INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

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CONSTRUCTION MANAGEMENT
(JNTUH-R15)
IV B.Tech II Sem

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UNIT -I
MANAGEMENT PROCESS

Management

- Management is an art of getting things done through and with the people in formally organized groups.

- It is an art of creating an environment in which people can perform and individuals and can co-operate towards attainment of group goal.

- **Management process** is a **process** of setting goals, planning and/or controlling the organizing and leading the execution of any type of activity, such as: a project.

Importance of management

- Helps in Achieving Group Goals
- Optimum Utilization of Resources
- Reduces Costs
- Establishes Sound Organization
- Establishes Equilibrium
- Essentials for Prosperity of Society

Functions/Role of management

- Planning
- Organizing
- Staffing
- Directing
- Controlling

Management theories

- Contingency Theory
- Systems Theory
- Chaos Theory
- Theory X and Theory Y

Management roles

- Interpersonal Role
- Informational Role
- Decisional Role

Strategic Management

- **Strategic management** involves the formulation and implementation of the major goals and initiatives taken by a company's top **management** on behalf of owners, based on consideration of resources and an assessment of the internal and external environments in which the organization competes.

Decision making Tools and techniques

- When running a business, making the right decisions can lead to success, while making the wrongs can result to failure. With so much riding on each decision, it's important that thoughtful consideration is put into each one that needs to be made. To help them, many business leaders go through a thoughtful decision-making process.

Basic steps in effective decision-making

- Identify the decision to be made
- Gather relevant information
- Identify alternatives
- Weigh evidence
- Choose among alternatives
- Take action
- Review decision and consequences

Decision-making tools and techniques

- Decision matrix
- T-Chart
- Decision tree
- Multi voting
- Pareto analysis
- Cost-benefit
- Conjoint analysis

