UNIT - I

ESTIMATION OF BUILDINGS

1.1 INTRODUCTION:

- Estimation or estimating is the process of calculating the quantities of various items of works involved in the project.
- Estimate is a document which furnishes the quantities of different works involved, their rates and the expenditure anticipate in a project.

1.2 NECESSITY OF ESTIMATES:

- To know about the approximate cost of the building construction.
- To calculate the tax of the building
- To fix the rent of building
- They know about the various items of works involved in the building construction and arrange the available materials of the construction.
- To arrange the labors of the construction works.
- Take the approval for the government projects.
- To having the loan from the bank.

1.3 ESTIMATION:

In the civil engineering field, the construction activity contains the following three steps.

- **Plans**: Preparation of drawings plan, section, elevation, with full dimension and detailed, specifications meeting the requirements of the proposed structure.
- **Estimation**: Preparation of an estimate is for arriving in the cost of the structure to verify the available funds or to procure the required funds for completion of the proposed structure.
- **Execution (construction):** It is grounding the proposed structure, for construction as per the provision contained in drawings and estimation.
- In, Estimation and costing there are two basic points involved in construction.
- **Quantity**: The quantity aspects is with reference to the measurement in the drawings (plan, elevation, section)
- **Quality:** The quality aspects are with reference to the specifications, i.e. properties of materials, workmanship etc.
- The estimation and costing of any structure is defined as the process of determination of quantities of items of work, and its cost for completion.

1.4 GENERAL ITEMS OF BUILDING

TECHNICAL TERM

Estimate:

An estimate is the anticipated or probable cost of work and is usually prepared before the construction is taken up. It is indeed calculations or computations of various items of an engineering work.

Quantity survey:

It is the schedule of all items of work in a building. These quantities are calculated from the drawing of the building. Thus quantity survey gives quantities of work done in case of each items, when priced gives the total cost. In short, quantity survey means calculations of quantities of materials required to complete the work concerned.

Specifications:

Detailed specifications gives the nature, quality and class of work, materials to be used in the various parts of work , quality of the material, their proportions, method of preparation, workmanship and description of execution of work are required.

Rates:

The rates of various items of works, materials to be used in the construction and the wages of different categories of labor (skilled and unskilled) should be available for preparing an estimate. The cost of transportation charges should also be known. As far as possible sanctioned "Schedule of Rates" shall be followed or the rates may be worked out by the "Analysis of Rates" method.

Site plan:

It is the plan drawn for a particular construction showing its position with respect to approaching roads, main bazaars, markets and other permanent features in a populated area. It shows the location of the area under construction with respect to the other areas and on it generally the names of the owners of areas or property holders adjoining to it are also denoted. North line is also clearly marked on it.

Line plan:

Line plan can be defined as the plan of a particular construction simply showing main features with the help of the single lines of different portions of the constructions. Details of constructions are not generally shown on this plan. This inside and outside dimensions shown on this plan should necessarily be corresponding to actual dimensions.

Index plan:

This is the plan of a particular colony showing the positions of different houses in single lines their number if any position of roads, schools, market, hospitals and other features etc. this plan is generally fixed on the entrance, or at exit or in the central place of the colony, for the guidance of the inhabitants and outsiders.

Detailed plan:

This plan indicates a plan of a construction drawn to a definite scale, showing all detailed information required for its execution. Various sections and elevations are clearly drawn on this plan.

Centre line plan:

This is actually a layout plan drawn to facilitate the laying out of foundation lines and other features. It is generally fixed on the entrance or at exit in the central place of the colony for the guidance of the inhabitants and outsiders.

Supplementary estimate:

When some additions are done in the original work, afresh detailed estimate is prepared to supplement the original work. This estimate is called supplementary estimate. It is also accompanied by all the papers as required in thru detailed estimate.

Administrative approval:

For any project required by the department an approvals sanction of the competent authority with respect to the cost and work is necessary at the first instance. Thus administrative approval denotes the formal acceptance by the administrative department concerned of the proposals for incurring expenditure.

Technical sanction:

It means the sanction and order by the competent authority of the department for the detailed estimate design calculations quantities of work rates and cost of work.after the technical sanction of the estimate is received the work is then taken up for construction.

Competent authority:

An officer or any other authority in the department to whom relevant powers are delegated by the government (Financial Department).

