment is kept in serviceable condition.

4. **Inspection of works at each stage:** The Inspectors must inspect the work before the contractor proceeds with the next stage. For example, inspections are necessary after excavation has been complete, before all under groundwork is covered up; for the form work and steel before concrete is poured. In case any defects are noticed, they must be got rectified before proceeding to the next stage. Inspection of mixing and placing of concrete is also necessary in some cases to ensure that the proper procedure is being followed.

## 5.4 Major Items of quality control:

Some major items which need to be carefully watched from the quality control point of view.

1. Concrete.
2. Steel.
3. Form works.
4. Masonry.
5. Water proofing.
6. Joinery and Timber work and
7. Services.

**Concrete:** Concrete is usually specified by nominal mix, but for large and important works, controlled concrete may be specified. Adequate control should be there on the quality of materials and the process of mixing, placing, compacting and curing. The

minimum quantity of water that gives the specified slump should be used. In the case of controlled concrete, the aggregates must be tested at regular intervals to ensure that the grading is within acceptable limits. Regular field tests must be conducted to ensure the proper slump and compressive strength of the samples taken from the concrete mix. The time between the mixing of water and the final compaction of concrete should be within the initial setting time of the cement used. Concrete should be placed carefully to avoid segregation of aggregates. Curing should be carried out for the full period in the prescribed manner.

**Steel**: Steel constitutes a major part of expenditure in most of the works. For structural work it is necessary to see that there is minimum wastage. In Reinforced Cement concrete, the process of bending, binding and placing should be checked carefully to ensure proper spacing and shape of the bent bars. It should also be ensured that the bars are free from rust, scales, oil and or other coatings.

**Form works:** The shape and surface finish of concrete depends upon the form work. The form work must be strong enough to support the wet concrete and have a smooth surface so that the finished concrete requires the least amount of rendering.

**Masonry:** It is necessary to see that the bricks used are of the specified quality and have the require bearing capacity when used in load bearing walls. The bond should be maintained properly.

The dimensions and verticality of masonry are also important items to be controlled.

**Water proofing:** water proofing also needs quality control. The damp proof courses and the damp proofing of roofs, etc are very important items needing special attention.

**Joinery and Timber work:** In this item both the quality of timber used and workmanship are important for quality control.

**Services:** Services include such as electrical, sanitary, water supply, air conditioning etc.

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## SYNOPSIS

1. Inspection is the art of comparing the materials, performance or products with the laid down standards.

2. Functions of Inspection department (i) Inspection of subsoil (ii) Inspection of materials (iii) Inspection of equipment (IV) Inspection of works at each stage.

3. Major items of quality control (i) Concrete (ii)Steel (iii) Masonry (iv) Water Proofing (v) Joinery and Timber work (vi) Services

4. Services include electrical, sanitary, water supply, air conditioning etc.

## SHORT ANSWER QUESTIONS

1. What is Inspection?
2. List out the Functions of Inspection Department.
3. Mention major items of quality control.

## ESSAY TYPE QUESTIONS

4. Explain the functions of Inspection Department.
5. Explain major items of quality control.

* * *

# CHAPTER 6
# CONTRACTS

## 6.1 Introduction

Contract is an undertaking by a person or a firm to do any work under certain terms and conditions, which should invariably be in writing. The work may be for the construction or maintenance and repairs, for the supply of labour or the transport of materials, etc.

Contractor means a person or a firm who undertakes any type of contract. Usually this term is confined to the contractors who are engaged in construction or execution of works or repairs.

The system through which the works are carried out by the contractors, who arrange all the materials, labour and equipment required for proper completion of the works is known as the contract system. The work should satisfy the specifications with expected quality .It should also be completed within the stipulated time.

## 6.2 Legality of Contracts

All the contract conditions should be according to the law because the court can force only those conditions, which are according to the established public policy and should put up good examples on the morals of the society as a whole.

As per the Indian Contract Act Sections 10, 11, and 68 the parties entering into the contract should be legally competent. The law relating to contract imposes upon each party of the

contract a legal obligation to observe the terms of the contract and give the other party the right to enforce fulfillment of these terms or to claim damages in respect of the loss suffered in consequence of the breach of the contract.

The obligation, which a contractor accepts, which he submits a tender are determined by the conditions of the tender, such acceptance of tender gives rise legally to a binding contract.

Some of the legal aspects of contracts are given below.

i) For a contract to complete a definite piece of work, recovery is possible only after completion.

ii) The impracticality of a work cannot be excuse for non-performance.

iii) A contractor who refuses to carryout the work before completion can be subjected for breach of contract.

iv) When an employer makes it impossible for contractor to complete the work in accordance with the contract, the contractor can sue for the rate of the completed work.

v) The penalties described in the penalty clause will not be applicable if the execution of the contract is delayed because of the fault of the employer.

vi) In case of the contractor's inability to complete the work, after part execution the employer can consider the contract as rescinded and take an action for the damages. The contractor under such circumstances has no lien for the money spent on the work by the contractor.

vii) When a contractor has finished part of a work and refused to complete the entire work and the employer without the

consent of the contractor takes the work in his own hands for completion. In this case the law implies that the employer has to pay for the work, which has done by the contractor.

viii) When a contractor without lawful excuse, refuses to carry on the work after part performance, the employer may have to pay for the materials delivered on the site by the contractor as distinguished from the materials, which have become fixed in to the work.

ix) When a contract is formed and it becomes impossible to perform the work immediately or at a later date, it may be possible to adjust the rights and liabilities of the parties.

## 6.3 Types of Contract Agreements

Contract agreements fall into the following two clauses.

1. Piece-work agreements. 2. Contracts.

## 6.4 Piece-work agreements.

These are agreements for doing the work at agreed rates, without reference to the total quantity of work or time. Small works or piecework up to Rs.5000/- are got done through the contractors by piecework agreement.

Piecework agreements are of the following types.

1. Piece-work. 2. Work Order.

**Piece-work:** In piece-work, the quantity of work is not mentioned and only the rate is mentioned. This agreement is used (i)for small works (ii) when it is necessary to start work in anticipation of the formal acceptance of the contract and (iii) for running contract.

**Work Order:** Work order is used for petty works; work orders may sometimes also mention the time limit within which the work is to be completed. No formal agreement is drawn up with the contractor as in the case of piece-work when the work is awarded by a work order.