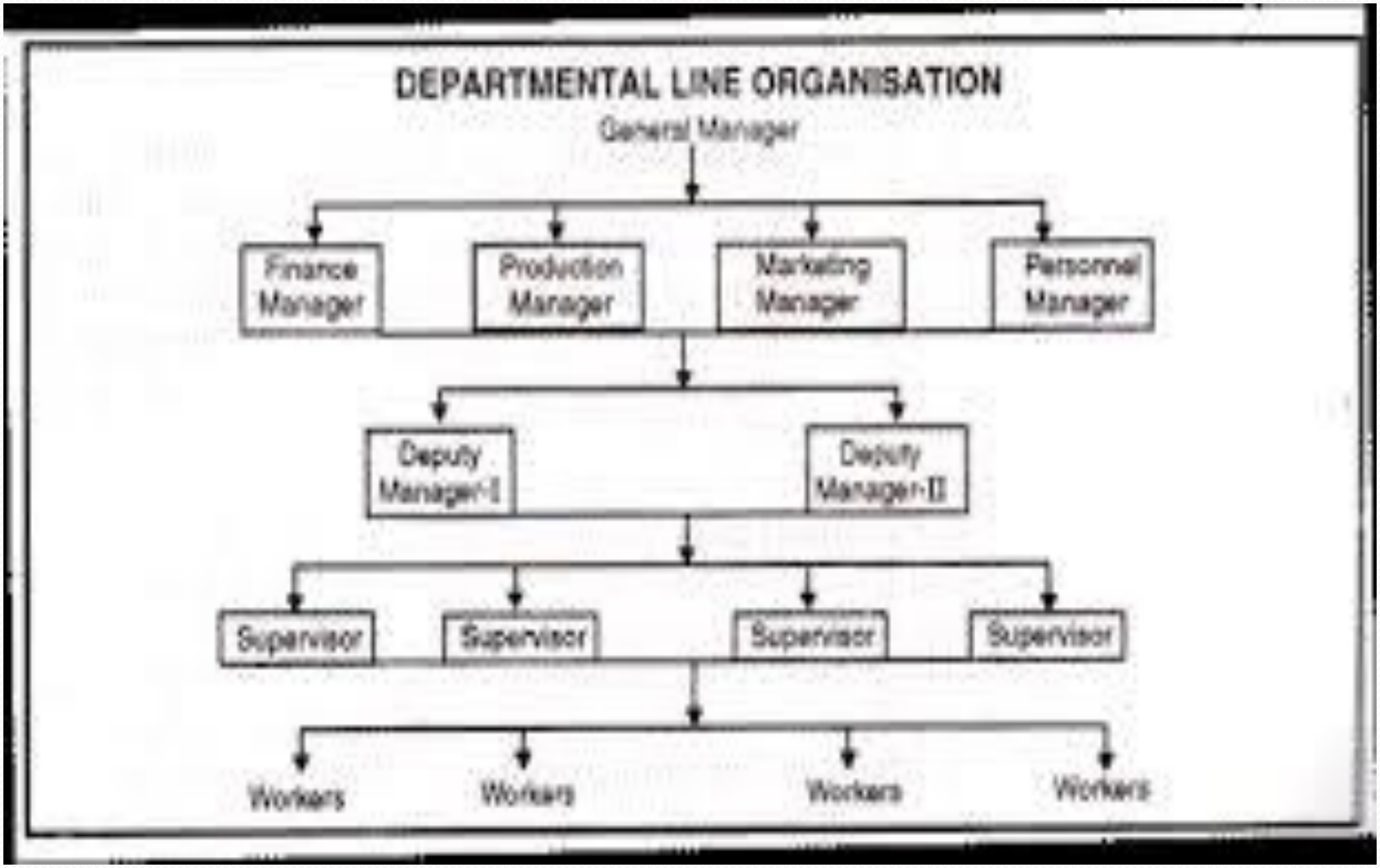
Organizational structure

- An **organizational structure** defines how activities such as task allocation, coordination and supervision are directed toward the achievement of organizational aims

Line Organisation

- Line organisation is the simplest and the oldest type of organisation. It is also known as scalar organisation or military type of organisation.

- In the words of J.M. Lundy, “It is characterized by direct lines of authority flowing from the top to the bottom of the organizational hierarchy and lines of responsibility flowing in an opposite but equally direct manner.”


DEPARTMENTAL LINE ORGANISATION
General Manager
Finance Manager
Production Manager
Marketing Manager
Personnel Manager
Deputy Manager-I
Deputy Manager-II
Supervisor
Supervisor
Supervisor
Supervisor
Workers
Workers
Workers
Workers

Functional Organisation

- F.W. Taylor, who is better known as the father of scientific management developed the concept of 'Functional Organization'. As the very name suggests, functional organization implies that the organization should be based on various functions.

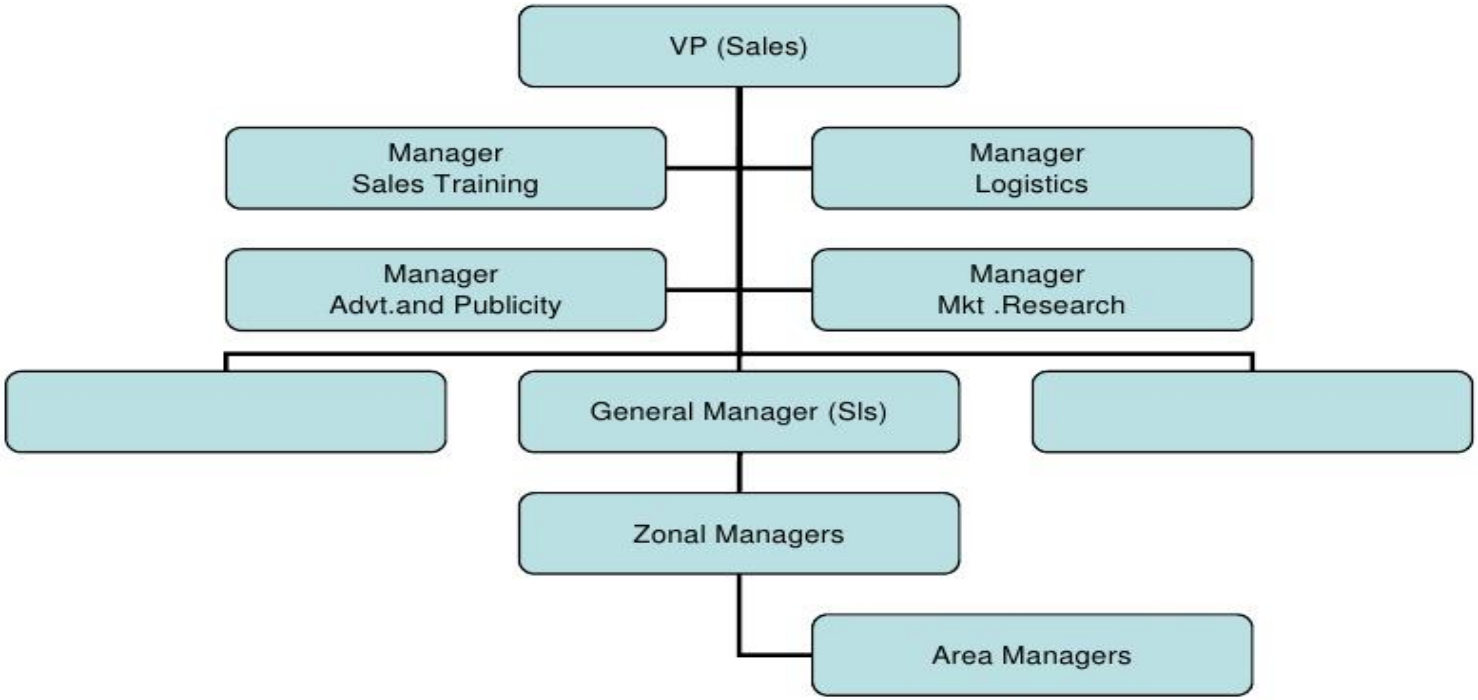
- Taylor's functional approach is mainly based on principle of specialization and tries to bring about organizational balance.


