SCHEME : K

Name : _____

Roll No. : _____ Year : 20___ 20___

Exam Seat No. : _____

LABORATORY MANUAL FOR

ESTIMATING , COSTING AND VALUATION (314313)

CIVIL ENGINEERING GROUP

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI
(Autonomous) (ISO 9001: 2015) (ISO/IEC 27001:2013)

VISION:

To ensure that the Diploma level Technical Education constantly matches the latest requirements of Technology and industry and includes the all-round personal development of students including social concerns and to become globally competitive, technology led organization.

MISSION:

To provide high quality technical and managerial manpower, information and consultancy services to the industry and community to enable the industry and community to face the challenging technological & environmental challenges.

QUALITY POLICY:

We, at MSBTE are committed to offer the best in class academic services to the students and institutes to enhance the delight of industry and society. This will be achieved through continual improvement in management practices adopted in the process of curriculum design, development, implementation, evaluation and monitoring system along with adequate faculty development programmes.

CORE VALUES:

MSBTE believes in the following:

- Skill development in line with industry requirements
- Industry readiness and improved employability of Diploma holders
- Synergistic relationship with industry
- Collective and Cooperative development of all stake holders
- Technological interventions in societal development
- Access to uniform quality technical education.

A Laboratory Manual

For

ESTIMATING, COSTING AND VALUATION

(314313)

SEMESER-IV

"K-SCHEME"

(CE/CR/CS/LE)

Maharashtra State

Board of Technical Education, Mumbai.

(Autonomous) (ISO: 9001: 2015) (ISO/IEC 27001:2013)

Maharashtra State Board of Technical Education, Mumbai
(Autonomous) (ISO: 9001: 2015) (ISO/IEC 27001:2013)
4th Floor, Government Polytechnic Building, 49, Kherwadi,
Bandra (East), Mumbai – 400051,
(Printed On _____, 2024)

Maharashtra State
Board of Technical Education, Mumbai.

Certificate

This is to certify that Mr. / Ms. ……..

Roll No……of fourth semester of Diploma in …….....of Institute,……..…… ……(Code:……)has completed the term work satisfactorily in course **Estimating, Costing and Valuation (314313)** for the academic year 20…… to 20…… as prescribed in the curriculum**.**

Place: …… Enrollment No: ……..

Date: …… Exam. Seat No: ……

Subject teacher **Head of Department** **Principal**

Seal of Institution

PREFACE

The development of the critically important industry-relevant abilities and skills is the main goal of any engineering laboratory or field work in the technical education system. In light of this, MSBTE developed the most recent "K" Scheme curricula for engineering diploma programs, emphasizing outcome-based learning. As a result, a sizable portion of the program is dedicated to practical work. This demonstrates how crucial laboratory work is in helping teachers, instructors, and students understand that every minute of lab time must be used efficiently to create these outcomes rather than wasting it on unnecessary activities. Every practical has thus been created to operate as a "vehicle" to help each student acquire this industry-identified capability in order to ensure the effective implementation of this outcome-based curriculum. The "chalk and duster" practice in the classroom is a challenging way to build practical skills. As a result, the development team of the "K" scheme laboratory manual focused on the intended results when creating the practical, as opposed to the customary approach of performing practical's to "verify the theory".

This lab manual is intended to support all parties involved, particularly the students, instructors, and teachers, in helping the students achieve the pre-established goals. It is required of every student to read through the relevant practical process in its entirety and comprehend the bare minimum of theoretical background related to the practical at least one day in advance of the practical. As a crucial starting point for carrying out the practical, each exercise in this handbook starts with establishing the competency, industry-relevant skills, course outcomes, and practical results. After that, the students will learn about the abilities they will acquire through the process outlined there and the safety measures that must be followed, which will enable them to use in addressing real-world situations in their professional life.

This manual also offers guidance to educators on how to manage resources so that students follow protocols and safety measures methodically and meet learning objectives. This allows teachers and instructors to effectively support student-centered lab activities through each practical exercise.

Today's globalized world has witnessed tremendous technological breakthroughs in surveying equipment and technology. Currently available accurate digital surveying tools are employed because of their speed, precision, and ease of use. The disciplines of civil engineering, mining engineering, environmental engineering, transportation engineering, and marine engineering heavily rely on these tools and applications. Given the importance of remote sensing and Geographic Information Systems (GIS) and their widespread usage in mapping and storing spatial data, it is expected that students will have a basic understanding of these subjects in order to use them in the field. Students who complete this course will have the necessary abilities and competences to perform tasks linked to surveys.

Although best possible care has been taken to check for errors (if any) in this laboratory manual, perfection may elude us as this is the first edition of this manual. Any errors and suggestions for improvement are solicited and highly welcome.

Program outcome (POs)

PO 1. Basic & Discipline specific knowledge: Apply knowledge of basic mathematics, sciences and engineering fundamentals and engineering specialization to solve the engineering problems.

PO 2. Problem Analysis: Identify and analyze well defined engineering problems using codified standard methods.

PO 3. Design /Development Solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO 4. Engineering tools experimentation and testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO 5. Engineering practices for society sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

PO 6. Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

PO 7. Lifelong learning: Ability to analyze individual needs and engage in updating in context of technological changes.

List of Relevant Skills

On the successful completion of the course the students will acquire the required industry relevant skills and they will be able to:

1. Read and interpret the given set of drawing.
2. Use appropriate method of estimating.
3. Finding out the various quantities of work for different items.
4. Use the relevant modes of measurements for the given item of work.
5. Analyze the rates of various materials and labor components of the structure.
6. Acquire knowledge of specifications of various types of materials used at construction site.
7. Find out the complete valuation of a constructed building or a purposed building.

Guidelines to teachers

1. Teacher should provide the guideline with demonstration of practical to the students with all features.
2. Teacher shall explain prior concepts to the students before starting of each practical.
3. Involve students in performance of each practical.
4. Teacher should ensure that the respective skills and competencies are developed in the students after the completion of the practical exercise.
5. Teachers should give opportunity to students for hands on experience after the demonstration.
6. Teacher is expected to share the skills and competencies to be developed in the students.
7. Teacher may provide additional knowledge and skills to the students even though not covered in the manual but are expected the students by the industry.
8. Finally give practical assignment and assess the performance of students based on task assigned to check whether it is as per the instructions.

Instructions to Students

1. Organize the work in the group and make record all programs.
2. Students shall develop maintenance skill as expected by industries.
3. Student shall attempt to develop related hand-on skills and gain confidence.
4. Student shall develop the habits of evolving more ideas, innovations, skills etc. those included in scope of manual
5. Student shall refer technical magazines.
6. Student should develop habit to submit the practical on date and time.
7. Student should well prepare while submitting write-up of exercise.
8. Attach /paste separate papers wherever necessary.

Practical Course outcome matrix:

- CO1 - Use the relevant modes of measurements for the given item of work.
- CO2 - Prepare approximate estimate of a civil engineering works.
- CO3 - Prepare detailed estimate of a civil engineering works.
- CO4 - Fix the rate for the given item of work using relevant rate analysis technique.
- CO5 - Conduct the process of the valuation for the specified purpose.

Pr. No.	Title of the Practical	Mapped Course Outcome				
		CO 01	CO 02	CO 03	CO 04	CO 05
01	Prepare the checklist of items from given drawing.	√	--	--	--	--
02	*Analysis of SSR for any five item of construction.	√	--	--	--	--
03	*Prepare approximate estimate by using service unit method.	--	√	--	--	--
04	*Prepare approximate estimate by using Typical bay method.	--	√	--	--	--
05	*Determine the quantities for Excavation, PCC, UCR, DPC of 1BHK load bearing residential building using long wall short wall method. (Part I)	--	--	√	--	--
06	* Determine the quantities for Brick Work, Plastering, flooring, slab of 1BHK load bearing residential building using long wall short wall method. (Part II)	--	--	√	--	--
07	Determine the quantities for Excavation, PCC, UCR, DPC of 1BHK load bearing residential building using Center line method (Part I).	--	--	√	--	--
08	Determine the quantities for Brick Work, Plastering, flooring, slab of 1BHK load bearing residential building using Center line method (Part II).	--	--	√	--	--
09	*Prepare detailed estimate with abstract for RCC (G+1) residential framed structure. (Part I) (Manual)	--	--	√	--	--
10	* Prepare detailed estimate with abstract for RCC (G+1) residential framed structure. (Part II) (Manual)	--	--	√	--	--
11	* Prepare detailed estimate with abstract for RCC (G+1) residential framed structure using relevant available open source Software.	--	--	√	--	--
12	Prepare detailed estimate with abstract for RCC (G+1) residential framed structure using relevant available open source software.	--	--	√	--	--
13	Prepare the bar bending schedule for the footing of given structure.	--	--	√	--	--
14	*Prepare the bar bending schedule for the column of given structure.	--	--	√	--	--
15	Prepare the bar bending schedule for the beam of given structure.	--	--	√	--	--

16	*Prepare the bar bending schedule for the slab of given structure.	--	--	√	--	--
17	Prepare the bar bending schedule for rebaring of beam to be extended.	--	--	√	--	--
18	Prepare the bar bending schedule for rebaring of column to be extended.	--	--	√	--	--
19	*Determine the earth work quantity in embankment and in cutting using mid sectional area method.	--	--	√	--	--
20	Determine the earth work quantity in embankment and in cutting using Prismoidal method.	--	--	√	--	--
21	* Determine the earth work quantity in embankment and in cutting using mid sectional area method.	--	--	√	--	--
22	Determine the earth work quantity in embankment and cutting using mean area method.	--	--	√	--	--
23	Prepare the detailed estimate of W.B.M. Road using relevant open source software (Part I)	--	--	√	--	--
24	Prepare the detailed estimate of W.B.M. Road using relevant open source software (Part II)	--	--	√	--	--
25	Prepare the detailed estimate for small septic tank	--	--	√	--	--
26	*Prepare the rate analysis for the given five items of work.	--	--	--	√	--
27	*Carry out survey and prepare a report on different Categories and types of labor required for completion of various items of work on site. (Visit and compare any three sites).	--	--	--	√	--
28	*Create a chart reflecting all values pertaining to valuation of residential building with their significance.	--	--	--	--	√
29	Prepare the valuation report for the given building.	--	--	--	--	√
30	*Determine the monthly rent of the given area of building from the given data.	--	--	--	--	√

CONTENT PAGE

List of Practical's and Formative Assessment sheet.

	available open source software.						
13	Prepare the bar bending schedule for the footing of given structure.	58					
14	*Prepare the bar bending schedule for the column of given structure.	67					
15	Prepare the bar bending schedule for the beam of given structure.	76					
16	*Prepare the bar bending schedule for the slab of given structure.	85					
17	Prepare the bar bending schedule for rebaring of beam to be extended.	92					
18	Prepare the bar bending schedule for rebaring of column to be extended.	99					
19	*Determine the earth work quantity in embankment and in cutting using mid sectional area method.	106					
20	Determine the earth work quantity in embankment and in cutting using Prismoidal method.	114					
21	* Determine the earth work quantity in embankment and in cutting using mid sectional area method.	123					
22	Determine the earth work quantity in embankment and cutting using mean area method.	131					
23	Prepare the detailed estimate of W.B.M. Road using relevant open source software (Part I)	137					
24	Prepare the detailed estimate of W.B.M. Road using relevant open source software (Part II)	142					
25	Prepare the detailed estimate for small septic tank	147					
26	*Prepare the rate analysis for the given five items of work.	162					
27	*Carry out survey and prepare a report on different Categories and types of labor required for completion of various items of work on site. (Visit and compare any three sites).	181					
28	*Create a chart reflecting all values pertaining to valuation of residential building with their significance.	191					
29	Prepare the valuation report for the given building.	197					

30	*Determine the monthly rent of the given area of building from the given data.	206					
Total Marks:-							

These marks are to be transferred in pro-forma published by MSBTE.