## 6.5 Types of Contracts

Contracts are of the following types.

1. Item rate Contracts.
2. Percentage Rate Contracts.
3. Lump sum contracts.

**6.6 Item Rate Contract**: In this type of contract, the contractor undertakes the work on the item rate basis. The payment is done on the basis of quantities of items done and their respective rates. The quantities of various items are worked out by detailed measurements. This type of contract is also known as unit price contract. The approximate quantities of all possible items of work are worked out and are shown in the tender form. Every contractor quotes his rates against each item are arrives at the final total amount of the work. This is the most common type of contract system, which is widely adopted.

Following are the advantages of item-rate contract

1. The additions and alterations in the plan and specifications can be easily made at any stage.

2. As the contractor gets the payment against the actual quantities of items done by him, the method is economical. No possibility for excess payment.
3. As the rates are item-wise the contractor is not worried regarding the uncertainties in the plan and specifications.
4. The work can be started after accepting the tenders without waiting for all the detailed drawings and specifications.

Disadvantages:

1. The total cost of the work can only be computed after completion of entire project. In such case the contractor may face financial difficulties if final cost increases abnormally.
2. Before preparing the bills for payment of money to the contractor, all measurements of various items of work have to be carefully taken and suitably entered in the measurement book.
3. Great care shall be taken by the department officers to strictly enforce the specifications during execution of work to avoid the using of substandard materials by the contractor.

**6.7 Percentage Rate Contract:** This is also known as cost-plus percentage contract. In this type of contract the contractor agrees to take the work of construction for fixed percentage over the actual cost of construction. This type of contract is given when no contractor is agreeing to do work on other types due to uncertainties and fluctuations in the market rates of materials and labour.

The department keeps the actual up to date records of the expenditure incurred on the work and pays the fixed percentage as agreed over it to the contractor. The contractor arranges for the labour, materials required for completion of the work, and maintains proper account of the construction costs.

The cost plus or percentage contracts can be of the following types:

1. Fixed Percentage of Cost
2. Cost plus a fixed sum
3. Cost plus a fixed sum with profit sharing
4. Cost plus variable percentage.

**6.8 Lump sum Contracts:** In this type of contract, the contractor undertakes the construction work or the execution of the specified work and completes it in all respects for a fixed amount of money. The detailed specifications of all items of works, detailed drawings, plans etc., are supplied by the department to the contractor. The contractor on the basis of given details, works out the total cost of the construction and quotes it in lump sum. The design, shape and materials are as per the choice of contractor, but they have to be got approved before the start of the work.

Following are the advantages of Lump sum Contracts.

1. Due to competition among the contractors, the contractor tries to take the work even at less profit, resulting in low cost of the work.

2. As the total cost of the work is known before hand, the owner can arrange the funds in time.
3. The contractor's profit directly depends on the time of completion; hence for getting more profit, the contractor tries to complete the work as early as possible.
4. The materials used on the temporary works during construction are relieved earlier resulting in their effective use in other works also.

Following are the disadvantages of Lump sum Contracts:

1. The owner tries to get the maximum work out of money he spends, where as the contractor tries to get the maximum profit, this causes conflicting interests.
2. It becomes very difficult to adjust the additions and alterations in the plan and the specifications at a later stage.
3. If the plans and specifications are not clear, the contractors will quote higher rates, resulting in high cost of the work.

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## SYNOPSIS

1. Contract is an undertaking by a person or a firm to do any work under certain terms and conditions.
2. Contractor means a person or a firm who undertakes any type of contracts.
3. Types of contracts: (i) Item rate contract (ii) Percentage rate contract (iii) Lump sum contract.
4. Types of Piece-rate agreements: (i) Piece-work (ii) Work Order
5. Item rate contract: In this contract the contractor undertakes the work on the item rate basis.
6. Percentage rate contract: In this contract the contractor agrees to take the work of construction for fixed percentage over the actual cost of construction.
7. Lump sum contract: In this contract the contractor undertakes the construction work and completes it in all respects for a fixed amount of money.
8. Work Order is used for pitty works and no formal agreement is drawn up with the contractor.

## SHORT ANSWER QUESTIONS

1. What is a contract?
2. Define contractor.
3. Write types of contract agreements.
4. What is a work order?
5. Write types of contracts.
6. What is item rate contract?
7. What is percent rate contract?

## ESSAY TYPE QUESTIONS

1. Explain legal aspects of contracts.
2. What is Item rate contact? Write its advantages and disadvantages.
3. Explain different types of contracts.
4. Explain the features of percentage rate contract.

*** * ***

# CHAPTER 7

# TENDER AND TENDER NOTICE

**7.1** **Tender:** A Tender is the contractor's bid in writing offering to execute the specified work of construction, supply of materials etc., at the rates and amounts indicated, within the time limit and under conditions specified and agreed to.

**7.2** **Necessity of Tenders:** Works, which are to be awarded to contractors, are publicised to enable a sufficient number of interested parties to bid. The lowest bid is generally accepted, unless there are good reasons for not doing so. The process of inviting bids and accepting them is known as tendering. The bid is usually made on the tender forms specified by the owner. The following tender documents are made available along with the tender forms to enable contractors to bid for the job.

1. Layout plan.
2. Set of drawings, including working drawings.
3. Detailed specifications or reference to standard specifications for each item of work
4. Schedule of stores to be issued by the owner indicating the rates and their place and issue.
5. Schedule of tools and plant and other facilities to be made available by the owner, indicating the conditions, hire changes and the place of delivery.
6. General conditions of the contract including time limits.
7. Special conditions of the contract that may have to be highlighted.
8. Amount of Security deposits to be paid /deducted.

**7.3 Tender Notice:** Whenever works are to be let out on contract, tenders are to be invited from the registered contractors or both registered and unregistered contractors depending on the magnitude and nature of the work by issuing notice in newspapers. The notice that includes various particulars of work is named as Tender Notice.