Functional Organizations
Project is managed with the existing functional hierarchy

Line and Staff Organization

- The line and staff organization is an improvement over the above mentioned two systems viz, line organization and functional organization. The line organization concentrates too much on control whereas the functional system divides the control too much.

Line and Staff organization



Human Resource Management

- It is the management of human resources. It is a function in the organizations designed to maximize employee performance in service of an employer's strategic objectives.
- HR is primarily concerned with the management of people within organizations, focusing on policies and on systems.

Human resource Management core functions

- Staffing
- Human resource development
- Compensation and benefits
- Safety and health
- Employee and labor relations

Human resources management activities

- Determine needs of the staff.
- Determine to use temporary staff or hire employees to fill these needs.
- Recruit and train the best employees.
- Supervise the work.
- Harmonize relationship between company and workers.
- Manage employee relations, unions and collective bargaining.
- Prepare employee records and personal policies.
- Ensure high performance.

Leadership

- **Leadership** is both a research area and a practical skill encompassing the ability of an individual or organization to "lead" or guide other individuals, teams, or entire organizations.

An effective leader is a person who does the following:

- Creates an inspiring vision of the future.
- Motivates and inspires people to engage with that vision.
- Manages delivery of the vision.
- Coaches and builds a team, so that it is more effective at achieving the vision.

UNIT – II
CLASSIFICATION OF CONSTRUCTION PROJECTS

Types of Construction Projects

- **PRIVATE CONSTRUCTION PROJECTS**

  Private parties include individuals, homeowners, corporations, other business entities, non-profit associations, privately funded schools, hospitals, publicly traded companies, etc. Anything, in other words, that is not the government.

STATE CONSTRUCTION PROJECTS

The term “state” can refer to projects commissioned by a county, city, municipality, government board, public school board or any other state-funded entity. The term “state construction” means, therefore, any government funded construction that is not “federal”

FEDERAL CONSTRUCTION PROJECTS

Federal construction projects are very similar to state projects. Just like state projects they can take on a variety of forms: very simple and traditional, and very complex. And the stuff being constructed can be pretty similar to the stuff constructed by state authority: courthouses, government buildings, flood control projects, etc.

Construction Process

The Construction Process is composed of six distinct stages, which are:

- Concept.
- Contracts and Bid Documents.
- Bidding.
- Construction.
- Construction Payments.
- Completion.

Functions of a Construction Manager

- Specifying project objectives and plans including delineation of scope, budgeting, scheduling, setting performance requirements, and selecting project participants.
- Maximizing resource efficiency through procurement of labour, materials and equipment.
- Implementing various operations through proper coordination and control of planning, design, estimating, contracting and construction in the entire process.
- Developing effective communications and mechanisms for resolving conflicts.