- '*' Marked Practical (LLOs) are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

Practical No: 01 **Prepare the checklist of items from given drawing.**

I. Practical Significance:

Checklists are great tools that can be used to optimize the way you organize your construction project in many ways. In order to successfully manage a construction project, you must track and organize the tasks and activities involved in managing them correctly and on time.

II. Industry/Employer expected outcome(s):

- Identify the different materials with their cost which is required at given construction site.

III. Course Level Learning Outcome (COs):

CO1 - Use the relevant modes of measurements for the given item of work.

IV. Laboratory Learning Outcome (LLO):

- LLO 1.1 Prepare the check list of items to be executed with market rates and units for detailed estimate of the given structure from the given drawing.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- Measurement of an item is based on the Principle of units
  The unit of different work is depends on their nature, size & shape. In general, the unit of different Items of work is based on the following principle.
  i) Mass, Voluminous and thick works shall be taken in cubic unit or volume. The measurements of length, breadth and height or depth shall be taken to compute the volume or cubic contents.
  ii) Shallow, thin & surface works shall be taken in square units or in area. The measurement of length and breadth or height shall be compute to the area.
  iii) Long and thin work shall be taken in linear or running unit, and linear measurement shall be taken.
  iv) Piece work, job work, etc. shall be taken in number.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawings	Load Bearing or Framed Structure (1BHK)	01

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper identification of materials with their units.
3. Tools and equipment's used on site.

IX. Procedure:

1. **Review the Drawing**: Thoroughly examine the provided drawing to understand the scope of work and the various elements involved.
2. **Identify Sections and Views**: Identify all the sections, views, and details in the drawing to ensure you cover every aspect of the project.
3. **List Major Components**: Note down the major components and structures, such as foundations, walls, roofs, windows, doors, etc.
4. **Break down Components**: Break down each major component into smaller tasks. For example, for a wall, you might have tasks like excavation, brickwork, plastering, and painting.
5. **Sequence of Work**: Arrange the tasks in the logical sequence of execution to ensure a smooth workflow.
6. **Create the Checklist**: Compile all the identified items into a structured checklist. This can be organized by categories such as foundation, structural work, finishing, etc.
7. **Review and Verify**: Double-check the checklist against the drawing to ensure all items are included and there are no omissions.

X. Observation Table:

Sr.No.	Particular of Item	Unit of measurement

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:
Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the importance of checklist?
2. State the general rules of fixing the units of measurement of items of works?
3. Explain the Modes of Measurements.
4. Prepare Checklist for residential building of G+1 RCC structure.

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Interpretation of drawing	40%
2.	Individual/Team work to prepare checklist	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 02 ***Analysis of SSR for any five item of construction.**

I. Practical Significance:

The purpose of a Schedule of Rates is to provide a standard pricing of a structure for similar work across different projects at various situations. This ensures that all parties involved in the tender process know and agree on the price to be paid for any type of work.

II. Industry/Employer expected outcome(s):

- Identify the different types of materials/labour with their specification and cost which is required at given construction site.

III. Course Level Learning Outcome (COs):

- CO1 - Use the relevant modes of measurements for the given item of work.

IV. Laboratory Learning Outcome (LLO):

- LLO 2.1 Analyze the SSR of into relevant categories and subcategories of construction activities.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- The Schedule of Rates (SSR) is a book that shows the printing rates for various projects, activities, etc. in different regions. These rates are subject to availability of local resources and services. For government contracts the SSR rate should be used. SSR rates are updated annually.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Schedule of Rates	-----	01

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper identification of material.
3. Tools and equipment's used on site.

IX. Procedure:

1. **Identify the Items**: - Select the five construction items you want to analyze.
2. **Collect/Refer the SSR or DSR by any mode. (Online/Offline)**:- Obtain the latest Schedule of Rates from the relevant authority or organization. The SSR provides the standard rates for various construction activities.
3. **Item Specifications:-** Following are some of the examples
   - **Cement Concrete (1:2:4) Mix:** Determine the quantity of cement, sand, and aggregate required per cubic meter.

- **Brick Masonry in Cement Mortar (1:6):** Calculate the number of bricks, cement, and sand required per cubic meter.
- **Reinforced Cement Concrete (RCC) Work:** Assess the amount of cement, sand, aggregate, and steel reinforcement required per cubic meter.
- **Plastering with Cement Mortar (1:4):** Measure the amount of cement and sand needed per square meter.
- **Structural Steel Work:** Quantify the steel sections and welding or bolting materials required.

4. **Breakdown of Costs: -** For each item, break down the costs into the following components:
   - **Material Cost:** Cost of raw materials such as cement, sand, aggregate, bricks, steel, etc.
   - **Labor Cost:** Wages for the labor involved in carrying out the construction activity.
   - **Equipment and Tools:** Cost of any machinery or tools required.
   - **Overheads:** Administrative and miscellaneous costs.
   - **Profit Margin:** The contractor's profit percentage.
5. Write the standard specification of the material from the SSR or DSR

X. Observation Table:

Sr.No.	Description	Unit	Rate (RS)	
			Complete	Labour

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the importance of DSR/SSR?
2. State the purpose of using DSR/SSR.
3. Justify your answer why every year DSR is updated?
4. State the different types of Specification.
5. Explain in brief Standard specification

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Interpretation of nature of work	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 03 *** Prepare approximate estimate by using Service Unit Method.**

I. Practical Significance:

- To produce a forecast of the probable cost of a future project, before the structure has been designed in detail and contract details are established.

II. Industry/Employer expected outcome(s):

- Prepare an approximate estimate for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO2 - Prepare approximate estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 3.1 Prepare the approximate estimate for the given civil engineering works. (Service unit method)

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- **Approximate / Preliminary Estimate: -** It is rough estimate prepared to know the approximate cost of work in short time. In this type of estimate, estimate is prepared on the basis of actual cost of similar existing structure. The various factors of comparison may be cubic content, per capita, per km, service unit etc. these are useful to know the cost at initial stages to decide the feasibility of work. To prepare approximate estimate less skill & time is required.
- **Purposes: -** **1.** To know the feasibility of project.
  2. To know project duration.
  3. To obtain administrative approval.
  4. For insurance & tax schedule.
  5. For planning the project.
  6. To know benefit cost ratio.
- **Methods:-** 1) Plinth area method
  2) Cubical Contents Method
  3) Service unit method
  4) Typical Bay Method
  5) Approximate quantities method
- **Service unit method:-**In this method all costs of a unit quantity such as per km for a highway, per meter span for a bridge, per classroom for school building, per bed for hospital, per litre for water tanks, per seat for cinema hall etc. are considered first and approximate cost is prepared by multiplying the cost per service unit by the number of units in the structure.

Approximate estimate = Number of service units X Cost per service unit.

This estimate can be prepared quickly, but it requires records of the unit current rates for similar designed structures having the same specifications at that locality.

Applications: - Buildings; Irrigation Projects; Roads & Highways; Sewerage project & water supply project; Over Head water tank; Preparation of Approximate estimate of Multi span bridge; Approximate Estimate of Percolation Tank; Approximate Estimate of Railway Project

VII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation.

VIII. Procedure:-

1. Define the Project Scope:

- Clearly understand the scope and requirements of the project.
- Identify the type of service unit applicable to the project (e.g., per square foot, per bed for a hospital, per student for a school, etc.).

2. Determine the Service Unit:

- Choose an appropriate service unit that represents the project. For instance, if estimating a school building, the service unit might be the number of students.

3. **Obtain Unit Cost Data:**

- Collect historical cost data or industry-standard unit costs for similar projects. This data should include all necessary components, such as materials, labor, equipment, and overhead costs.

4. **Calculate the Total Number of Service Units:**

- Estimate the total number of service units required for the project. For example, if building a school for 500 students, the service unit is 500.

5. **Compute the Basic Cost:**

- Multiply the total number of service units by the unit cost.

  Basic Cost=Total Number of Service Units x Unit Cost

6. Adjust for Additional Factors:

- Include adjustments for location, inflation, project complexity, and any other specific conditions that might affect costs. These can be added as a percentage of the basic cost.

7. **Include Contingencies:**

- Add a contingency amount to cover unforeseen expenses. This is usually a percentage of the total estimated cost.

8. Review and Validate:

- Review the estimate for accuracy and completeness.

- Validate the estimate with historical data or benchmark it against similar projects to ensure it is reasonable.

9. **Documentation:**

- Document all assumptions, calculations, and sources of data used in the estimate.

Q.1) A cinema hall building is proposed to be constructed for 1180 seat capacity of viewers. If the cost of similar buildings is Rs. 35,780/- per seat. Calculate the cost of project.

Q.2) A hospital building is proposed to be constructed for 200 bed capacity. If cost of similar building is Rs. 40,000. Calculate approximate cost of building project by service unit method.

Q.3) The cost of construction of college building is 3 crores for the capacity of 600 students and area of construction about 2500 m^2 . Prepare approximate estimate of a new proposed college building for 3500 students with the area 14000 m^2. Use service unit method

IX. Result:

X. Practical Question Answers:

XI. Conclusions:

XII. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the service unit method?
2. Explain how will you determine the service unit for a project?
3. State steps involved in preparing an estimate using the service unit method?
4. State the information which is needed to prepare an estimate using the service unit method?

Space for Answer

XII. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating Cost	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 04 *** Prepare approximate estimate by using Typical Bay Method.**

I. Practical Significance:

- To produce a forecast of the probable cost of a future project, before the structure has been designed in detail and contract details are established.

II. Industry/Employer expected outcome(s):

- Prepare an approximate estimate for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO2 - Prepare approximate estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 4.1 Prepare the approximate estimate for the given civil engineering works. (Typical bay method)

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- **Approximate / Preliminary Estimate: -** It is rough estimate prepared to know the approximate cost of work in short time. In this type of estimate, estimate is prepared on the basis of actual cost of similar existing structure. The various factors of comparison may be cubic content, per capita, per km, service unit etc. these are useful to know the cost at initial stages to decide the feasibility of work. To prepare approximate estimate less skill & time is required.
- **Purposes: -** **1.** To know the feasibility of project.
  2. To know project duration.
  3. To obtain administrative approval.
  4. For insurance & tax schedule.
  5. For planning the project.
  6. To know benefit cost ratio.
- **Methods:-** 1) Plinth area method
  2) Cubical Contents Method
  3) Service unit method
  4) Typical Bay Method
  5) Approximate quantities method

  Typical Bay Method:-Bay is a centre to centre distance between the supports. When the area of a structure consists of similar parts such as a go-down, a railway platform, factory shades, etc. which are constructed with intermediate columns or with roof trusses on wall placed at equal distances forming bays.

Approximate cost = Number of bays X Cost of one bays

VII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation or calculating the cost of work.