**7.4. E.M.D:** Earnest Money Deposit is the amount, which the contractor has to deposit with the department at the time of submitting a tender. This accompanies the tender form and this is usually 2% of the total estimated cost of the project. This serves as a check to prevent the contractor from refusing to accept the work when the tender has been accepted. The other objects of collecting earnest money are:

1. To reduce unnecessary competition: If no earnest money is collected, heavy competition may start among the tenderers. The contractors who do not have sound financial status may also offer their tenders, which increase the unnecessary competition among the tenderers.

2. To act as a tool for punishment: In case the contractors quote lower without intention of doing work, the earnest money shall be forfeited by the department as a punishment to such contractors.

3. To act as compensation: When the lowest contractor refuses to take up the work, the work can be allotted to the

second lowest contractor. The earnest money forfeited from the first lowest contractor compensates to loss of the department.

## 7.5 Security Money Deposit

The contractor has to deposit about 10% of the tendered amount with the department as soon as his tender is accepted. This is inclusive of the earnest money already deposited by the contractor. This money is kept as a check so that the contractor fulfils all the terms and conditions of the contract and carries out the work satisfactorily in accordance with the specification and maintains satisfactory progress for completion of the work. In case he fails to fulfill the terms of the contract, the whole of the security money or part of it is forfeited by the department.

When the contractor completes the work as per drawings, specifications and directions of the department within the specified time, the security money is refunded to the contractor. Normally the security deposit is refunded after the maintenance period, which may be 6 to 12 months after the completion of work, and it's handing over to the department.

## 7.6 Publicity and Sale of Tenders

It is essential that tenders be given adequate publicity so that a sufficient number of contractors may bid and the most attractive offer may be obtained. At the same time it is also necessary that bids be obtained from contractors who have the capability and capacity to undertake the work. For this purpose,

organisations like the Railways and Public works Departments, which regularly get works executed through contractors, maintain lists of approved contractors. These lists are prepared after examining the past performance and capacity of the contractors. Approved contractors may be classified in terms of the value of work that could be assigned to them.

Tenders are publicised by the issue of a notice inviting tenders, which indicates (1) name and description of the work (2) estimated cost (3) completion time (4) earnest money payable indicating the manner in which payment is to be made (5) security deposit (6) time and place where tender documents may be inspected or obtained (7) last date and place of obtaining tender papers and submission thereof (8) time and place of opening the tenders (9) authority competent to accept tenders. The tender notice may be advertised in newspapers and issued to registered contractors by post. Copies of the tender notice are also put up on the notice boards of various offices of the organisation. For very large works or those involving special techniques, which may not be within the capacity of the construction industry in the country, global tenders will be issued all over the world inviting bids for the work. Contractors are given a reasonable period of time, depending upon the size of the work to prepare and submit their tenders. Tender documents are usually priced and are issued on payment of the prescribed amount. The sale of tender papers starts and closes at the time notified in the tender notice.

## 7.7 Opening of Tenders and their Scrutiny

Tenders must be submitted latest by the prescribed date and time in a sealed cover to ensure secrecy till they are opened. The name of the work and the due date should be written on the envelope for the purpose of identity, dispensing with the need to open the envelope. Tenders may be delivered by post or deposited in the sealed tender box generally provided in the premises of the owner.

The earnest money if any must be deposited in the manner prescribed along with the tenders. Tenders submitted without earnest money, if prescribed are rejected. The amount is refundable if tenders are not accepted and is usually adjusted against the contractor's security money if the bid is accepted. Generally about 2% of the estimated amount is asked for as earnest money. In the case a contractor, whose tender is accepted, fails to undertake the work, the earnest money deposited by him is forfeited. Tenders received after the due date and time is rejected. The valid tenders are opened at the time notified in the presence of representatives of the tenders, who may choose to be present. Each tender is carefully scrutinized and any cuttings or over writings are initialed to ensure that tenders are not tampered with at a later stage. A record of the tenders received is also kept.

## 7.8 Acceptance of Tenders

The rates and amounts quoted in all the valid tenders are tabulated in the form of a comparative statement to enable a

comparison of the bids made. While preparing the comparative statement, careful note is made of all the conditions that may have been mentioned and their financial implications worked out. For example, in the case of the supply of material, if a tenderer does not quote rates inclusive of sales-tax, octroi and other charges as required, the financial implications thereof should be worked out, so that a proper comparison can be made. The arithmetical calculations with respect to rates, quantities, amounts and totaling should also be checked.

The lowest tender is generally accepted unless there are good reasons not to do so, such as poor past performance and limited financial or physical capacity of the tenderer.

If the rates quoted are on the high side, all tenders may be rejected and re-invited to obtain a reasonable bid. In order to ensure that there is no legal complication in not accepting any tender, a clause is added in the tender notice reserving the right to reject any or all tenders without assigning any reason. The tenderer whose bid is accepted is intimated in writing and asked to sign the contract documents within a specified period of time. If he fails to do so, the offer is cancelled; the security deposit forfeited and the work allotted to the contractor whose tender is the next highest.

After signing the contract agreement, the site of the work is formally handed over to the contractor, then he can start the work. The time for completion is reckoned from the day the site is handed over to the contractor.

## 7.9 Work Order

Work order is used for petty works; work orders may sometimes also mention the time limit within which the work is to be completed. No formal agreement is drawn up with the contractor as in the case of piece-work when the work is awarded by a work order.

## 7.10 Contract Agreement

Contract agreements are fall into the following categories:

1. Contracts
2. Piece work agreements

Contracts are classified as:

1. Percentage Rate contracts.
2. Item Rate contracts.
3. Lump sum contracts.

Piece-work agreements are of following types

1. Piece work 2. Work order

## 7.11 Conditions of Contract

The Conditions of contracts includes the following

1. Time of completion of work.
2. Volume of work.
3. Specifications of work.
4. Rates of payment.
5. Penalties for default on the part of the contractor etc.

* * *

## SYNOPSIS

1. Tender is the contractor's bid in writing offering to execute the specified work of construction, supply of materials etc, at the rate and amount indicated, within the time limit and under conditions specified and agreed to.
2. Tender notice is the notice, which includes various particulars of work through which tenders are invited from contractors for a contract.
3. EMD: Earnest Money Deposit is the amount, which the contractor has to deposit with the department at the time of submitting a tender. This is usually 2% of the total estimated cost of the project.
4. Security Deposit is the amount, which the contractor has to deposit about 10% of the tendered amount with the department as soon as his tender is accepted.
5. Piece work agreements are (i) Piece-work (ii) Work Order

## SHORT ANSWER QUESTIONS

1. Define Tender.
2. What is Tender notice?
3. What is E.M.D.?
4. What is Security Deposit?
5. Define work order.
6. List out the conditions of contract.