Main responsibilities of a Construction Manager

- The most common responsibilities of a Construction Manager can be classified as follows:
- Project Management;
- Planning;
- Cost Management;
- Time Management;
- Quality Management;
- Contract Administration;
- Safety Management;

Importance of construction project/construction planning

- Planning helps to minimize the cost by optimum utilization of available resources.
- Planning reduces irrational approaches, duplication of works and inter departmental conflicts.
- Planning encourages innovation and creativity among the construction managers.
- Planning imparts competitive strength to the enterprise.

Importance of Construction Management:

- Construction management practices invariably lead to “maximum production at least cost”. A good construction management, results in completion of a construction project with in the stipulated budget.
- Construction management provides importance for optimum utilization of resources. In other words, it results in completion of a construction project with judicious use of available resources.
- Construction management provides necessary leadership, motivates employees to complete the difficult tasks well in time and extracts potential talents of its employees.
- Construction management is beneficial to society as the effective and efficient management of construction projects will avoid, escalation of costs, time overrun, wastage of resources, unlawful exploitation of labor and pollution of environment.

Stages of construction planning

- Pretender planning
- Contract planning

Pretender planning

- The majority of work secured by a contractor is done so by some form of competitive tendering process.
- The importance of gaining as much information as possible about the proposed contract and site cannot be over emphasized.
- The contract documentation and tender drawings will provide a useful starting point but most Estimators will need to visit the proposed site to get a ‘feel’ for the contract and the environment in which the work will take place.

Contract planning

It is the planning after the acceptance of a tender and award after a contract. It includes following

- Preparation of labor requirement
- Material statement chart
- Master plan for carrying the work
- Detailed drawings
- Dates are decided for making orders for supply of material
- Sequence of operations and their inter relationship to be planned

Methods of construction management

- Critical path method
- Program evaluation and review technique
- Lean construction method
- Line of balance method

CRITICAL PATH METHOD

The essential technique for using CPM is to construct a model of the project that includes the following:

- A list of all activities required to complete the project (typically categorized within a work breakdown structure),
- The time (duration) that each activity will take to complete,
- The dependencies between the activities and,
- Logical end points such as milestones or deliverable items.

PROGRAM EVALUATION REVIEW TECHNIQUE

- PERT is a method to analyze the involved tasks in completing a given project, especially the time needed to complete each task, and to identify the minimum time needed to complete the total project.

COST OPTIMIZATION

- Cost optimization optimizes cost and one or more responses at the same time to determine the factor settings that are both cost-effective and produce acceptable values for the responses. Often the factor settings that produce the best results are the most expensive to do. Cost optimization determines a compromise between minimizing cost and optimizing the responses.

UNIT – III
RESOURCE PLANNING

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 utilized with in a given time to get maximum benefit in terms of construction output.

The five categories of resource planning techniques include

1. Resource Loading
2. Resource Aggregation
3. Resource Availability Analysis
4. Resource-Constrained Scheduling
5. Resource Leveling

Resource Loading

Resource loading allows the planner to assign resources such as labor, equipment and materials to each activity in the project schedule.

- These units might be craftsmen, pieces of equipment or quantities of construction materials.
- Craftsmen or equipment the norm.

Resource Aggregation

Resource aggregation totals each type of resource used in the schedule for each time unit between scheduled project start and finish.

- Look at the early and late start and finish dates.
- Remember your resource requirements for the critical path doesn't change only the float activities
- You like to see a bell curve on your resource aggregation always keeping in mind the early and late dates on the items with float.
- EX-Average daily manpower per week graph

Resource Availability Analysis

- Simply compares the amount of resources required to the maximum amount of resources that are available for use.
- In the real world can we get more resources.

Time-and-Resource-Constrained Scheduling

- Time constrained or resource constrained.
- Time use an end date.
- Resources schedule the project on available resources.

Resource Availability Analysis

- Simply compares the amount of resources required to the maximum amount of resources that are available for use
- In the real world can we get more resources.
- When the assigned resources exceed those available:

– Shift non-critical activities within the schedule

– Obtain more resources

– Extend the schedule to lower the demand during the original schedule.