VIII. Procedure:

1. **Identify Scope**: Clearly define the scope of the project or item you are estimating. This includes understanding the size, complexity, and specific requirements.
2. **Select Typical Bays**: Identify typical components or sections (bays) of the project that are representative and recurring. For example, in a building, typical bays could be standard floors or rooms.
3. **Determine Unit Cost**: Establish the unit cost for each typical bay. This can be based on historical data, industry benchmarks, or previous similar projects.
4. **Calculate Quantities**: Determine the quantity of each typical bay required for the entire project based on the scope defined in step 1.
5. **Multiply and Sum**: Multiply the unit cost of each typical bay by its quantity, then sum these values to obtain the total estimated cost for the project.

Q.1) Prepare approximation estimate of a factory building from following data:-

a) Office premises – R.C.C framed type (Total area 120 m^2built up.)

b) Workshop – 3 bays of size 4 X 8 m with load bearing walls & A.C. sheet roof.

c) Plinth area rates: - i) R.C.C building – Rs. 6500/ m^2

ii)Load bearing building – Rs. 4000/ m^2

Q.2) Prepare the approximate estimate of a bridge having 4 spans of 42 m each using following data. Cost of existing bridge is Rs. 1.5 Cr. Existing bridge having 3.3 spans of 50 m each.

Q.3) Prepare approximate estimate of building using following data:-

i) Proposed built up area of the building is 135 m^2.

ii) Similar type of structure is constructed with built up area 105 m^2& the total cost of construction is Rs. 9,95,000/- in nearby area last year.

iii) 10% increase in rate is observed in last 12 months.

Q.4) Calculate approximate estimate from following data for a school building:-

i) Number of classroom – 10

ii) Area of each classroom – 40m^2

iii) Area of other facilities – 100 m^2

Similar school building having same specifications & having built up area of 700m^2 was constructed in year 2010 at Rs. 63 lakhs.

IX. Result:

X. Practical Question Answers:

XI. Conclusions:

XII. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the necessity of typical bay methods?
2. Define approximate estimate and also state its methods?
3. State the under which situations typical bay method is used.
4. State the importance of approximate estimate

Space for Answer

XI. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating cost	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 05 *** Determine the quantities for Excavation, PCC, UCR, DPC of 1BHK load bearing residential building using long wall short wall method. (Part I)**

I. Practical Significance:

- Detailed estimate plays a vital role in preparing estimate. Estimate is prepared on the basis of finding out the quantities of a structure which will help to prepare the bill of quantities. Through this we are getting the clear idea about how much quantity of material is required for the construction work.

II. Industry/Employer expected outcome(s):

- Evaluate the quantities for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO3 - Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 5.1 Use long wall short wall method to determine the quantity of items of work (Excavation, PCC, UCR, DPC) using standard measurement sheet for 1BHK load bearing residential Building (Part-I).

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- **Detailed Estimate**: -Detailed estimate is an accurate estimate and consists of working out the quantities of each item of work. The dimensions, length, breadth and height of each item are taken out correctly from drawing and quantities of each item are calculate, and abstracting and billing are done. All other expenses required for satisfactory completion of project are added to the above cost to know the total cost of the detailed estimate.

- **Purposes: - 1.** Technical sanction.
  2. Administrative approval.
  3. The execution of a contract with the contractor.
  4. Framing & inviting tenders.
  5. Accurate idea of cost of construction.
  6. Material required.
  7. Labours required.
  8. Project duration

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawings (Plan and wall section)	Load Bearing or Framed Structure (1BHK)	01(For batch of 5 student)

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation.

IX Procedure:-

PWD method is also called as Long wall and short wall or “out-to-out” and “in-to-in” method. For the accurate estimate the dimensions, length, breadth and height or depth are taken out correctly from drawings. Then the following steps are followed

1) Draw the center line plan.

2) Consider wall spanning in horizontal direction as “long wall” and vertical direction as “short wall” in plan or vice versa.

3) Calculate the center to center lengths of long wall and short wall

4) Calculate length of “long wall” out to out

Length of long wall = c/c length of long wall + width of item

5) Calculate length of “short wall” in to in

Length of short wall = c/c length of short wall - width of item

6) Multiply the length by the width and depth to find the quantity (as per unit of measurement given in IS1200).

Length of long wall (L) = C/C length + B/2 + B/2

Length of short wall (S) = C/C length - B/2 - B/2

B= width of item.

7) Prepare a measurement sheet as per IS 1200 and put the quantities in it.

Space for drawing Centre line plan (Not to the scale)

X Observation Table:-

Sr. No.	Particulars of item	No	Length (L) In M	Width/Breadth (W/B) In M	Height/Depth (H/D) In M	Quantity	Total Quantity

(Note: - Above is the sample format of measurement sheet. Students are to be ask to attached separate measurement sheet for calculating the quantities)

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Define estimate?
2. Define detailed estimate and also state its methods?
3. Differentiate between unit quantity method and quantity method.
4. State the data required for preparing detailed estimate.
5. State the steps in preparation of detailed estimate

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantities	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 06 *** Determine the quantities for Brick Work, Plastering, flooring, slab of 1BHK load bearing residential building using long wall short wall method. (Part II)**

I. Practical Significance:

- Detailed estimate plays a vital role in preparing estimate. Estimate is prepared on the basis of finding out the quantities of a structure which will help to prepare the bill of quantities. Through this we are getting the clear idea about how much quantity of material is required for the construction work.

II. Industry/Employer expected outcome(s):

- Evaluate the quantities for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO3 - Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 6.1 Use long wall short wall method to determine the quantity of items of work (Brick Work, Plastering, flooring, slab) using standard measurement sheet for 1BHK load bearing residential Building. (Part-II).

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- **Detailed Estimate**: -Detailed estimate is an accurate estimate and consists of working out the quantities of each item of work. The dimensions, length, breadth and height of each item are taken out correctly from drawing and quantities of each item are calculate, and abstracting and billing are done. All other expenses required for satisfactory completion of project are added to the above cost to know the total cost of the detailed estimate.

- **Purposes: - 1.** Technical sanction.

  2. Administrative approval.

  3. The execution of a contract with the contractor.

  4. Framing & inviting tenders.

  5. Accurate idea of cost of construction.

  6. Material required.

  7. Labours required.

  8. Project duration

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawings (Plan and wall section)	Load Bearing or Framed Structure (1BHK)	01(For batch of 5 student)

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation.

IX Procedure:-

PWD method is also called as Long wall and short wall or "out-to-out" and "in-to-in" method. For the accurate estimate the dimensions, length, breadth and height or depth are taken out correctly from drawings. Then the following steps are followed

1) Draw the center line plan.

2) Consider wall spanning in horizontal direction as "long wall" and vertical direction as "short wall" in plan or vice versa.

3) Calculate the center to center lengths of long wall and short wall

4) Calculate length of "long wall" out to out

Length of long wall = c/c length of long wall + width of item

5) Calculate length of "short wall" in to in

Length of short wall = c/c length of short wall - width of item

6) Multiply the length by the width and depth to find the quantity (as per unit of measurement given in IS1200).

Length of long wall (L) = C/C length + B/2 + B/2

Length of short wall (S) = C/C length - B/2 - B/2

B= width of item.

7) Prepare a measurement sheet as per IS 1200 and put the quantities in it.

Space for drawing Centre line plan (Not to the scale)

X Observation Table:-

Sr. No.	Particular of item	No	Length (L) in M	Width/Breadth (W/B) in M	Height/Depth (H/D) in M	Unit	Quantity

(Note: - Above is the sample format of measurement sheet. Students are to be ask to attached separate measurement sheet for calculating the quantities)

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Explain how do you calculate the length of long walls and short walls?
2. State the materials which are typically quantified using this method?
3. Explain how the quantity of bricks or blocks is calculated using this method?
4. State the steps involved in using the long wall short wall method for quantity estimation?
5. Explain how does this method help in cost estimation and planning?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantities	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 07 **Determine the quantities for Excavation, PCC, UCR, DPC of 1BHK load bearing residential building using Center line method (Part I).**

I. Practical Significance:

- Detailed estimate plays a vital role in preparing estimate. Estimate is prepared on the basis of finding out the quantities of a structure which will help to prepare the bill of quantities. Through this we are getting the clear idea about how much quantity of material is required for the construction work.

II. Industry/Employer expected outcome(s):

- Evaluate the quantities for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO3 - Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 7.1 Use center line method to determine the quantity of items of work (Excavation, PCC, UCR, DPC) using standard measurement sheet for 1BHK load bearing residential Building (Part-I).

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- **Detailed Estimate**: -Detailed estimate is an accurate estimate and consists of working out the quantities of each item of work. The dimensions, length, breadth and height of each item are taken out correctly from drawing and quantities of each item are calculate, and abstracting and billing are done. All other expenses required for satisfactory completion of project are added to the above cost to know the total cost of the detailed estimate.

- **Purposes: - 1.** Technical sanction.

  2. Administrative approval.

  3. The execution of a contract with the contractor.

  4. Framing & inviting tenders.

  5. Accurate idea of cost of construction.

  6. Material required.

  7. Labours required.

  8. Project duration

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawings (Plan and wall section)	Load Bearing or Framed Structure (1BHK)	01(For batch of 5 student)

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation.

IX Procedure:-

Centre Line Method of Calculation of Earthwork.

1. In centre line method sum of total length of centre line of walls, long wall and short walls has to be found out.

2. In this method the Total Centre line length is calculated by subtracting the Centre line length by ½ x number of junction(Tee junctions or Cross Junctions x Width of required Item.

3. Total Centre Line Length = (Centre Line Length – ½ X Number of Junction x Width of that Item)

4. This method is quick but required special attention at junction, meeting points of partition or cross walls.

5. For rectangular, circular, polygonal building having no cross walls, this method is simple.

6. For building having cross or partition walls for every junction or partition or cross walls with main wall special consideration shall have to be made to calculate the correct quantity.

7) Prepare a measurement sheet and put the quantities in it.

Space for drawing Centre line plan (Not to the scale)

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X Observation Table:-

Sr. No.	Particulars of item	No	Length (L) In M	Width/Breadth (W/B) In M	Height/Depth (H/D) In M	Quantity	Total Quantity

(Note: - Above is the sample format of measurement sheet. Students are to be ask to attached separate measurement sheet for calculating the quantities)

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Define detailed estimate and also state its methods?
2. State the importance of preparing the detailed estimate.
3. State the steps in preparation of detailed estimate
4. Explain how you will ensure the accuracy when you are applying the center line method?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantities	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 08 **Determine the quantities for Brick Work, Plastering, flooring, slab of 1BHK load bearing residential building using Center line method (Part II).**

I. Practical Significance:

- Detailed estimate plays a vital role in preparing estimate. Estimate is prepared on the basis of finding out the quantities of a structure which will help to prepare the bill of quantities. Through this we are getting the clear idea about how much quantity of material is required for the construction work.

II. Industry/Employer expected outcome(s):

- Evaluate the quantities for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO3 - Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 8.1 Use centre line method to determine the quantity of items of work (Brick Work, Plastering, flooring, slab) using standard measurement sheet for 1BHK load bearing residential Building (Part-II).

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- **Detailed Estimate**: -Detailed estimate is an accurate estimate and consists of working out the quantities of each item of work. The dimensions, length, breadth and height of each item are taken out correctly from drawing and quantities of each item are calculate, and abstracting and billing are done. All other expenses required for satisfactory completion of project are added to the above cost to know the total cost of the detailed estimate.

- **Purposes: - 1.** Technical sanction.