## ESSAY TYPE QUESTIONS

1. Explain the procedure of scrutiny of tenders.
2. Write about the following.

   (a) EMD. (b) Security Deposit.
3. Explain the procedure of accepting a Tender.
4. Explain the procedure of publicity and sale of Tenders.

* * *

# CHAPTER 8
# ACCOUNTS

## 8.1 Necessity of Accounts

The accounts of an organisation are maintained in accordance with a system which lays down the detailed procedures to be followed in entering into different transactions involving financial matters and keeping a record of such transactions. The system of accounts is devised to suit the requirements of the organisation, taking into consideration the volume and type of transactions entered into at various levels of the organisation for smooth and efficient functioning.

## 8.2 Different Methods of Carrying out Works

Public works are carried out either departmentally or through contractors. Complicated and important works, where a high degree of reliability in the quality of work is essential, are generally executed departmentally by engaging labour. This method requires intensive planning and supervision, so that the output of labour and machines is commensurate with the expenditure incurred. For most works, however, the contract method is employed, when the department, taking advantage of competitive bidding by rival contractors, is able to get the work executed at the lowest possible rates. Moreover, the risks involved in construction and the day-to-day problems are the headaches of

the contractor and the departmental staff can devote sufficient time to ensure that the contractor's work is in accordance with the designs, specifications, time schedule and other conditions laid down in the agreement.

## 8.3 Public Works Department System of Accounts

The Main features of the system are:

1. The divisional officer obtains money required for disbursement in connection with the execution of works and contingent charges by cheque on the civil treasury/bank. He also collects some of the departmental receipts and deposits them in the treasury /bank.
2. The accounts of all these transactions, as well as transactions of subordinate officers acting on behalf of the divisional officer are compiled under the supervision of the divisional accountant and are submitted to the pay and accounts officer/accountant general.
3. The divisional officer also maintains clear accounts of the stores received by him and makes these accounts available to the accountant general at the time of audit.
4. The charges for each project, work or sub-work under each major head of expenditure are maintained separately in the accounts of the divisional officer.
5. Personal payments of all Government employees of the department are made on bills presented to the treasury/pay and accounts officer and these are, therefore, brought to account by the accountant general/pay and accounts officer himself.

The divisional officer is the primary disbursing officer and maintains a detailed account of the departmental receipts-and payments kept by him and not at the treasury/pay and accounts office as in the civil accounting system. The accountant general audits the accounts maintained by the divisional officer and, therefore, the accountant general has not only to satisfy himself about the maintenance of accounts, but also about the audit. The divisional officer should, therefore, keep the following points in view.

1. That a claim, which has been accepted, is valid and that a voucher is a complete proof of the payment which it supports and that the account is correct in all respects.
2. It is necessary that all accounts are so kept and the details so fully recorded that they can support any enquiry.
3. It is further necessary that the record of all transactions in general are so clear, explicit and self-contained that it can form convincing evidence in a court of law, if so required.
4. Every transaction involving the giving and taking of cash, stores, other properties, rights, privileges and concessions, which have money value, should be brought to account.

## 8.4 Definition of some of the terms used in accounts

1. Administrative Approval: This term denotes the formal acceptance by the Administrative department concerned, of the proposal for incurring expenditure in the PWD.

2. Technical sanction: It is an order by a competent authority sanctioning a properly detailed estimate of the cost of a work to be carried out by the PWD.
3. MajorEsimate: An estimate whose sanctioned amount exceeds a certain fixed limit is known as major estimate. In PWD this limit is fixed at Rs.1 lakh.
4. Minor estimate: An estimate whose sanctioned amount is lower than a fixed limit is known as minor estimate. In PWD this limit is fixed at Rs.1 lakh.
5. Detailed Estimate: An estimate prepared on the basis of the detailed quantities of all items worked out from the designs and drawings is known as a detailed estimate.
6. Petty Work: A work, which does not cost more than Rs.7500 is known as a petty work.
7. Debit and Credit: In simple terms, ’debit’ means expenditure and ‘credit’ means a receipt.
8. Cash: The term ‘cash’ as defined in the CPWD code includes legal coins, notes, cheques, deposit-at-call receipts of scheduled banks, drafts and payments on demand.

## 8.5 Classification of Transactions and Heads of Accounts

The functions of the Government are widely varied and complex and as a result, the financial transactions are so huge that it needs a system of identifying the various types of financial activities of the Government to maintain the accounts and to control the expenditure. Basically the transactions of the Government are of two types, i.e., receipts and expenditure. For

accounts purposes, receipts and expenditure are divided into a number of sectors. Each sector is further divided into major heads. Under each major head there are minor heads, subheads and detailed heads. Each sector has an alphabetical series for identification.

The sectors in the receipt section are:

A. Tax revenue.

B. Non-tax revenue.

C. Grants-in-aid and contributions.

The sectors under the expenditure heads in the revenue account section are:

A. General services.

B. Social and community services.

C. Economic services.

D. Grants-in-aid and contributions.

Some of the sectors under the expenditure head in the capital account section are:

A. Capital account- general services.

B.Capital account-social and economic services.

C. Capital account of economic services.

D. Grants-in-aid and contributions.

Code numbers are assigned to each major head in the form of three digits Arabic numbers. The first digit indicates the section to which the transaction belongs, as mentioned below:

0 and 1— receipt section.

2 and 3—expenditure on revenue account.

4 and 5—expenditure on capital account.

6 and 7—expenditure on public debts, loan, etc. and transfer to counting every fund.

8 and 9—Public account.

The last two digits indicate the major heads, the same number representing the same major head, whether it is in the revenue receipt section, revenue expenditure section, capital expenditure section, etc.