Time and Resource Constrained Scheduling

- Schedules can be time constrained or resource constrained but not both.
  - Time use an end date
  - Resource schedules the project on available resources
- Time- get more resources
- Resource- a shortage extend the time

Resource Leveling

- Attempts to keep the requirements for a construction resource as constant as possible over the duration of the project.
- Non-critical activities are shifted within the schedule using the available total float in order to level resource usage and the planned project completion date is unchanged as a result of the leveling process.
- This techniques are used when the project duration is fixed.
- Maximizing the effects of resource leveling requires performing both a backward and forward pass again through the network.
- The primary objective is to reduce the peaks and valleys without increasing the duration.
- Delaying those activities to the last available space.

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

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.

Register of material-at-site

- 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.

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 authorized persons to issue to bearer to be charged to a particular job or department and signified there in.

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.

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.

Scheduling

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.

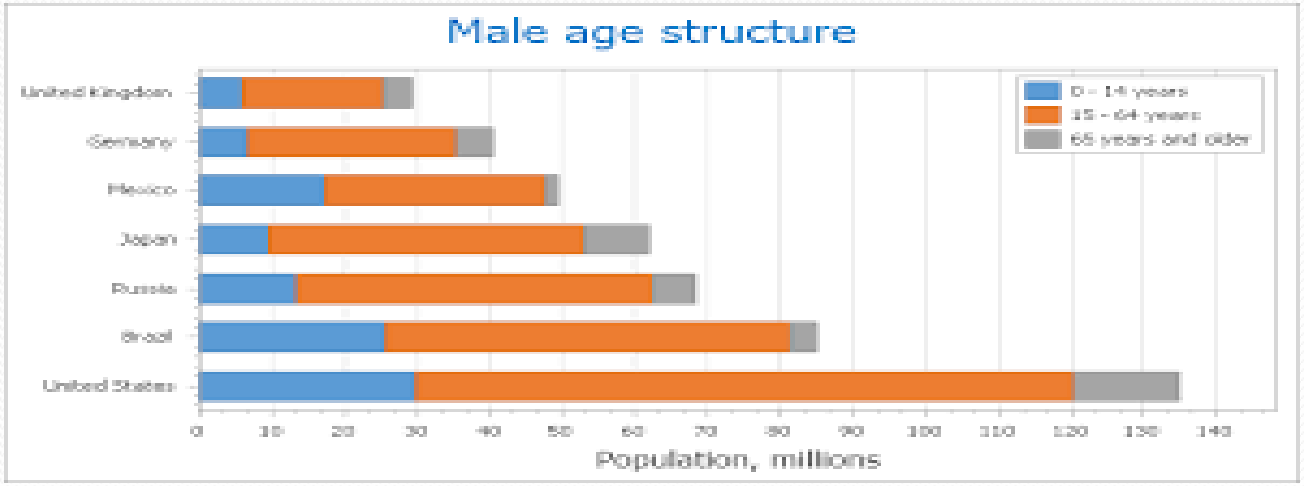
Advantages of Scheduling

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 utilization can be optimized 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.

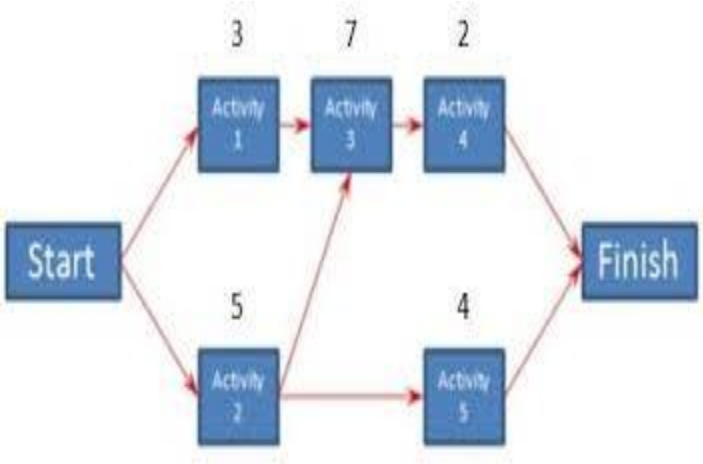
BAR CHARTS

- 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.



Critical path method of scheduling

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



BUDGET

- Budgeting has come to be accepted as an efficient method of short-term planning and control.

DEFINITION OF BUDGET

- The Chartered Institute of Management Accountants, England, defines a 'budget' as under:
- “A financial and/or quantitative statement, prepared and approved prior to define period of time, of the policy to be pursued during that period for the purpose of attaining a given objective.”