  2. Administrative approval.

  3. The execution of a contract with the contractor.

  4. Framing & inviting tenders.

  5. Accurate idea of cost of construction.

  6. Material required.

  7. Labours required.

  8. Project duration

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawings (Plan and wall section)	Load Bearing or Framed Structure (1BHK)	01(For batch of 5 student)

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation.

IX Procedure:-

Centre Line Method of Calculation of Earthwork.

1. In centre line method sum of total length of centre line of walls, long wall and short walls has to be found out.

2. In this method the Total Centre line length is calculated by subtracting the Centre line length by ½ x number of junction(Tee junctions or Cross Junctions x Width of required Item.

3. Total Centre Line Length = (Centre Line Length – ½ X Number of Junction x Width of that Item)

4. This method is quick but required special attention at junction, meeting points of partition or cross walls.

5. For rectangular, circular, polygonal building having no cross walls, this method is simple.

6. For building having cross or partition walls for every junction or partition or cross walls with main wall special consideration shall have to be made to calculate the correct quantity.

7) Prepare a measurement sheet and put the quantities in it.

Space for drawing Centre line plan (Not to the scale)

X Observation Table:-

Sr. No.	Particular of item	No	Length (L) In M	Width/Breadth (W/B) In M	Height/Depth (H/D) In M	Unit	Quantity

(Note: - Above is the sample format of measurement sheet. Students are to be ask to attached separate measurement sheet for calculating the quantities)

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Define the center line method?
2. Explain how you will calculate quantities using the center line method?
3. State the advantages of using the center line method?
4. State the quantities which are typically calculated using this method?
5. Are there any specific considerations or adjustments needed when using this method?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantities	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 09 *** Prepare detailed estimate with abstract for RCC (G+1) residential framed structure. (Part I and II)**

I. Practical Significance:

- Detailed estimate plays a vital role in preparing estimate. Estimate is prepared on the basis of finding out the quantities of a structure which will help to prepare the bill of quantities. Through this we are getting the clear idea about how much quantity of material is required for the construction work. This kind of estimate also gives the idea about how much cost will be required to build the structure.

II. Industry/Employer expected outcome(s):

- Calculating the cost for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO3 - Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 8.1 Prepare the detailed estimate for RCC (G+1) residential framed structure from the given drawing. (Part-I and II)

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- **Detailed Estimate**: -Detailed estimate is an accurate estimate and consists of working out the quantities of each item of work. The dimensions, length, breadth and height of each item are taken out correctly from drawing and quantities of each item are calculate, and abstracting and billing are done. All other expenses required for satisfactory completion of project are added to the above cost to know the total cost of the detailed estimate.

- **Purposes: - 1.** Technical sanction.
  2. Administrative approval.
  3. The execution of a contract with the contractor.
  4. Framing & inviting tenders.
  5. Accurate idea of cost of construction.
  6. Material required.
  7. Labours required.
  8. Project duration

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Collect drawing of G+1 framed structure.	Framed Structure (1BHK)	01(For batch of 5 student)

VIII. Precautions to be followed:

- Ensure all calculations are double-checked for accuracy and consistency.
- Use local market rates and standards for materials and labor.

IX Procedure:-

1. For a group of 4 to 5 students subject teacher should provide the drawings.
2. **Detailed Drawings Review:-**
   - **Architectural Drawings:** Study plans, elevations, and sections for room sizes, openings, and architectural features.
   - **Structural Drawings:** Analyze reinforcement details, column grid, beam layout, slab thickness, etc.
3. **Quantity Takeoff**
   - **Material Quantities:** Calculate quantities of cement, aggregates, steel reinforcement, formwork materials, etc.
   - **Labour Quantities:** Estimate labor hours for excavation, reinforcement fixing, concreting, etc.
4. **Rate Analysis**
   - **Material Rates:** Gather current rates for cement, steel, aggregates, formwork materials, etc.
   - **Labor Rates:** Determine hourly wages or contractor rates for skilled and unskilled labor.
5. **Abstract Preparation:-**
   - **Abstract of Cost:** Compile a detailed abstract showing quantities, rates, and costs for each component (foundation, columns, beams, slabs, etc.).
   - **Unit Rates:** Calculate unit rates (per cubic meter or square meter) for each structural element.
6. **Estimation Calculation**
   - **Direct Costs:** Calculate direct costs (material and labor) for each component using quantity and rate data.
   - **Indirect Costs:** Include overheads, contingencies, taxes, and profit margins as applicable.
7. **Contingency and Markup**
   - **Contingency:** Allocate a percentage (typically 5-10%) for unforeseen expenses.
   - **Markup:** Add a profit margin (usually 10-15%) to the total estimated cost.
8. **Final Documentation**
   - **Detailed Estimate:** Prepare a document detailing all calculations, assumptions, and methodologies used.
   - **Abstract Report:** Present the abstract of cost in a tabular format, summarizing costs by structural element.

X Observation Table:-

a) Measurement sheet:-

Sr. No.	Particulars of item	No	Length (L) In Meter	Width/Breadth (W/B) In Meter	Height/Depth (H/D) In Meter	Quantity	Total Quantity

b) Abstract Sheet:-

Sr. No. / Item Code	Description of items	Quantity	Unit	Rate for (in Rs.)	
				Completed	Labour

c) Face Sheet :-

S.N.	Particulars	Amount
1.	Estimated cost	Rs……..
2.	Water supply & sanitary charges @____ % (8%)	Rs……..
3.	Electrification charges @____ % (8%)	Rs……..
4.	Contingencies @____ % (3 to 5%)	Rs……..
5.	Work charged establishment @____ % (1 to 2%)	Rs……..
	Total amount	Rs……..
	In words …….	

(Note: - Above is the sample format of measurement sheet, abstract sheet and face sheet. Students are to be ask to attach separate abstract sheet for calculating the cost).

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Draw the standard format of Measurement sheet, abstract sheet and face sheet.
2. State the role of an estimator while preparing detailed estimate.
3. State the necessity of face sheet.
4. Justify your answer- have any price fluctuations or seasonal variations been considered?
5. Explain who is responsible for reviewing and approving the estimate before construction begins?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating cost	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 10 *** Prepare detailed estimate with abstract for RCC (G+1) residential framed structure using relevant available open source Software.**

I. Practical Significance:

- Detailed estimate plays a vital role in preparing estimate. Estimate is prepared on the basis of finding out the quantities of a structure which will help to prepare the bill of quantities. Through this we are getting the clear idea about how much quantity of material is required for the construction work. This kind of estimate also gives the idea about how much cost will be required to build the structure.

II. Industry/Employer expected outcome(s):

- Calculating the cost for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO3 - Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 11.1 Use the relevant open source software to prepare the detailed estimate for RCC (G+1) residential framed structure from the given drawing. (Part-I and II)

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- **Detailed Estimate**: -Detailed estimate is an accurate estimate and consists of working out the quantities of each item of work. The dimensions, length, breadth and height of each item are taken out correctly from drawing and quantities of each item are calculate, and abstracting and billing are done. All other expenses required for satisfactory completion of project are added to the above cost to know the total cost of the detailed estimate.

- **Purposes: - 1.** Technical sanction.

  2. Administrative approval.

  3. The execution of a contract with the contractor.

  4. Framing & inviting tenders.

  5. Accurate idea of cost of construction.

  6. Material required.

  7. Labours required.

  8. Project duration

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Collect drawing of G+1 framed structure.	Framed Structure (1BHK)	01(For batch of 5 student)

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation.
3. Appropriate software should be used

IX Procedure: -

1. Quantities which are calculated in the Practical-09 should be used.
2. Put the above quantities with their cost in any one free software which you're going to use.
3. Take proper precautions while putting the data in the software.
4. Analyze the software.

X Observation Table:-

It should be based on the free software which the student will used.

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. List out the various types of software's used for calculating the quantities and cost.
2. State the precautions while entering the data in the software.
3. State the open-source software are you planning to use (e.g., Free CAD, Sweet Home 3D, etc.)?
4. Have you explored the software's capabilities for estimating material quantities, costs, and generating abstracts?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating cost	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
4.	Practical Question Answer	20%
5.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 11 **Prepare the bar bending schedule for the footing of given structure.**

I. Practical Significance:

- Bar bending schedule makes it easy for the site engineers to check and accept the length of the bent and cut bars during an inspection before the concrete is to be poured. It also helps with better quality control at the construction site. It makes it easy and quick for customers and contractors to produce bills for construction work.

II. Industry/Employer expected outcome(s):

- Calculating the quantity of steel required for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO3 - Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 13.1 Calculate the reinforcement quantities for footing of a room size for 4 m X 5 m from the given set of drawings.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- A bar bending schedule is a tabular format of showing the reinforcing bars that includes details such as bar type, total length, weight, and a drawing of the desired bending shape. A bar bending schedule is established for every different kind of RCC work. During the construction process, the BBS can be used to determine the need for bars of various widths and lengths, and the bars can be positioned and bent as per these specifications. Details like as bar size and type, bending shape, number of bars in a sets or individual bars, bar length (in running metres), total length, and total weight are provided.
- **Calculation involving Bar Bending Schedule in construction:-**

  (a) Length of one hook = (4d) + [(4d+ d)] – where, (4d+ d) refers to the curved portion = 9d.

  (b) The additional length (la) that is introduced in the simple, straight end to end length of a reinforcement bar due to being bent up at say 30° to 60°, but it is generally 45° $=l_1-l_2=$ la

  Where,

  $(D/l_2)= \tan\theta$ & $(D/l_1) = \sin\theta$

  Therefore, the additional length = $(D/\sin\theta) – (D/\tan\theta)$

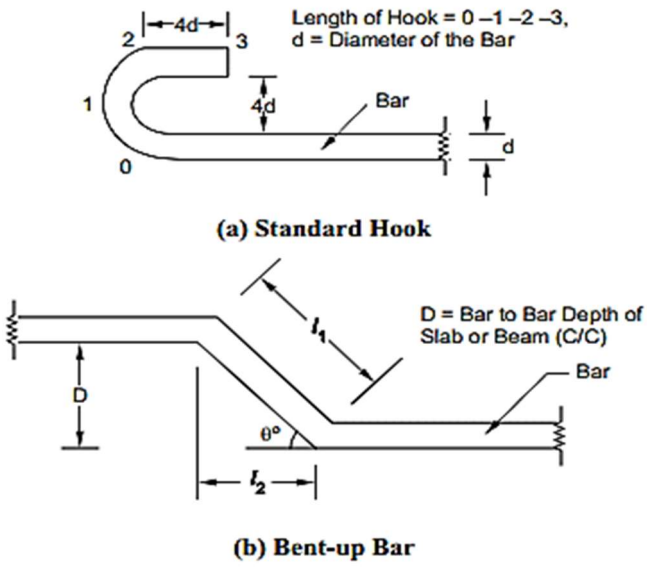


Fig: Hooks & bends in Reinforcement

Giving different values to Θ (=30°,45° & 60° respectively), we get different values of la, as tabulated below:-

S.N.	Θ°	(D/ sinΘ)	(D/ tanΘ)	Additional length of Bent-up Bar, la
1	30°	D/0.5	D/0.5733	0.27D
2	45°	D/0.707	D/1.0	0.414D = 0.42D(0.42D is generally the value that is adopted)
3	60°	D/0.866	D/1.732	0.577D = 0.58D(0.58D is usually adopted)