The major heads are assigned blocks of numbers, as indicated below:

| | |
|---|---|
| 1. Receipts | 020 to 199 |
| 2. Expenditure on revenue account | —211 to 309 |
| 3. Expenditure on capital account | —411 to 599 |
| 4. Public debt. | —601 to 610 |
| 5. Loans advances, etc. | —611 to 799 |
| 6. Contingency fund | 800 |
| 7. Public account. | —801 to 899 |

Some of the important major heads, both in the receipt and expenditure under sections, are indicated below:

| Description of the major head | Receipt section | Code numbers expenditure on revenue account | Expenditure on capital account |
|---|---|---|---|
| Public works | 059 | 259 | 459 |
| Education | 077 | 277 | 477 |
| Art and culture | 078 | 278 | 478 |
| Medical | 080 | 280 | 480 |
| Public health, sanitary and | 082 | 282 | 482 |
| Housing | 083 | 283 | 483 |
| Urban development | 084 | 284 | 484 |
| Labour and employment | 087 | 287 | 487 |
| Agriculture | 105 | 305 | 505 |
| Minor irrigation, soil conservation and Tree development | 106 | 306 | 506 |
| Forest | 113 | 313 | 513 |
| Industries | 120 | 320 | 520 |
| Water and power | 131 | 331 | 531 |
| Multipurpose river projects | 132 | 332 | 532 |
| Irrigation and navigation, drainage and flood control | 133 | 333 | 533 |
| Power projects | 134 | 334 | 534 |
| Roads and bridges | 137 | 337 | 537 |

## 8.6 Payment to Labour- N.M.R. Format

Except for the regular and work charged establishments, all persons engaged departmentally for the execution of works are considered as casual labour. Their wages are drawn on "Muster rolls".

Muster rolls are prepared in the prescribed form. The Nominal Muster Roll (N.M.R) form consists of two parts.

Part I of N.M.R. form consists of necessary columns for entering the names of labour, designation, father's name, their attendance particulars, rates of wages and the total amount payable for each labour. N.M.R form has the provision for entering the total amount of the muster, signature or left hand thumb impression of the labour as a receipt. At the bottom of this form, the person preparing such N.M.R form should sign before submitting to A.E / D.E.E who in turn verifies the details entered and makes the payment.

Part II of the muster roll is used for recording the name of work, amount of work done in cases in which the work is susceptible to measurements. Other details like the number of measurement book, pages in which the measurements are recorded will also be entered in this part. If the work is not susceptible to measurement, a remark to that effect is recorded.

Some important instructions regarding the preparation of Muster rolls are:

1. Duplicate copies of muster rolls should not be prepared.

2. Separate muster rolls are prepared for each period of payment. Labour may be paid more than once a month depending upon local conditions and practices.

3. The daily record of attendance and times should be recorded in such a way as to leave no possibility of tampering or making unauthorised entries.

4. After the muster roll has been passed, payment should be made as early as possible.

5. A record of wages that remains unpaid must be kept in a register of unpaid wages.

6. Subsequent payment of unpaid wages is recorded in the hand receipt. A note of the same is recorded in the register of unpaid wages as well as in the muster roll.

7. Wages that remain unpaid for three months must be reported to the divisional office.

8. Progress of work done by the labour is recorded and is to be compared with departmental rates.

9. Muster rolls are checked with reference to entries in the measurement book to the extent of 50% in the sub-divisional and 50% in the division office, when the divisional engineer makes payments.

## 8.7 Measurement Books (M-BOOKS)

The measurement book, (common Form No. 298) is a most important record since it is the basis of all accounts and quantities

whether the work is done by daily labour, piece work, Schedule contract, lump-sum contract or of materials received.

It is the original record of actual measurements or accounts and forms a reliable record as it may have to be produced as evidence in court of law.

All the books belonging to a division should be numbered serially and the pages of each book should be machine numbered. A register of M-Books should be maintained in Form PWD VI-20, in the divisional office showing (a) The serial number of each book, (b) The names of sub-divisions to which issued, (c) The date of issue and the date of its return, so that its eventual return to the divisional office may be watched.

A similar register should be maintained in the sub-divisional office showing the names of the sub-divisional officer and section officers to whom measurement books are issued. Books no longer in use would be withdrawn promptly even though not completely written up.

All completed measurement books containing measurements of the works executed by contractors, having running accounts should be sent to the Divisional Office for final record after final bills have been paid to the contractors.

The following instructions should be observed carefully while recording detailed measurements in the M. Book.

1. Topmost lines under columns 1 to 4 on each page of a measurement book should invariably filled in the field.

2. Any lines not required should be carefully scored out in order to prevent additional entries being made later on
3. Only Executive, Deputy Executive or Asst. Executive Engineers should record detailed measurements.

## 8.8 Check measurement of works

The object of check measurement is to detect errors in measurements and to prevent fraudulent entries. Check measurements should therefore be conducted on such items:

(a) Which appear obviously incorrect.

(b) Which would be more easily susceptible of fraud.

(c) Which would more seriously affect the total amount of the bill if inaccurate? The entry "measured in my presence" by a sub-divisional Officer cannot be accepted as check measurement.

Sub-divisional Officers should necessarily check measure before payment and in proper time in the following cases:

(i) All final bills on running accounts,

(ii) All first and final bills over Rs.5000/-

(a) Check measurements are necessary when supplies are arranged by the public Works Stores Division from the firm direct to the Division concerned.

(b) In addition to check measurement by the sub-divisional officers, it is an important duty of Executive/Divisional engineers to check measure the works which are in progress during their inspections. They should also maintain a register of such check measurements.

(c) The number of check measurements by the Executive/Divisional Engineers in charge of regular divisions should be at least 36 in a financial year.

(d) Divisional Engineers in charge of special divisions should check at least 24 in a financial Year. Further the Divisional Engineer should check measure at least once, all individual works costing Rs.50, 000/- and more.

(e) The check measurements to be done by Executive Engineer should be spread out throughout the year and there should be no rush of check measurements towards the end of the financial year.

(f) The frequency of check measurements should be correlated with the amount of bill to be paid in the respective months.

(g) In addition to the above, the Superintending Engineers of circles should also check measure works at random in a particular year or years as directed by the Chief Engineers from time to time.

(h) The fact of check measurement by the sub-divisional Officer or the Executive Engineer should invariably be noted in the M-Book at the time of check measurement. The items check measured should be indicated by the initials of the checking officer, which should be placed on the left side of the column "particulars" in line with the item check measured.

(i) When the date of measurement and the date of check measurement are the same, a certificate to that effect should be recorded.