Essentials of a Budget

(1) It is prepared for a definite future period.

(2) It is a statement prepared prior to a defined period of time.

(3) The Budget is monetary and *I* or quantitative statement of policy.

(4) The Budget is a predetermined statement and its purpose is to attain a given objective.

- A budget, therefore, be taken as a document which is closely related to both the managerial as well as accounting functions of an organization.

BUDGETARY CONTROL

- Budgetary Control is the process of establishment of budgets relating to various activities and comparing the budgeted figures with the actual performance for arriving at deviations
- The above definitions reveal the following essentials of budgetary control:

(1) Establishment of objectives for each function and section of the organization.

(2) Comparison of actual performance with budget.

(3) Ascertainment of the causes for such deviations of actual from the budgeted performance.

(4) Taking suitable corrective action from different available alternatives to achieve the desired objectives.

Objectives of Budgetary Control

- *Planning*
- *Coordination*
- *Control*

ADVANTAGES

(1) It facilitates reduction of cost.

(2) Budgetary control guides the management in planning and formulation of policies.

(3) Budgetary control facilitates effective co-ordination of activities of the various departments and functions by setting their limits and goals.

(4) It ensures maximization of profits through cost control and optimum utilization of resources.

(5) It evaluates for the continuous review of performance of different budget centers.

UNIT – IV
CONTRACT

Contract

- 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 labor or the transport of materials, etc.

Types of Contract Agreements

- Contract agreements fall into the following two clauses.

  - Piece-work agreements.
  - Contracts.

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.

Types of Contracts

- Contracts are of the following types.

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

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.

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

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.

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.

Important instructions regarding the preparation of Muster rolls

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

Continued

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.

Continued

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.

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 labor, piece work, Schedulecontract, 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.

UNIT – V
MANAGEMENT INFORMATION SYSTEM

Types of labor

Construction labor can broadly divided into two types

- 1. Casual labor
- 2. Regular establishment

Casual labor

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

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.

LABOUR LAWS

- 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

1. Laws concerning the working conditions of labour.
2. Laws concerning wages and other payments to labour.
3. Laws concerning the social security of labour.
4. These laws are proved very much helpful to the labour for improving their living conditions.

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.

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.

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

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

Minimum Wages Act, 1948

- 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.

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 7th day after the last day of the wage period if the establishment has less than 1,000 employees.

II. The 10th day after the last day of the wage period if establishment has more than 1,000 employees.

CONTINUED

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.

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.

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.

CLASSIFICATION OF LABOUR LAWS

- Laws related to Industrial Relations
- Laws related to Wages
- Laws related to Working Hours, Conditions of Service and Employment
- Laws related to Equality and Empowerment of Women
- Laws related to Deprived and Disadvantaged Sections of the Society
- Laws related to Social Security

CONSTRUCTION INDUSTRY AND SAFETY

- Construction is a high hazard industry that comprises a wide range of activities involving construction, alteration, and/or repair.
- Examples include residential construction, bridge erection, roadway paving, excavations, demolitions, and large scale painting jobs.
- Construction workers engage in many activities that may expose them to serious hazards, such as falling from rooftops, unguarded machinery, being struck by heavy construction equipment, electrocutions, silica dust, and asbestos.

Types of hazards on construction sites

- Chemical
- Physical
- Biological
- Ergonomic

Causes of accidents

- **Workers and work-team**

– Actions/behavior

– Capabilities including knowledge and skills

– Communication

– Immediate supervision

– Workers' health/fatigue

- **Workplace**

– Site conditions (excluding equipment, material & weather)

– Site layout/space

– Working environment (light/noise/hot/cold) – Working schedule – Housekeeping

Costs of Accidents

- Direct costs

  The direct costs are insurance. These include medical costs and others workers' compensation insurance benefits as well as liability and property-damage insurance

- Indirect costs

1. Transportation costs
2. Wages paid to injured worker for time not worked
3. Cost incurred because of delays which resulted from accident
4. Costs of overtime necessitated by accidents
5. Loss of efficiency of crew

Hazard Identification

- Systematic recognition of any aspects of a project which have a potential to be a danger to these persons working on worksite or being around the project.
- Example of hazards present in working at heights, use of ladders and scaffolds, collapse of temporary structures, use of vehicles, mechanical plant & equipment, etc.

Thank you