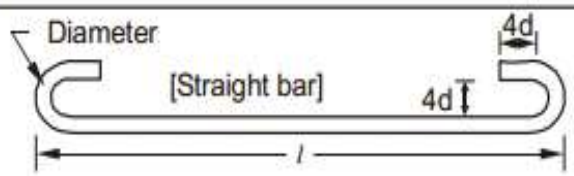
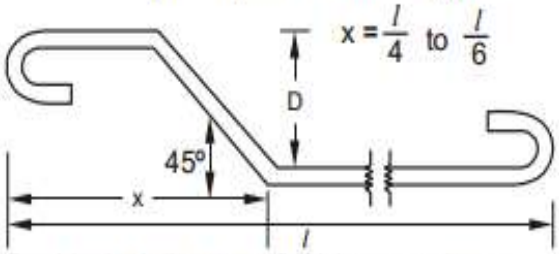
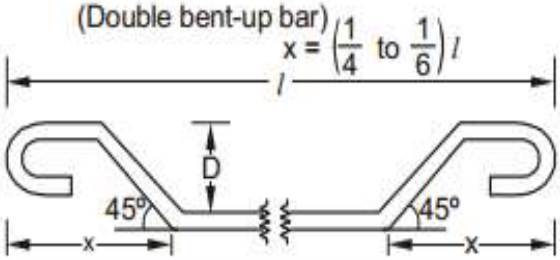
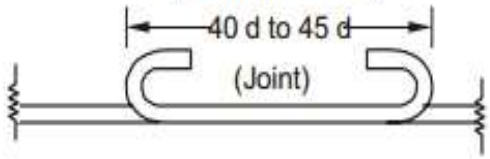
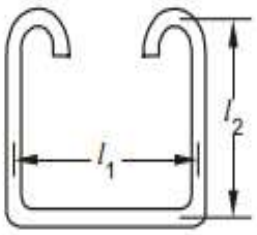
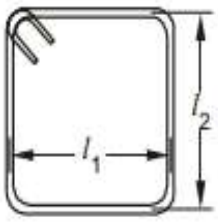
Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.		2[9d] = 18 d (both hooks together)	[l + 18 d]
2.	[Bent-up at one end only]]  D = Vertical distance (C/C) between bars	2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.	(Double bent-up bar) 	2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.	(Overlap of bars) 	2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.		[Here, one hooks height = 14d] 2 × (14d) = 28 d	$[l_1 + 2l_2 + 28\ d]$
6.		2(12d) = 24 d	$[2(l_1 + l_2) + 24\ d]$

Figure presents the procedure to arrive at the length of hooks & the total length of a given steel reinforcement

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawings of footing Plan and Section	-----	01(For batch of 5 student)

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation.

IX Procedure:-

1. Draw Footing Plan and Section
2. **Understand the Design Requirements:**
   - Review the structural drawings and footing design specifications to understand the dimensions, reinforcement details.
3. **Calculate Reinforcement Quantities:**
   - Determine the dimensions (length, width, depth) of the footing.
   - Calculate the required reinforcement quantities (steel bars) based on design requirements (e.g., steel percentage, bar diameters specified in the design).
4. **Prepare Bar Bending Schedule (BBS):**
   - List down each type and size of reinforcement bars required (diameter, number of bars, length).
   - Specify the bending shapes and dimensions (bend lengths, hooks, lap lengths) as per design drawings and standards.
   - Arrange bars in a systematic manner to facilitate construction and minimize wastage.
5. **Estimate Reinforcement Material:**
   - Calculate the total length of each type of reinforcement bar required.
   - Estimate the quantity of steel reinforcement (in metric tons or kilograms) needed for the footing based on the calculated lengths and densities of steel bars.
6. **Weight of bar:** After calculating the total no of steel bar and total cutting length of steel bar multiplying these with the unit of steel bar to calculate the weight of steel bar.
7. Finally, the diameter wise weight of bar required for given RCC work will be achieved.
8. **Check and Review:**
   - Verify the BBS against design drawings to ensure all design requirements are met.
   - Double-check calculations for reinforcement quantities and ensure they align with structural design specifications.

Draw Footing Plan and Section

Calculation of lengths

Bar Bending Schedule:-

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the importance of bar bending schedule?
2. Draw the format of bar bending schedule.
3. Draw various types of bars?
4. Explain how you will be going to calculate anchorage length of bar in footing.

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantity of steel	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 12 ***Prepare the bar bending schedule for the column of given structure.**

I. Practical Significance:

- Bar bending schedule makes it easy for the site engineers to check and accept the length of the bent and cut bars during an inspection before the concrete is to be poured. It also helps with better quality control at the construction site. It makes it easy and quick for customers and contractors to produce bills for construction work.

II. Industry/Employer expected outcome(s):

- Calculating the quantity of steel required for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO3 - Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 14.1 Calculate the reinforcement quantities for column of a room size for 4 m X 5 m from the given set of drawings.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- A bar bending schedule is a tabular format of showing the reinforcing bars that includes details such as bar type, total length, weight, and a drawing of the desired bending shape. A bar bending schedule is established for every different kind of RCC work. During the construction process, the BBS can be used to determine the need for bars of various widths and lengths, and the bars can be positioned and bent as per these specifications. Details like as bar size and type, bending shape, number of bars in a sets or individual bars, bar length (in running metres), total length, and total weight are provided.
- **Calculation involving BBS in construction:-**

  (c) Length of one hook = (4d) + [(4d+ d)] – where, (4d+ d) refers to the curved portion = 9d.

  (d) The additional length (la) that is introduced in the simple, straight end to end length of a reinforcement bar due to being bent up at say 30° to 60°, but it is generally 45° $=l_1-l_2=$ la

  Where,

  $(D/l_2)= \tan\theta$ & $(D/l_1) = \sin\theta$

  Therefore, the additional length = $(D/\sin\theta) – (D/\tan\theta)$

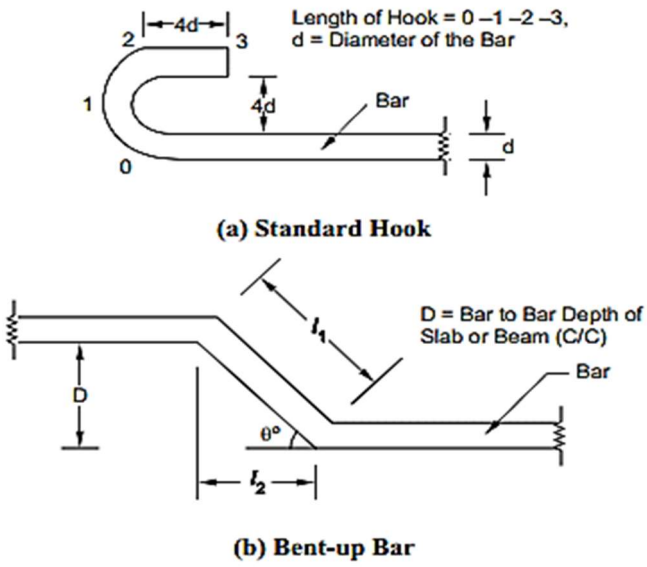


Fig: Hooks & bends in Reinforcement

Giving different values to Θ (=30°,45° & 60° respectively), we get different values of la, as tabulated below:-

S.N.	Θ°	(D/ sinΘ)	(D/ tanΘ)	Additional length of Bent-up Bar, la
1	30°	D/0.5	D/0.5733	0.27D
2	45°	D/0.707	D/1.0	0.414D = 0.42D(0.42D is generally the value that is adopted)
3	60°	D/0.866	D/1.732	0.577D = 0.58D(0.58D is usually adopted)

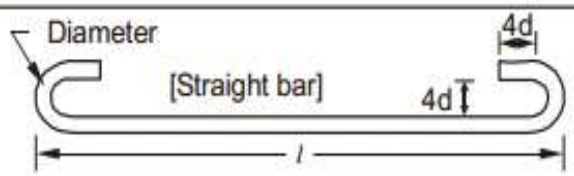
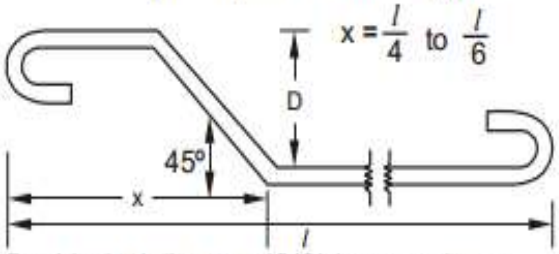
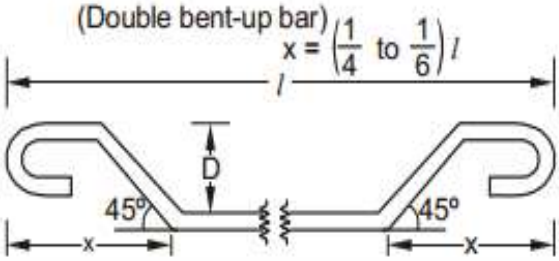
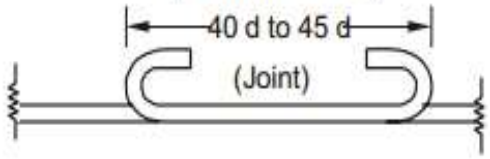
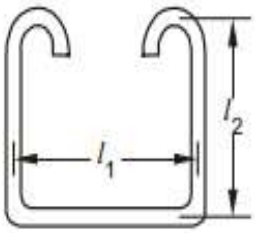
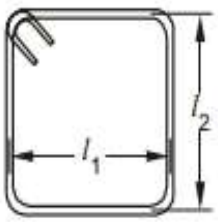
Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.		2[9d] = 18 d (both hooks together)	[l + 18 d]
2.	[Bent-up at one end only]]  D = Vertical distance (C/C) between bars	2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.	(Double bent-up bar) 	2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.	(Overlap of bars) 	2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.		[Here, one hooks height = 14d] 2 × (14d) = 28 d	$[l_1 + 2l_2 + 28\ d]$
6.		2(12d) = 24 d	$[2(l_1 + l_2) + 24\ d]$

Figure presents the procedure to arrive at the length of hooks & the total length of a given steel reinforcement

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawings of column Plan and Section	-----	01(For batch of 5 student)

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation.

IX Procedure:-

1. Draw Column Plan and Section
2. **Information Required:-**
   a) **Column Design Details:** Obtain structural drawings, design specifications, and column dimensions.
   b) **Concrete Cover:** Note the required concrete cover (usually 40mm for columns).
   c) **Steel Details**: Identify the type and grade of steel, as well as the diameter of reinforcement bars.
3) **Identify Reinforcement Details**
   a) **Main Reinforcement**: Determine the number, size, and placement of vertical bars.
   b) **Lateral Ties:** Identify the spacing, size, and placement of ties/stirrups.
4) **Calculate Cut Lengths of Reinforcement Bars**
   a) **Main Bars**: Calculate the total length of each vertical bar considering the height of the column and laps/splices if required. Consider hooks or bends at the top and bottom, usually 90° or 135° bends.
   b) **Lateral Ties:** Calculate the perimeter of the column cross-section to find the length of one tie. Add the length required for hooks (generally 10 times the diameter of the bar).
5) **Create the Bar Bending Schedule (BBS) Table**
   a) **Format**: Typically, the BBS table includes columns for bar mark, bar shape, diameter, length, number of bars, and total length.
   b) **Table Structure**:

   Bar Mark: Unique identifier for each bar type.

   Bar Shape: Standard shapes (e.g., straight, L-bend, U-bend).