(j) When the measurement is done in the presence of higher officer, the higher officer himself should record the measurements.

## SYNOPSIS

**1.** Methods of carrying out works:

a) Departmentally b) Through Contractors

**2.** Muster Roll: The wages of all casual labour drawn on "Muster Rolls"

**3.** M.B. Measurement Book is a most important record since it is the basis of all accounts and quantities of materials received.

**4.** Check measurements are conducted on

(I) Which appear obviously incorrect.

(II) Which would be more susceptible of fraud.

(III) Which would more seriously affect the total amount of the bill if inaccurate.

**5**. Administrative Approval: This term denotes the formal acceptance by the Administrative department concerned, of the proposal for incurring expenditure in the PWD.

**6**. Technical sanction: It is an order by a competent authority sanctioning a properly detailed estimate of the cost of a work to be carried out by the PWD.

**7.** Major Estimate: An estimate whose sanctioned amount exceeds a certain fixed limit is known as major estimate. In PWD this limit is fixed at Rs.1 lakh.

**8**. Minor estimate: An estimate whose sanctioned amount is lower than a fixed limit is known as minor estimate. In PWD this limit is fixed at Rs.1 lakh.

**9**. Detailed Estimate: An estimate prepared on the basis of the detailed quantities of all items worked out from the designs and drawings are known as a detailed estimate.

## SHORT ANSWER QUESTIONS

1. Write different methods of carrying out works.
2. What is Muster roll?
3. What is M.B.?
4. What is Cash?
5. Write sectors in the receipt heads.
6. Write sectors in expenditure heads.
7. What is a detailed estimate?
8. Define Technical sanction.
9. Define Administrative approval.
10. What is a major estimate?

## ESSAY TYPE QUESTIONS

1. Explain salient features of PWD system of accounts.
2. Describe the various types of PWD accounts.
3. Explain the procedure of maintaining Muster roll.
4. Explain about check measurements.

# CHAPTER 9
# STORES

## 9.1 Stores

A wide variety of stores and equipment is utilised for construction work. This includes building materials like bricks, stone, aggregates, cement, lime, steel bars, structural steel, sanitary fittings, water supply, electrical stores and fittings as well as a variety of machinery and equipment ranging from survey and drawing instruments to transport and special purpose vehicles like dumpers, bulldozers and other earthmoving equipment, batching and mixing plants for concrete, vibrators, drilling and pumping equipment, air compressors, pile drivers and a host of other items. Special types of equipment may be necessary for some works like bridge construction and for large works it may be necessary to provide material handling equipment like cranes, lifts, conveyors etc.

As large part of expenditure on construction works is on materials and equipment it is necessary that the accounting of stores should be done systematically, and a set of rules have been prescribed by the PWD for the purpose.

The administration of the stores of a division is vested in the hands of divisional officer, who is primarily responsible for (1) The procurement of stores, (2) Their custody and distribution (3) Their disposal when rendered surplus or unserviceable.

## 9.2 Classification of Stores

The PWD classify the stores into the following types.

1. Stock.
2. Machinery and equipment.
3. Road metal.
4. Materials charged to works.

## 9.3 Stock

Items of common use in construction work, such as bricks, aggregates, cement, steel, etc., are kept in the stock of a division and are issued as and when required for the execution of works. The following are the advantages of keeping a stock of materials.

1. The procedure for the procurement of the same item is not repeated for different works.
2. The use of approved materials of the prescribed specifications is ensured.

It is however, ensured that only such quantity of material is stocked as can be utilised during a reasonable period of time. Unnecessary accumulation of material may

i. Cause deterioration in storage.

ii. Result in increased costs of storage and handling Stock.

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.

## 9.4 Subheads of Stock

'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. The CPWD has the following sub-heads of stock:

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, aluminium 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 godowns, payment to work charged store establishment etc.)

## 9.5 Machinery and Equipment

The machinery equipment, vehicles, furniture and instruments required for use in construction works are known as machinery and equipment. The machinery and equipment are of two kinds.

1. General machinery and equipment. These are required for general use in the division
2. Special machinery and equipment. These are not required for general use in the division, but are procured for use in the specific works.

## 9.6 Road Metal

A record of Road metal is kept in measurement books and claims for payment examined on the basis of the recorded measurements.

Road metal is often kept by the road side before use and an account of its quantity is kept in the sub-divisional office in Form 16, statement of receipts, issues and balance of road metal. Copies of these statements are submitted to the divisional office.

Road metal found surplus, as a result of physical verification or otherwise should immediately be brought on account, treating it as a receipt, Shortage should be noted in the form of a remark in red ink and should be carried forward from month to month, until the discrepancy is set right by recovery, write-off or other means.

## 9.7 Material Charged to Works

In addition to the charges falling under the main classes namely, cash and stock, there are other transactions affecting the cost of work. They may be charges incurred in other divisions or departments, materials received from them or services rendered by them or there may be cash receipts that are taken in reduction of expenditure in accordance with the rules.

The cost of special establishment employees on the acquisition of land when chargeable to the accounts of the works should be treated as part of the works expenditure.

## 9.8 General Stock Items

Items of common use in construction work, such as bricks, cement, steel rods, lime, AC sheets etc., are kept in the stock of a division and issued as and when required for the execution of works.

## 9.9 Issue of Stores Material

Materials are issued from stock for the following purposes.

1. for use on works either by contractors or departmentally.
2. for dispatch to other subdivisions or departments.
3. for sale to contractors, employees and other outside parties.

Materials are issued only on receipt of an indent, Form No.7, signed by the divisional or sub divisional officer. Five copies of the indent are prepared, using carbon paper. One copy is retained by the indenter and the other copies sent to the supplying authority. The storekeeper of the stores finds out from the stock balances if the quantities indented can be issued. If it is not possible to issue the whole quantity, he records the quantities that are actually issued on all the four copies of the indents and puts his signatures on them. At the same time he makes corresponding entries of issues on the 'bin cards'. He also obtains the signature of the indenter on one copy, which is retained as a voucher in support of the transaction. One copy is returned to the

indenter and the remaining two are sent to the divisional office for further record.