Ordinary measurement book:

It is measured book in which entries regarding the work done or supplies made and services performed are recorded for the purpose of making payments to the contractors or the labor. Entries in the M.B are generally recorded by the sectional officers or by any other officers deputed for the purpose

Lump sum items:

Sometimes while preparing estimate for the certain small items like front architecture or decoration work of a building it is not possible to workout detailed quantities so far such lump sum items a lump sum rate is provided.

Plinth area:

The built up covered area of a building measured at floor level of any storey is called plinth area.

Circulation area:

The total cost of construction including all expenditures incurred plus the cost of external services up to the end of the completion of the work is called capital cost. It also includes the cost of preliminary works, miscellaneous items and supervision charges etc.

1.5 General items required for Estimation

Estimating is the technique of calculating or computing the various quantities and the expected Expenditure to be incurred on a particular work or project. In case the funds available are less than the estimated cost the work is done in part or by reducing it or specifications are altered, the following requirement are necessary for preparing an estimate.

1. Drawings like plan, elevation and sections of important points.
2. Detailed specifications about workmanship& properties of materials etc.
3. Standard schedule of rates of the current year.

1.6 Units of measurements :

The units of measurements are mainly categorized for their nature, shape and size and for making payments to the contractor and also. The principle of units of measurements normally consists the following:

1. Single units work like doors, windows, trusses etc., is expressed in numbers.
2. Works consists linear measurements involve length like cornice, fencing, hand rail, bands of specified width etc., are expressed in running meters (RM).
3. Works consists areal surface measurements involve area like plastering, white washing, partitions of specified thickness etc., and are expressed in square meters (m2).
4. Works consists cubical contents which involve volume like earth work, cement concrete; Masonry etc are expressed in Cubic meters.

1.7 Rules for measurement:

The rules for measurement of each item are invariably described in IS- 1200.
However some of the general rules are listed below.

1. Measurement shall be made for finished item of work and description of each item shall include
    a) Materials,
    b) Transport,
    c) Labor,
    d) Fabrication Tools And
    e) Plant and all types of overheads for finishing the work in required shape, size and specification.
2. In booking, the order shall be in sequence of
    a) Length,
    b) Breadth and
    c) Height or Thickness.
3. All works shall be measured subject to the following tolerances.
4. Linear measurement shall be measured to the nearest 0.01m.
5. Areas shall be measured to the nearest 0.01 sq.m
6. Cubic contents shall be worked-out to the nearest 0.01 cum
7. Same type of work under different conditions and nature shall be measured separately under separate items.
8. The bill of quantities shall fully describe the materials, proportions, workmanships and accurately represent the work to be executed.
9. In case of masonry (stone or brick) or structural concrete, the categories shall be measured separately and the heights shall be described.

    a) From foundation to plinth level.
    b) From plinth level to first floor level.
    c) From Fist floor to second floor level and so on.

1.8 Requirements of estimation and costing

1. Estimate gives an idea of the cost of the work and hence its feasibility can be determined i.e. whether the project could be taken up with in the funds available or not.
2. Estimate gives an idea of time required for the completion of the work.
3. Estimate is required to invite the tenders and Quotations and to arrange contract.
4. Estimate is also required to control the expenditure during the execution of work.
5. Estimate decides whether the proposed plan matches the funds available or not.

1.9 Procedure of estimating or method of estimating.

- Estimating involves the following operations preparing detailed Estimate.
- Calculating the rate of each unit of work Preparing abstract of estimate

1.9.1 Data required to prepare an estimate

- Drawings i.e. plans, elevations, sections etc.
- Specifications, Rates.

1. **Drawings**
   a) If the drawings are not clear and without complete dimensions the preparation of estimation become very difficult. So, it is very essential before preparing an estimate.

2. **Specifications**
   a) General Specifications: This gives the nature, quality, class and work and materials in general terms to be used in various parts of wok. It helps no form a general idea of building.
   b) Detailed Specifications: These gives the detailed description of the various items of work laying down the Quantities and qualities of materials, their proportions, the method of preparation workmanship and execution of work.