   Diameter: Diameter of the bar in mm. Length: Length of individual bars in meters.

   Number of Bars: Total number of each type of bar.

   Total Length: Total length of bars (Length × Number of Bars).

6) **Verify Double-Check Calculations**: Ensure all measurements and calculations are accurate.
7) **Reinforcement Estimate**

Total Weight Calculation:

Use the formula: Weight (kg) = Total Length (m) × Unit Weight of Steel (kg/m).

Unit Weight Formula: Weight = $D^2 \times 0.00617$ Weight=$D^2 \times 0.00617$ (where D is the diameter in mm).

Prepare Reinforcement Estimate Table: Include columns for bar mark, diameter, total length, and weight.

Draw Column Plan and Section

Calculation of lengths

Bar Bending Schedule:-

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the necessity of bar bending schedule?
2. State the approximate percentage of steel required for various RCC members.
3. Explain the inspection and quality control procedures during and after the reinforcement placement?
4. Explain how you will be going to calculate bar bending schedule?
5. State the spacing of the stirrups?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantity of steel	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 13 **Prepare the bar bending schedule for the beam of given structure.**

I. Practical Significance:

- Bar bending schedule makes it easy for the site engineers to check and accept the length of the bent and cut bars during an inspection before the concrete is to be poured. It also helps with better quality control at the construction site. It makes it easy and quick for customers and contractors to produce bills for construction work.

II. Industry/Employer expected outcome(s):

- Calculating the quantity of steel required for the given civil engineering works.

III. Course Level Learning Outcome (COs):

- CO3 - Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 15.1 Calculate the reinforcement quantities for beam of a room size for 4 m X 5 m from the given set of drawings.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

- A bar bending schedule is a tabular format of showing the reinforcing bars that includes details such as bar type, total length, weight, and a drawing of the desired bending shape. A bar bending schedule is established for every different kind of RCC work. During the construction process, the BBS can be used to determine the need for bars of various widths and lengths, and the bars can be positioned and bent as per these specifications. Details like as bar size and type, bending shape, number of bars in a sets or individual bars, bar length (in running metres), total length, and total weight are provided.
- **Calculation involving BBS in construction:-**

  (a) Length of one hook = (4d) + [(4d+ d)] – where, (4d+ d) refers to the curved portion = 9d.

  (b) The additional length (la) that is introduced in the simple, straight end to end length of a reinforcement bar due to being bent up at say 30° to 60°, but it is generally 45° $= l_1 - l_2 =$ la

  Where,

  $(D/l_2) = \tan\theta$ & $(D/l_1) = \sin\theta$

  Therefore, the additional length = $(D/\sin\theta) - (D/\tan\theta)$

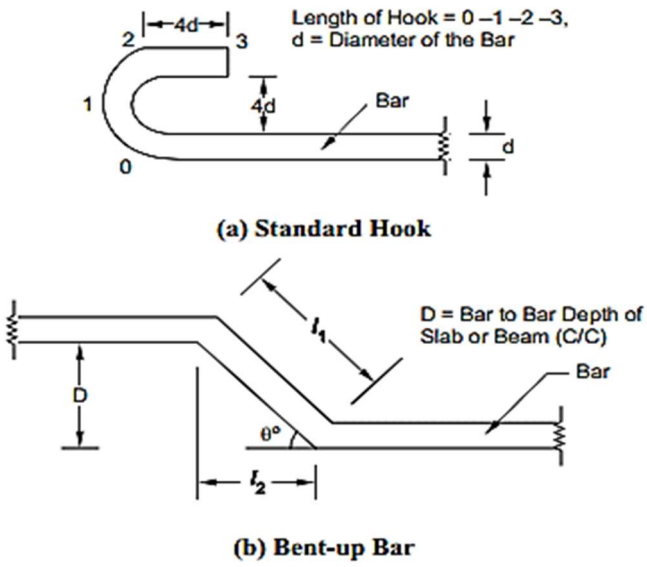


Fig: Hooks & bends in Reinforcement

Giving different values to Θ (=30°,45° & 60° respectively), we get different values of la, as tabulated below:-

S.N.	Θ°	(D/ sinΘ)	(D/ tanΘ)	Additional length of Bent-up Bar, la
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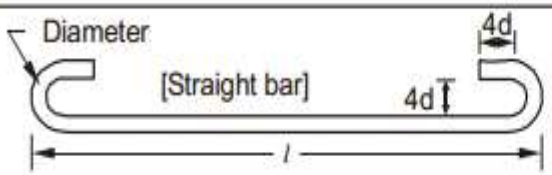
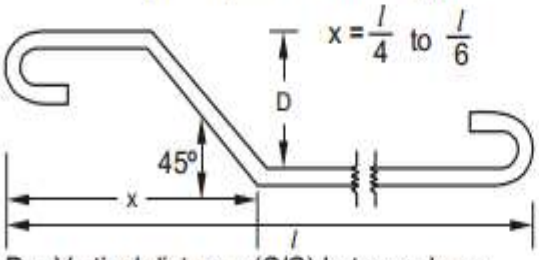
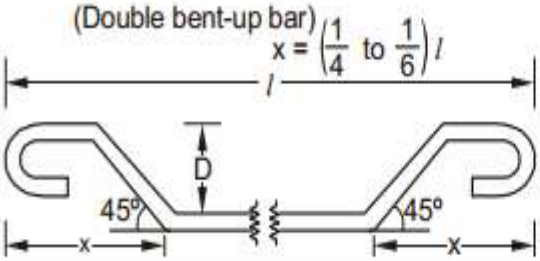
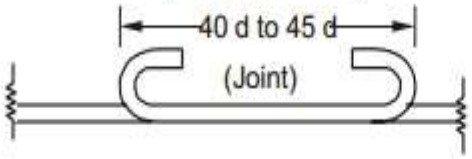
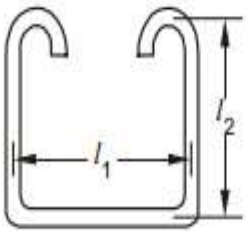
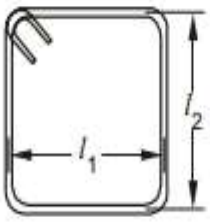
Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.		2[9d] = 18 d (both hooks together)	[l + 18 d]
2.	[Bent-up at one end only]]  D = Vertical distance (C/C) between bars	2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.	(Double bent-up bar) 	2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.	(Overlap of bars) 	2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.		[Here, one hooks height = 14d] 2 × (14d) = 28 d	$[l_1 + 2l_2 + 28\ d]$
6.		2(12d) = 24 d	$[2(l_1 + l_2) + 24\ d]$

Figure presents the procedure to arrive at the length of hooks & the total length of a given steel reinforcement

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawings of beam Plan and Section	-----	01(For batch of 5 student)

VIII. Precautions to be followed:

1. Safety Precautions on site.
2. Proper evaluation.

IX Procedure:-

1. Draw Beam Plan and Section
2. **Collect Structural Drawings and Specifications: -** Obtain the structural drawings that detail the dimensions, reinforcement details, and other specifications of the beam.
3. **Understand the Beam Design: -** Identify the length, breadth, and depth of the beam. Note the type, grade, and diameter of the reinforcement bars used (main bars, stirrups, distribution bars, etc.).
4. **Calculate Cutting Lengths:-** For each type of reinforcement bar, calculate the cutting length. This includes accounting for bends, hooks, and overlaps.

   Formula for Cutting Length

   Straight Bar: Cutting Length=Total Length of the Beam−Concrete Cover at Both Ends

   Bent-Up Bars: Add the lengths of all straight portions and bent portions.
5. **Stirrups**:

   For rectangular stirrups: Cutting Length=2× (a+b) +Hooks Length−Bend Deductions

   Where a and b are the dimensions of the stirrup, hooks length is typically 10d where d is the diameter of the bar, and bend deductions are calculated.
6. **Determine Quantities: -** Calculate the number of each type of bar required for the beam.

   Main Bars:

   $$\text{Number of Main Bars} = \frac{\text{Total Length of the Beam}}{\text{Spacing}} + 1$$

   Multiply the number by the cutting length to get the total length required.

   Stirrups:

   $$\text{Number of Stirrups} = \frac{\text{Total Length of the Beam}}{\text{Spacing}} + 1$$

   Multiply the number by the cutting length to get the total length required.
7. **Prepare the Bar Bending Schedule: -** Create a table that lists each type of bar, its diameter, shape, dimensions, cutting length, and quantity.
8. **Verify and Cross-Check:-**

Review the BBS for accuracy and completeness.

Ensure all bars are accounted for and their lengths are correctly calculated.

Verify that the total reinforcement quantity matches the design requirements.

Draw Beam Plan and Section

Calculation of lengths

Bar Bending Schedule:-

XI. Result:

XII. Practical Question Answers:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the code which is used for bar bending schedule?
2. State the five components of the bar bending schedule?
3. State the applications of bar bending?
4. Explain the anchorage and lap lengths required?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantity of steel	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Practical Question Answer	20%
4.	Practical Submission on time	20%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 16 **Preparation of bar bending schedule with reinforcement estimate for the slab of given structure.**

I. Practical Significance:

Preparing a bar bending schedule and estimating reinforcement for a slab ensures accurate material procurement and compliance with building standards. It reduces costs by minimizing material wastage, and ensures the durability and safety of the structure through precise reinforcement placement and quantity estimation.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop competency of measurement of cutting length of steel, understanding of structural drawing and preparation of bar bending schedule.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 16.1- Calculate the reinforcement quantities for slab of a room size for 4 m X 5 m from the given set of drawing.

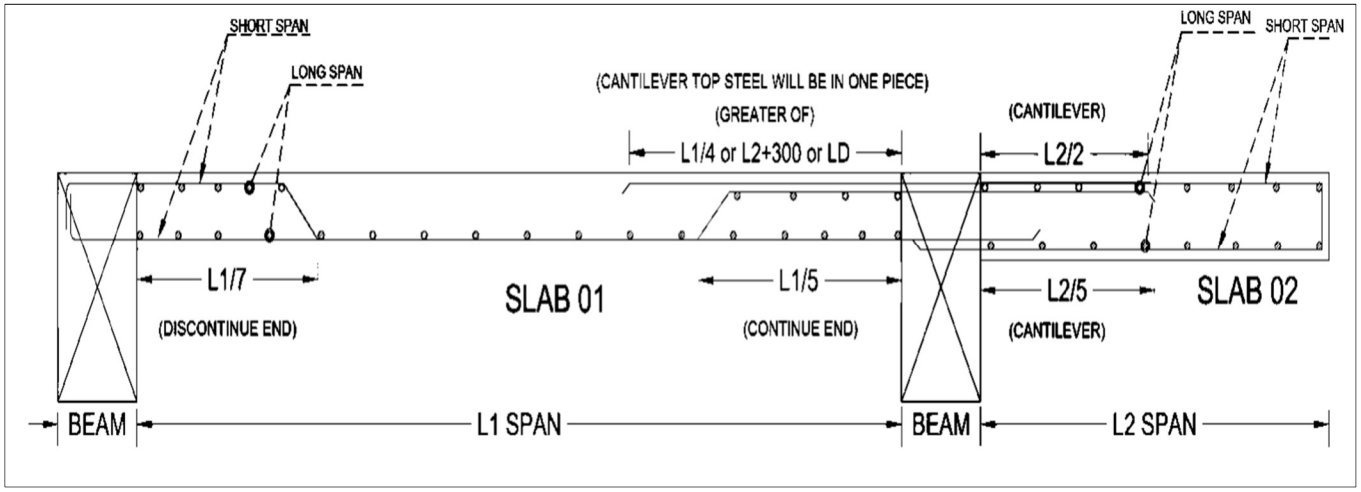
V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

R.C.C. work is usually estimated under two items. The concrete work including centering, shuttering and binding of steel bars in position is taken under one item in cu.m and the steel reinforcement and its bending is taken under a separate item in quintal. The quantity of steel being small no deduction is made for steel from the volume of concrete. Binding wire is not taken separately but included in item of R.C.C. work.