## 9.10 Common Irregularities in Stock Account

The irregularities that commonly occur in stock accounts are given below:

1. Items not recorded in the bin card simultaneously with the entries on the indents.
2. Stock issued to contractors not recorded in contractor's ledger.
3. Transactions not recorded at the time of issue/receipt and in the order of their occurrence.
4. Shortages or surplus not adjusted when the book balances do not tally with the ground balances.
5. Corrections, etc., not initialed.
6. Transactions not duly supported by indents.
7. Issues not acknowledged by the indenter on the copy of the indent, which is retained by the store holder.

## 9.11 Issue of Material to Contractors

Sometimes it is desirable to retain the supply of the certain materials in the hands of the Government. The use of items of good quality can be ensured by supply is made by the Government from its stock. Items like cement, steel, bricks, asphalt material etc., are therefore generally issued to contractors even though the contract may be for completed items of work.

When the supply of certain items from the stock is envisaged, the contract should specify the following.

1. The full description of the materials to be supplied by the Government for use on works.
2. The place of delivery.
3. The rate including the storage rate, to be charged to the contractor for each item.
4. The contractor shall be responsible for obtaining the items and making payment there of at the rates specified, by deduction from bills.
5. No carriage or incidental charges are to be borne by the government beyond the place of delivery.

The cost of material issued to the contractor for use on a work should ordinarily be recovered by deduction from the first bill authorising payment for the work. The divisional officer may, however, permit recovery in phases to the extent the material is actually used in the construction at the time of payment. Moreover stores should not be issued to contractors in bulk long before they are actually required due to the risk of pilferage and misuse. The issue of stores to the contractors should therefore, be regulated and restricted to the actual requirements over a reasonable period of time.

## 9.12 Issue of Machinery and Equipment

Construction Machinery like road rollers, concrete mixers, vibrators, etc., can be issued to contractors for use on works of the department. A provision for the supply of such items is made in the notice inviting tenders and in the contract documents, clearly indicating the rates of recovery.

The recovery of charges should cover the following

1. Direct charges:
    i) Running expenses, i.e., the charges that would be incurred when the machinery is actually utilised.
    ii) Maintenance charges which include
        a) Supervision charges b) minor repairs
        c) Special repairs d) other miscellaneous charges
2. Indirect Charges
    i) Yearly depreciation, which is calculated by dividing the value of the article by the life of the machine in years.
    ii) Interest on capital investment, i.e., the cost of the machine.
    iii) Departmental charges on direct charges.

When the supply of materials and equipment is envisaged in the contract, for Government or contribution work, only the direct charges are recovered from the contractors. When such a supply of articles is not stipulated in the contract, or when the items are provided to commercial departments and private bodies for use on works under their supervision, full hire charges including both the direct and indirect charges are recovered.

## 9.13 Receipts

Materials are received on stock from the following sources:

1. Suppliers or Contractors: Most supplies are procured by direct purchase from suppliers and contractors.

2. Other Subdivisions, Divisions or Departments: Supplies are obtained from these sources when the materials available exceed their requirement.
3. Departmental Manufacture: Items like bricks, charcoal, etc., may be manufactured departmentally.
4. Works Buildings etc.: Some items may be obtained by recovery from works/buildings, etc. that are dismantled.

## 9.14 Record of Receipt of Stock

All materials, when received, must be examined and weighed, counted, or measured, as the case may be and an entry made in the 'goods received sheets' in Form 8-A. The goods received sheets' are printed in booklet form in triplicate or quadruplicate and the pages are machine numbered. These are fitted in triplicate with the help of carbon paper. The storekeeper retains one copy and the other two are sent to the sub-divisional officer, who passes on one of the copies to the divisional office for record and payment.

## 9.15 Receipt of Machinery and Equipment

When articles of machinery and equipment are received, they should be examined and counted. A record of these is kept in the tools and plant received sheet. Form 13, which are prepared in triplicate. The storekeeper retains one copy and the other two sent to the sub-divisional officer, who retains one copy for his record and sends the other to the divisional office for making payment.

## 9.16 Materials at Site Account

In the case of minor works in which transactions relating to the materials at site are not likely to be heavy, an account in form P.W.D VI-83 should be maintained of all departmental materials brought on to the site of a work. This should clearly show the sources and quantities of all receipts and of their issues to the work as the transactions occur.

The detailed account of the material issued to the work is known as the 'materials-at-site account'.

All departmental materials brought on to the site of work for use on that work, from any source, should be entered as receipts in the 'Materials-at-site accounts', immediately on their receipts giving a reference to the measurement book.

The register of material-at-site account should show separately for each material:

(i) The estimated requirement.

(ii) The issue rate.

(iii) Receipts, issues and balances, month to month

(iv) Net issues at the end of each month.

After completion of work, a theoretical calculation of the quantities of materials used on each subhead is made on the basis of the magnitude of work executed. These are recorded in Part I and Part II indicating the surplus or deficit as per actual consumption and the theoretical calculations, together with an explanation of the difference. Part III of the form is a statement showing the disposal of material remaining unused as per 'Material-at-site accounts'. The unused material is disposed off in the following manner.

(i) Transfer to stock, provided the items are serviceable and are likely to be required for other works.

(ii) Transfer to other works in progress, if required..

(iii) Sale of the items those are no longer required.

**9.17 Indent**

Material should issue only on receipt of an indent, form 7 signed by the divisional or the sub-divisional officer. These indents on stores are demands on store keeper signed by authorised persons to issue to bearer to be charged to a particular job or department and signified there in.

**9.18 Invoice**

The store keeper will prepare and sign the form of the invoice attached to the indent according to the supply as actually made. Simultaneously an entry should be made in the register of stock issues Form 8.

**9.19 Bin Card**

This is a card, which is attached to each Bin, or the container for stores a record of all materials entering or leaving the bin and the balance of materials in hand is kept in this card.

**9.20 Stock Register**

The accounts branch of the divisional office maintains day- to- day record of both the quantity and value of transactions relating to each item of stock. Separate ledgers are maintained for articles falling under each subhead of stock. The register has different sets of pages for different articles. The value of items posted on ‘goods received sheet’ on the basis of bills. The ‘goods received sheets’ are then posted in the priced stores ledger. The pages of the register are machine numbered.

**9.21 Issue Rate**

The issue rate is the unit rate at which the item is issued from the stock. It covers the cost of the procurement and storage of the article. The issue rate for each article should be fixed at the beginning of each year.