3. **Rates**
   a) For preparing the estimate the unit rates of each item of work are required. for arriving at the unit rates of each item.
   b) The rates of various materials to be used in the construction. The cost of transport materials.
   c) The wages of labor, skilled or unskilled of masons, carpenters, Amador, etc.,

4. **Complete estimate**
   a) Most of people think that the estimate of a structure includes cost of land, cost of materials and labor, but many other direct and indirect costs included and are shown below.
   b) The following are some of L.S. Items in the estimate. Water supply and sanitary arrangements.
   c) Electrical installations like meter, motor, etc.,
   d) Architectural features. Contingencies and unforeseen items.
   e) In general, certain percentage on the cost of estimation is allotted for the above L.S.Items Even if sub estimates prepared or at the end of execution of work.

5. Work charged establishment

a) During the construction of a project considerable number of skilled supervisors, work assistance, watch men etc., are employed on temporary basis.

b) The salaries of these persons are drawn from the L.S. amount allotted towards the work charged establishment.

c) That is establishment which is charged directly to work.

d) The mount of 1½ to 2% of the estimated cost is provided towards the work charged establishment.

1.10 Methods of taking out quantities

The quantities like earth work, foundation concrete, brickwork in plinth and super structure etc., can be workout by any of following two methods:

1. Long wall - short wall method Centre line method.
2. Partly centre line and short wall method.

1. Long wall-short wall method

- In this method, the wall along the length of room is considered to be long wall while the wall perpendicular to long wall is said to be short wall.
- To get the length of long wall or short wall, calculate first the centre line lengths of individual walls.
- Then the length of long wall, (out to out). may be calculated after adding half in breadth at each end to its centre line length.
- Thus the length of short wall.
- Measured into in and may be found by deducting half breadth from its centre of line length at each end.
- The length of long wall usually decreases from earth work to brick work in super structure while the short wall increases.
- These lengths are multiplied by breadth and depth to get quantities.

❖ **Detailed estimate**

The preparation of detailed estimate consists of working out quantities of various items of work and then determines the cost of each item. This is prepared in two stages.

1. **Centre line method**
   - This method is suitable for walls of similar cross sections.
   - Here the total centre line length is multiplied by breadth and depth of respective item to get the total quantity at a time.
   - When cross walls or partitions or verandah walls join with main all, the centre line length gets reduced by half of breadth for each junction.
   - Such junction or joints are studied carefully while calculating total centerline length.
   - The estimates prepared by this method are most accurate and quick.

2. **Partly centre line and partly cross wall method**
   - This method is adopted when external (i.e., around the building) wall is of one thickness and the internal walls having different thicknesses.
   - In such cases, centre line method is applied to external walls and long wall-short wall method is used to internal walls.
   - This method suits for different thicknesses walls and different level of foundations. Because of this reason, all Engineering departments are practicing this method.

1.11 NEEDS FOR ESTIMATION AND COSTING:

1. Estimate gives an idea of the cost of the work and hence its feasibility can be determined Estimate gives an idea of time required for the completion of the work.
2. Estimate is required to invite the tender sand Quotations and to arrange contract. Estimate is also required to control the expenditure during the execution of work. Estimate decides whether the proposed plan matches the funds avail or not.
3. To know the quantities of various items of work, a material and labor and their source of identification.
4. To decide whether the proposal can match the available funds to complete the structure.
5. To obtain the administrative and technical sanction of estimate from the competent authorities to release the funds for construction.
6. To invite tenders or quotations based on the estimate quantities for entrust of works to the execution.

Detailed Estimate

S.no	Description of work	No	Length	Breadth	Height/Depth	Quantity	Remarks

Abstract estimate

S.No.	Description of work	Quantity	Rate	Per	Amount

1.12 UNITS OF MEASUREMENT:

- The units of different works depend on their nature, size and shape. In general, the units of different items of works are based on the following principle.
- Massive or volumetric items of work such as earth work, concrete for foundations, R.R Masonry, Brick Masonry etc. The measurements of length, breadth, height or depth shall be taken to compute the volume or cubical contents.
- Shallow, thin and surface work shall be taken in square unit or in area. The measurements of length and breadth or height shall be taken to compute the area,

  Ex. Plastering, white washing etc.
- Long and Thin work shall be taken in linear or running units and linear measurement shall, be taken.

  Ex: Fencing, Rainwater pipes, ornamental borders etc.
- Single units of work are expressed in numbers.

DUTIES OF QUANTITY SURVEYOR:

- The quantity surveyor must be well versed with the drawing of work.
- He should be able to read the drawing correctly and bill the quantities accurately.
- He should have the knowledge of the construction procedure.
- He should be able to write the description of different works.
- He should able to prepare the schedule of the project.
- He should be able to value all variations under the contract.