VII. Typical bar bending schedule for continue slab:



VIII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Structural drawing of slab.	Drawing showing the plan of slab and section along shorter and longer length of slab.	03 nos
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	03 nos

IX. Precautions to be followed:

1. Any discrepancies in structural drawings should be resolved before proceeding for BBS preparation.
2. Understand the schedule of rebar for given RCC work.
3. Calculations of Rebar length should do carefully.
4. Bend deduction should be done carefully while calculating the rebar length.
5. Crank length of bent up bar should be calculated carefully.
6. Diameter wise the total weight of bar should calculate separately.
7. Cover provided to the bar of given R.C.C. work should get subtracted from length of bar.

X. Procedure:

1. Identification (Bar mark):

   Tag the different type of bar sin the drawing with a unique id and list it out in sheet. Consider the location for tagging (like slab, column, beam, footing etc.)
2. Diameter of steel bar:

   Mention the diameter of steel bar against each bar mark.
3. No of bar required:

   In case of beam, column etc. the no of steel bars are provided in drawing but in case of slab, footing etc. the no. of steel bars need to be calculated.
   - No of bars = (length of member – 2 x cover / spacing) + 01
4. Shape and sizes:

   Refer the drawing for making out the correct shape of each type of steel bar and the size of each of the element in shape. For Links and Rings mostly inner dimensions are considered and for others out to out dimensions are preferred.
5. Cut length:

   The total length of steel bar is get calculated by considering the addition and deduction required as per the diameter, no of bends, laps, type of hooks etc.

   Note: While calculating the cut length of bar end, top and bottom (as per provided) cover must deduct.
6. Weight of bar:

   After calculating the total no of steel bar and total cutting length of steel bar multiplying these with the unit of steel bar to calculate the weight of steel bar.
7. Finally, the diameter wise weight of bar required for given RCC work will be achieved.

XI. Observation Table/Bar Bending Schedule:

(Subject teacher should provide the drawing of Slab for BBS calculation)

Sr. No.	Item of work	Shape of bar	Dia. of bar (mm)	Length of steel bar (m)	No. of bars	Total Length of bar (m)	Weight of bar (kg/m)	Total weight of bar (kg)
01	02	03	04	05	06	07	08	09

Sr. No.	Item of work	Shape of bar	Dia. of bar (mm)	Length of steel bar (m)	No. of bars	Total Length of bar (m)	Weight of bar (kg/m)	Total weight of bar (kg)
01	02	03	04	05	06	07	08	09

XII. Blank Space for calculation:

XIII. Result *(Mention diameter wise weight of steel bar separately):*

XIV. Interpretation of results:

XV. Conclusions:

XVI. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the practical importance of Bar Bending Schedule.
2. State the thumb rules for calculating the steel bar quantity for different RCC work.
3. State the rules for bend deduction on Bar Bending Schedule.

Space for Answer

XVII. References/Suggestions for further reading.

- IS:1200: Part V-1982 Method of measurement of Building and Civil Engineering Work (Formwork).
- IS:1200: Part VIII-1983 Method of measurement of Building and Civil Engineering Work (Steel Work and Iron Work).
- IS:2502-1963 (reaffirmed 2004) Code of practice for bending and fixing of bars for concrete reinforcement.
- SP: 27: 1987 Handbook of Method of Measurement of Buildings Works.

XVIII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantity of steel	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Prepare Bar bending schedule	15%
4.	Answers to practical related questions.	15%
5.	Submission of report on time.	10%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 17 **Preparation of bar bending schedule with reinforcement estimate for rebaring of beam to be extended.**

I. Practical Significance:

Preparing a bar bending schedule and estimating reinforcement for a slab ensures accurate material procurement and compliance with building standards. It reduces costs by minimizing material wastage, and ensures the durability and safety of the structure through precise reinforcement placement and quantity estimation.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop competency of measurement of cutting length of steel, understanding of structural drawing and preparation of bar bending schedule.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 17.1- Estimate the steel quantity from thegiven drawing using IS code 2502-1963 for rebaring of beam structural members.

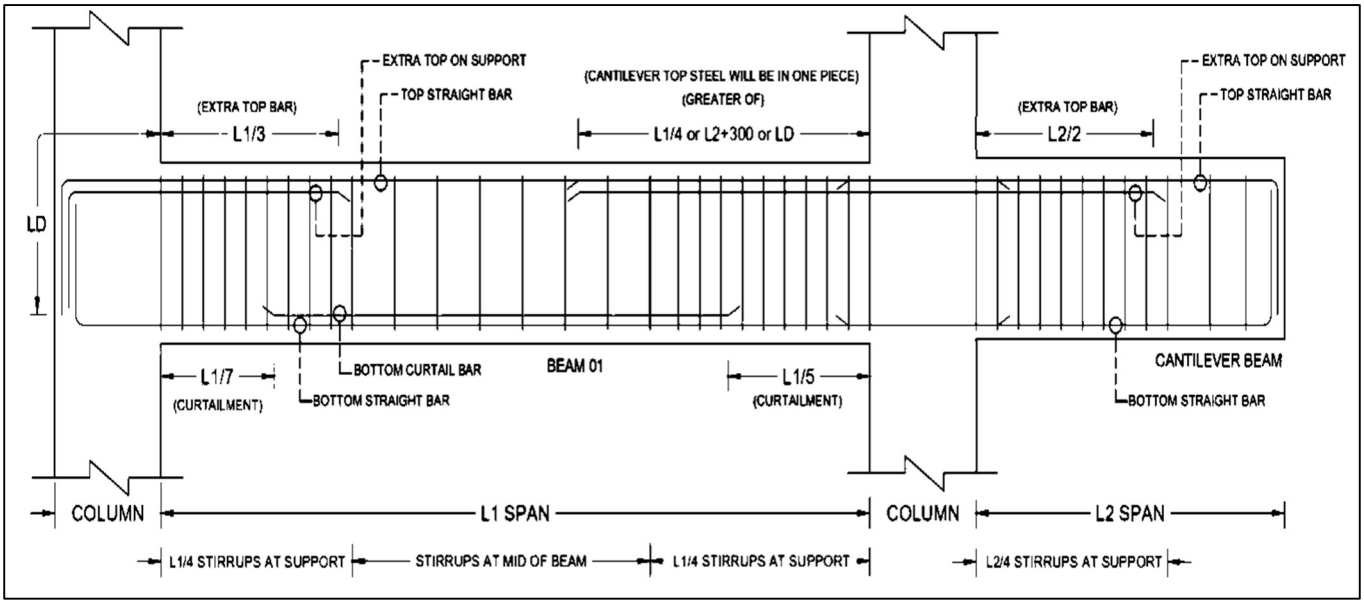
V. Relevant Affective Domain related Outcome(s):

- Using safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

R.C.C. work is usually estimated under two items. The concrete work including centering, shuttering and binding of steel bars in position is taken under one item in cu.m and the steel reinforcement and its bending is taken under a separate item in quintal. The quantity of steel being small no deduction is made for steel from the volume of concrete. Binding wire is not taken separately but included in item of R.C.C. work.

VII. Typical bar bending schedule for Continues beam:



VIII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Structural drawing of beam.	Drawing showing the plan of beam and section along shorter and longer length of beam.	03 nos
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	03 nos

IX. Precautions to be followed:

1. Any discrepancies in structural drawings should be resolved before proceeding for BBS preparation.
2. Understand the schedule of rebar for given RCC work.
3. Calculations of Rebar length should do carefully.
4. Bend deduction should be done carefully while calculating the rebar length.
5. Crank length of bent up bar should be calculated carefully.
6. Diameter wise the total weight of bar should calculate separately.
7. Cover provided to the bar of given R.C.C. work should get subtracted from length of bar.

X. Procedure:

1. Identification (Bar mark):

   Tag the different type of bar sin the drawing with a unique id and list it out in sheet. Consider the location for tagging (like slab, column, beam, footing etc.)
2. Diameter of steel bar:

   Mention the diameter of steel bar against each bar mark.
3. No of bar required:

   In case of beam, column etc. the no of steel bars are provided in drawing but in case of slab, footing etc. the no. of steel bars need to be calculated.
   - No of bars = (length of member – 2 x cover / spacing) + 01
4. Shape and sizes:

   Refer the drawing for making out the correct shape of each type of steel bar and the size of each of the element in shape. For Links and Rings mostly inner dimensions are considered and for others out to out dimensions are preferred.
5. Cut length:

   The total length of steel bar is get calculated by considering the addition and deduction required as per the diameter, no of bends, laps, type of hooks etc.

   Note: While calculating the cut length of bar end, top and bottom (as per provided) cover must deduct.
6. Weight of bar:

   After calculating the total no of steel bar and total cutting length of steel bar multiplying these with the unit of steel bar to calculate the weight of steel bar.
7. Finally, the diameter wise weight of bar required for given RCC work will be achieved.

XI. Observation Table/Bar Bending Schedule:

(Subject teacher should provide the drawing of Beam for BBS calculation).

Sr. No.	Item of work	Shape of bar	Dia. of bar (mm)	Length of steel bar (m)	No of bars	Total Length of bar (m)	Weight of bar (kg/m)	Total weight of bar (kg)
01	02	03	04	05	06	07	08	09

Sr. No.	Item of work	Shape of bar	Dia. of bar (mm)	Length of steel bar (m)	No. of bars	Total Length of bar (m)	Weight of bar (kg/m)	Total weight of bar (kg)
01	02	03	04	05	06	07	08	09

XII. Blank Space for calculation:

XIII. Result *(Mention diameter wise weight of steel bar separately):*

XIV. Interpretation of results:

XV. Conclusions:

XVI. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the practical importance rebaring of beam.
2. State the lapping length of bar suggested as per IS.

Space for Answer

XVII. References/Suggestions for further reading.

- IS:1200: Part V-1982 Method of measurement of Building and Civil Engineering Work (Formwork).
- IS:1200: Part VIII-1983 Method of measurement of Building and Civil Engineering Work (Steel Work and Iron Work).
- IS:2502-1963 (reaffirmed 2004) Code of practice for bending and fixing of bars for concrete reinforcement.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVIII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantity of steel	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Prepare bar bending schedule	15%
4.	Answers to practical related questions.	15%
5.	Submission of report on time.	10%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 18 **Preparation of bar bending schedule with reinforcement estimate for rebaring of column to be extended.**

I. Practical Significance:

Bar bending schedule is providing the details of total bar length and the total weight of the steel required in the given R.C.C. work. It helps to understand the cutting length of bar and shape of the bars to be provided in RCC work. Rebaring is the process of insertion of steel bars in existing RCC member when, there is need of extension of existing members due to change in design or any other reason.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop competency of measurement of cutting length of steel, understanding of structural drawing and preparation of bar bending schedule.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 18.1- Estimate the steel quantity from the given drawing using IS code 2502-1963 for rebaring of column structural members.