**9.22 Accounting shortages and surplus**

The value of the stores found shortage or deficit should, however, not be debited to the relevant final head of account, but kept under 'Miscellaneous P.W. Advance' pending recovery or adjustment. When the loss is treated as unrecoverable and ordered to be written off, the head 'Miscellaneous P.W. Advance' is cleared by debit to the work for which the stores were collected if the accounts are still open. If not, to the general head 'Losses on Stock' under the related major head.

**9.23 Write off**

When stores of any type become unserviceable, a report is immediately made on Form 18 'Survey report of Stores'. This should be done at once on discovery of the fact, as it is desirable to avoid keeping worthless materials on stock. In the report all proper explanations must be given including the period in which the articles have been in store or in use, and the cause of deterioration must also be stated. This report should be sent to the competent authority for obtaining further orders. The stores are written off after a sanction to that effect is obtained and an entry made in the store records reducing the balance by the quantity written off, giving reference to the sanction.

## FORM 8-A

## GOODS RECEIVED SHEET

Division.....

Sub-division.....

Section.....

Name of Supplier.....

| *Sl. No.* | *Date* | *Invoice R.R. No.* | *Purchase/ Supply Order* | | *Description of material* | *Stores code No.* | *Quantity* | *Unit* | *Rate* | *Amount* | *Incidental charges* | *Amount including incidental charges* | *Bin card No.* | *Stores ledger folio No.* | *Reference to payment voucher or adjustment debit* | | *Remarks including result of test check by senior officers* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *No* | *Date* | | | | | | | | | | | *No* | *Date* | |
| 1 | 2 | 3 | 4A | 4B | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15A | 15B | 16 |
| | | | | | | | | | *Rs. P.* | *Rs. P.* | *Rs. P.* | *Rs. P.* | | | | | |

Dated signature and designation.....
of the officer entering measurements

Notes : (1) Separate G.R.S. should be prepared in respect of goods purchased from each supplier.

(2) The articles falling under each subhead of stock should be grouped together and entered on separate sheets.

## FORM 8
## BIN CARD

Article.....
Code No.....
Unit.....
Issue rate.....

Maximum Stock.....
Minimum Stock.....
Ordering Level.....

Bin Card No.....
.....
From.....
.....
From.....

Signature of Issuing Officer

| Date | GRS/ Indent No. | Quantity In | Quantity Out | Balance | Initials of store-keeper/ Sectional officer | Remarks | Date | GRS/ Indent No. | Quantity In | Quantity Out | Balance | Initials of store-keeper/ Sectional officer | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3A | 3B | 4 | 5 | 6 | 1 | 2 | 3A | 3B | 4 | 5 | 6 |

## FORM 7

### STORES INDENT

No.....
Date.....
Division.....
Sub-division.....

Government of .....
Stores indent on.....Division.....

| *Sl. No.* | *Description of stores* | *Code No.* | *Quantity indented* | *Quantity issued* | *Unit* | *Rate* | | *Value* | | *Head of account* | *Name of work/ job (with name of contractor from whom value is recoverable)* | *Name of the person to whom the stores are to be delivered and his signature* | *Dated signature of indentor and his designation Divisional/ Sub-divisional Officer* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | *Name Signature* | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 8 | | 9 | 10 | 11 | 12 |
| | | | | | | *Rs.* | *P.* | *Rs.* | *P.* | | | | |

**FORM 7 (*Continued*)**

| *Issued on . . . . .*<br>*Signature*<br>*Designation* | *Received*<br>*Signature*<br>*Designation* | *Bill and No . . . .*<br>*Signatures of* *Storekeeper* / *Sectional officer* | *Ledger folio No. and folio No. of item*<br>*Ledger keeper* / *Divisional accountant* | *Remarks, if any* |
|---|---|---|---|---|
| 13 | 14 | 15 | 16 | 17 |

**FORM 9**

SUMMARY OF STOCK RECEIPTS

Division..... Name of Subhead ..... Month.....

| *Sl. No.* | *Date* | *Goods receiver' sheet No.* | *Value debitable to stock* | *Remarks including reference to voucher in the case of items paid for during the month* |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | *Rs.* *P.* | |

Total value of receipts.....

Less : Items paid for during the month.....

Net : debit to 'stock' by credit to purchases.....

Divisional accountant

Note : A separate summary should be prepared for each subhead of stock and the value of all subheads abstracted on another sheet in the following form:

Small stores.....

Building materials.....

**FORM 10**

**SUMMARY OF INDENTS**

Division ..... Name of subhead..... Month..... . .....

| *Sl. No.* | *Date* | *Indent No.* | *Value creditable to stock* | *Name of division/work to which the amount is debitable* |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

*Abstract of Debits*

(a) Division A..... (b) Division B..... (c) Works A.....
(d) Works B etc.....

Certified that the total amount debitable to another division has been agreed within the amount shown in the division-wise ledger of stores issued.

Total

Divisional accountant

Note : A separate summary should be prepared for each subhead of stock and the value of all the subheads abstracted on another sheet in the following form.

## SYNOPSIS

1. Classification of stores
   - i) Stock
   - ii) Machinery and equipment
   - iii) Road metal
   - iv) Materials charged to works
2. Stock: Items of common use in construction works, such as bricks, cement, aggregates, steel etc. are kept as in the stock.
3. Machinery and equipment are of two types:
   - I) General or ordinary
   - II) Special
4. Indents are demands on store keeper signed by authorised persons to issue to bearer to be charged to a particular job or department and submitted therein.
5. Bin Card is a card, which is attached to each bin or the container for stores a record of all materials entering or leaving the bin and the balance of materials in hand is kept in this card.
6. Issue Rate is the unit rate at which the item is issued from the stock.

## SHORT ANSWER QUESTIONS

1. What is Stock?
2. What is Indent?
3. What is Bin Card?
4. Define Issue Rate.
5. Give classification of P.W.D. Stores.

## ESSAY TYPE QUESTIONS

1. What is meant by Stock? What are the sub heads of Stock?
2. What is meant by material at site account? How is it maintained?
3. Explain briefly how the record of Road metal is maintained.
4. What are the common irregularities in the Stock accounts?

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