1.13 REQUIREMENTS OF A GOOD ESTIMATOR:

The quantity surveyor must be well versed with the drawings of works.

He should be able to read the drawing correctly and bill the quantities accurately.

IMPORTANT TERMS:

- **Plinth area**

✓ It is the covered built-up area measured at the floor level of any storey.

✓ Plinth area is also called as built-up area and is the entire area occupied by the building including internal and external walls.

✓ Carpet area

✓ This means area in building which is useful on i.e area of drawing room, dining room, kitchens staircase, stores, verandas, Entrance hall, bathroom.

✓ It is generally 50% to 60% of plinth area.

✓ Carpet Area is the area that can be covered by a carpet.

✓ This area does not include the thickness of pillars and inner walls.

✓ The common areas are also not included. Common areas are the lifts, staircase, lobby, play area etc.

DIFFERENT TYPE OF ESTIMATES:

- Preliminary/Approx./Abstract/Rough Cost Estimate
- Plinth Area Estimate
- Cube Rate or Cubical Content Estimate
- Appx. Quantity Method Estimate
- Detailed Estimate or Item Rate Estimate
- Supplementary Estimate
- Revised Estimate
- Sub-Estimate
- Annual Repair or Maintenance Estimate (A.R or A.M Estimate)
- Complete Estimate

Preliminary or Approximate estimate:

- This estimate is prepared to decide financial aspect, policy and to give idea of the cost of the proposal to the competent sanctioning authority.

- It should clearly show the necessity of the proposal and how the cost has been arrived at. The calculations for approximate estimate can be done with the following data.
- The data can be had from a similar construction already complete in the nearby area, executed by the department.
- The following documents should be attached with it.
    - Detailed report
    - Site plan of the proposal
    - It should also clearly mention about the acquisition of land, Provision of electric and water supply etc.

Types of Approximate Estimate:

- Plinth area method
- Cubical content method
- Unit cost (or) service unit method
- Typical bay method
- Carpet area method
- Rough quantity method

Plinth area Estimate:

- P.A. is approximate estimate
- Plinth area should be calculated for covered area by taking external dimensions of the building at the floor level.
- Courtyard and other open area should not be included.
- For multi storied building Plinth Area for each storey is determined separately.
- Plinth area rate is known from cost of similar building in the locality.
- Approx. Cost of the building = Plinth area Rate/ m^2 x Plinth Area

Cubic Contents Estimate:

- Cube rate estimate is again approximate estimate.
- Cubical content of the building is determined by multiplying length, breadth and height of the building.
- External length and breadth at the floor level are calculated for the purpose.
- Height should be taken from the floor level to the top of roof.

- For multi storeyed building height is taken from floor level of one storey to top of next higher floor.
- Cube rate estimate is more accurate as compared to the plinth area estimate.

Unit cost (or) service unit method:

- The unit method of estimating is the simplest and quickest method.
- In this method, the quantity surveyor counts the number of units which are going to be accommodated in a building, for example the number of occupants or main furniture objects used by an individual.
- The number is then multiplied by the cost per unit to get the total estimated cost of the project.

Typical bay method:

- This method is useful and is generally followed in case of building having several bays.
- The cost of the one class room is worked out and then multiplied by the number of bays in that building.
- The extra cost of the end walls and difference in framing. If there is any, should be made, so as to arrive at the correct cost.

Carpet area method:

- Carpet area the covered area of the usable spaces of rooms at any floor.
- It is measured between walls to walls within the building and is the sum of the actual areas of the rooms where you can carpet.
- Floor area = Plinth Area –Area of Walls.
- This includes the floor areas of all rooms, verandahs, passages, staircase rooms, bathroom etc.
- In residential building, the carpet area will be about 55% to 65% of the plinth area.

PROBLEMS:

1. Prepare a preliminary estimate of building of a building with a total plinth area of all building is 1500sq.m. and from following data.

- ✓ Plinth area rate - Rs. 9500/ m^2
- ✓ Special architectural design – 1.5% of building cost.
- ✓ Water supply and Sanitary - 5% of building cost.

- ✓ Electrical Installation - 14% of building cost.
- ✓ Services - 6% of building cost.
- ✓ Contingencies - 3% of building cost.
- ✓ Supervision - 8% of building cost.

Determine the total cost of building project.

Area (given) = 1500 m²

Rate = Rs. 9500/m²

Total cost = Rs. 9500 × 1500

= Rs. 1,42,50,000

Cost for,

Architectural design } = 1.5% of building cost } = $\frac{1.5}{100}$ × 14250000

= Rs. 213750

Water supply and sanitary } = 5% of building cost } = $\frac{5}{100}$ × 14250000

= Rs. 712500

Electrical installation } = 14% of building cost } = $\frac{14}{100}$ × 14250000

= Rs. 19,95,000

Services = 6% of building cost = $\frac{6}{100}$ × 14250000

= Rs. 8,55,000

Contingencies = 3% of building cost = $\frac{3}{100}$ × 14250000

= Rs. 427500

Supervision = 8% of building cost = $\frac{8}{100}$ × 14250000

= Rs. 11,40,000

Total = 2,34,41,250

(Two crores thirty four lakhs fourty one thousand two hundred fifty only)

2. Estimate the quantities of brickwork and plastering required in a wall 4 m long, 3 m high and 30 cm thick. Calculate also the cost if the rate of brickwork is Rs.320.00 per cu.m and of plastering is Rs.8.50 per sq.m.

Solution:

Quantity of brickwork = L x B x H = 4 x 3 x .30 = 3.6 cu.m

Quantity of plastering = 2 x L x B = 2 x 4 x 3 = 24 sq.m

(Two faces)

Cost of brickwork = 3.6 x 320.00 = Rs.1152.00

Cost of plastering = 24 x 8.50 = Rs.204.00

Total Cost = Rs.1152.00 + Rs.204.00

= Rs.1356.00.

Annual repair estimate:

- ✓ In order to keep building and roads in perfect condition, annual repairs should be carried out as follow: -
- ✓ In case of a building-white washing, painting of doors and windows, cement plaster repairs (inside & outside), repairs of floors etc.
- ✓ In no case this annual repair amount should increase more that 1.5 % to 2 % of the capital cost of the building.
- ✓ In case of a road-filling patches, maintenance of berms etc.

Special repair estimate:

- ✓ If the work cannot be carried out of the annual repair funds due to certain reasons resulting in the genuine increase in cost, then special repairs estimate is to be prepared. The reason of increase may be: -
- ✓ In case of roads-if the whole surface is full of corrugation & patches, then the total surface is to be scarified.
- ✓ The old metal is taken out, consolidation by adding more metal is done and top surface is repainted.

Revised estimate:

- ✓ When the sanctioned estimate exceeds by 5% either due to the rate being found insufficient or due to some other reasons, a fresh estimate is prepared which is called a Revised Estimate.
- ✓ A comparative statement on the last page of the estimate is attached giving there in the reasons of the increase of cost in case of each item.

Supplementary Estimate:

- ✓ This is fresh detailed estimate in addition to the original sanctioned estimate prepared when additional works are deemed necessary during the progress of a work to supplement the original works.
- ✓ The abstract of cost should show the amount of the original sanctioned estimate as well as the supplementary amount of the original sanctioned estimate as well as the supplementary amount for which sanction is required.

METHODS OF CALCULATIONS OF QUANTITIES OF MATERIALS:

The calculations of quantities of materials can be done using various methods of estimates. The application of an individual method depends upon the design and shape of the building. The different methods are as under:

- ✓ Centre line method
- ✓ Crossing method
- ✓ Out to out and in to in method
- ✓ Bay method
- ✓ Service unit method

Centre line method:

- ✓ This method is suitable only if the offsets are symmetrical and the building is more or less rectangular in shape.
- ✓ The centre line of the building is determined carefully after doing deductions for repeated measurements.
- ✓ This centre line acts as length for the complete calculations of the estimate.
- ✓ If the deduction is not cared for the results of estimates may be wrong.
- ✓ All the walls should have the same section.

Crossing Method:

- ✓ In this method, lengths and breadths of the masonry walls at plinth level are taken (internal dimension of the room + thickness of the walls) for calculating quantities.
- ✓ The symmetrical offsets are a must as in the case of centerline method.

Out to out & in to in Method:

- ✓ This method is most practicable under all circumstances and is generally followed in the P.W.D. for computing the quantities of various items.
- ✓ The estimation in this book has been done using this method.