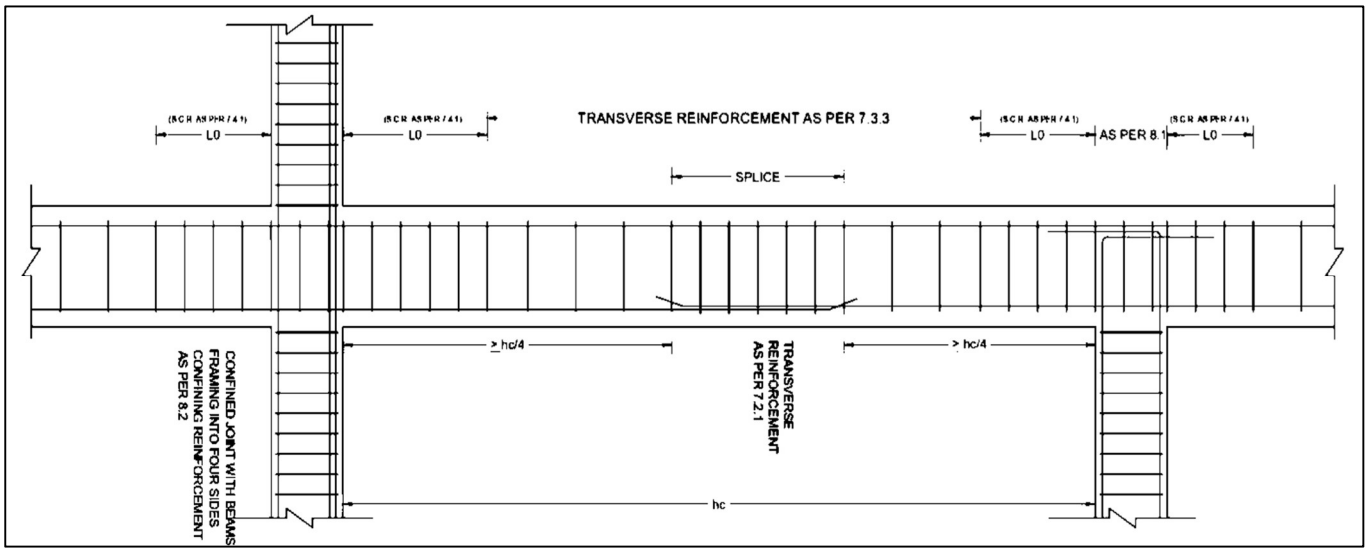
V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

R.C.C. work is usually estimated under two items. The concrete work including centering, shuttering and binding of steel bars in position is taken under one item in cu.m and the steel reinforcement and its bending is taken under a separate item in quintal. The quantity of steel being small no deduction is made for steel from the volume of concrete. Binding wire is not taken separately but included in item of R.C.C. work.

VII. Typical bar bending schedule for column: (*Rotate the book to see diagram*)



VIII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Structural drawing of column.	Drawing showing the section of column.	03 nos
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	03 nos

IX. Precautions to be followed:

1. Any discrepancies in structural drawings should be resolved before proceeding for BBS preparation.
2. Understand the schedule of rebar for given RCC work.
3. Calculations of Rebar length should do carefully.
4. Bend deduction should be done carefully while calculating the rebar length.
5. Crank length of bent up bar should be calculated carefully.
6. Diameter wise the total weight of bar should calculate separately.
7. Cover provided to the bar of given R.C.C. work should get subtracted from length of bar.

X. Procedure:

1. Identification (Bar mark):
   Tag the different type of bar sin the drawing with a unique id and list it out in sheet. Consider the location for tagging (like slab, column, beam, footing etc.)
2. Diameter of steel bar:
   Mention the diameter of steel bar against each bar mark.
3. No of bar required:
   In case of beam, column etc. the no of steel bars are provided in drawing but in case of slab, footing etc. the no. of steel bars need to be calculated.
   - No of bars = (length of member – 2 x cover / spacing) + 01
4. Shape and sizes:
   Refer the drawing for making out the correct shape of each type of steel bar and the size of each of the element in shape. For Links and Rings mostly inner dimensions are considered and for others out to out dimensions are preferred.
5. Cut length:
   The total length of steel bar is get calculated by considering the addition and deduction required as per the diameter, no of bends, laps, type of hooks etc.
6. Weight of bar:
   After calculating the total no of steel bar and total cutting length of steel bar multiplying these with the unit of steel bar to calculate the weight of steel bar.
7. Finally, the diameter wise weight of bar required for given RCC work will be achieved.

XI. Observation Table/Bar Bending Schedule:

(Subject teacher should provide the problem of column for BBS calculation)

Sr. No.	Item of work	Shape of bar	Dia. of bar (mm)	Length of steel bar (m)	No of bars	Total Length of bar (m)	Weight of bar (kg/m)	Total weight of bar (kg)
01	02	03	04	05	06	07	08	09

Sr. No.	Item of work	Shape of bar	Dia. of bar (mm)	Length of steel bar (m)	No of bars	Total Length of bar (m)	Weight of bar (kg/m)	Total weight of bar (kg)
01	02	03	04	05	06	07	08	09

XII. Blank Space for calculation:

XII. Result *(Mention diameter wise weight of steel bar separately):*

XIII. Interpretation of results:

XIV. Conclusions:

XV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Draw the typical drawing of beam and column junction.
2. Write the formula with example to calculate the length of helical ties in column.

Space for Answer

XVI. References/Suggestions for further reading.

- IS:1200: Part V-1982 Method of measurement of Building and Civil Engineering Work (Formwork).
- IS:1200: Part VIII-1983 Method of measurement of Building and Civil Engineering Work (Steel Work and Iron Work).
- IS:2502-1963 (reaffirmed 2004) Code of practice for bending and fixing of bars for concrete reinforcement.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculating quantity of steel	40%
2.	Individual/Team work	20%
B.	**Product Related (10 marks)**	**40%**
3.	Prepare bar bending schedule	15%
4.	Answers to practical related questions.	15%
5.	Submission of report on time.	10%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 19 **Determination of the earth quantity in embankment and cutting using Trapezoidal method.**

I. Practical Significance:

Earthwork is the process of shifting the portion of earth's surface from one place to another place. Earthwork may be done in embankment or in cutting of earth surface. The calculation of earthwork quantity is necessary for accurate estimation of material requirements and costs. It helps to ensure the planning and precise resource allocation of earth moving activities which helps to minimize the project costs.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop the competency in measurement of earthwork by using trapezoidal formula and also the earthwork balancing.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 19.1-Use the Trapezoidal method to determine the earth work quantity in embankment and cutting.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

The volume of earthwork can be calculated by using the trapezoidal formula for a series of cross sections when areas are calculated at equidistant points.

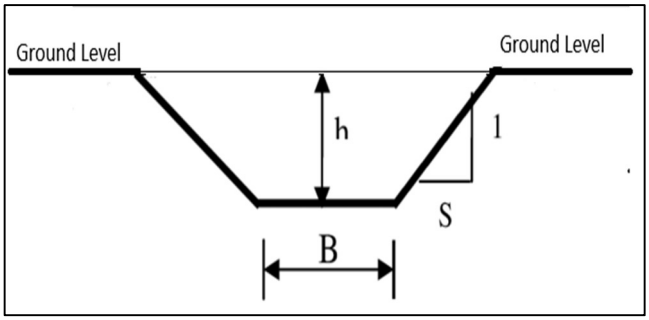
- Trapezoidal formula:
- Volume of earthwork = $\frac{D}{2}\{A_0 + 2A_1 + 2A_2 + 2A_3 + \cdots \ldots \ldots + 2A_{n-1} + A_n\}$

$$V = D + \left\{\frac{A_0 + A_n}{2} + A_1 + A_2 + A_3 + \cdots \ldots + A_{n-1}\right\}$$

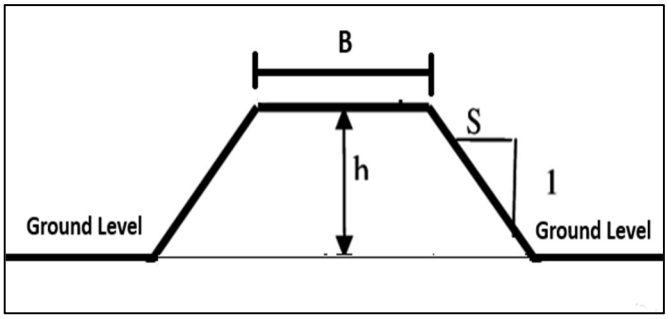
Where, V= Volume of earthwork. D= Distance between the section.

Earthwork in embankment marked positive and earthwork in cutting marked negative to reduce the confusion in calculation of earthwork.

VII. Typical cross section of earthwork in embankment and cutting:



Cross Section in Cutting



Cross Section in Embankment

VIII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawing of road or canal etc.	Drawing showing the plan, longitudinal and cross-section road or canal.	03 nos
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	03 nos

IX. Precautions to be followed:

1. Drawing related to the road or canal construction should read carefully.
2. Depth should be calculated carefully from the given ground elevations.
3. Area of cross section at various point should be calculated precisely.

X. Procedure:

1. Read the data/drawing carefully.
2. Calculate the depth of filling or cutting from given ground and formation level.
3. Calculate the cross-sectional area at desired point by using formula $Bd+Sd^2$.
4. Use the trapezoidal formula to calculate the earthwork in cutting or in embankment for given road or canal section.
5. Finally, the quantity of earthwork will get in terms of cu.m

XI. Earthwork Calculations using trapezoidal formula:

(Subject teacher should provide the problem of earthwork calculation)

Example:

Earthwork Calculations by Trapezoidal method:

Formation Level Calculations:

Zero depth Calculations *(if necessary):*

XII. Result:

XIII. Interpretation of results:

XIV. Conclusions:

XV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the different method of earthwork calculation.
2. What is balancing of earthwork?

Space for Answer

XVI. References/Suggestions for further reading.

- IS:1200: Part 01-1992 Methods of measurement of building and civil engineering works, Part 1: Earthwork.
- IS:1200: Part 27-1992 Method of measurement of building and civil engineering works, Part 27: Earthwork done by mechanical appliances.
- SP: 27: 1987 Handbook of Method of Measurement of Buildings Works.

XVII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculation of quantity of earth work	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 20 **Determination of the earth quantity in embankment and in cutting using Prismoidal method.**

I. Practical Significance:

Earthwork is the process of shifting the portion of earth's surface from one place to another place. Earthwork may be done in embankment or in cutting of earth surface. The calculation of earthwork quantity is necessary to ensure the proper allocation of resources which will help to minimize the cost of project. Prismoidal method provides more accuracy in earthwork calculation than the simpler method like Trapezoidal method. By accurately predicting earthwork volumes, it supports efficient construction planning and scheduling, minimizing delays and enhancing overall project management.

II. Industry/Employer expected outcome(s):

This practical is expected to develop the competency in measurement of earthwork by prismoidal formula and also the earthwork balancing.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 20.1- Use the Prismoidal method to determine the earth work quantity in embankment and cutting.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

The volume of earthwork can be calculated by using the prismoidal formula for a series of cross sections when areas are calculated at equidistant points Earthwork calculated by prismoidal formula is more accurate than calculated by any other method of earthwork calculations. Prismodial formula is more conveniently used to calculate earthwork in case of contour plan where depression are needed to fill.

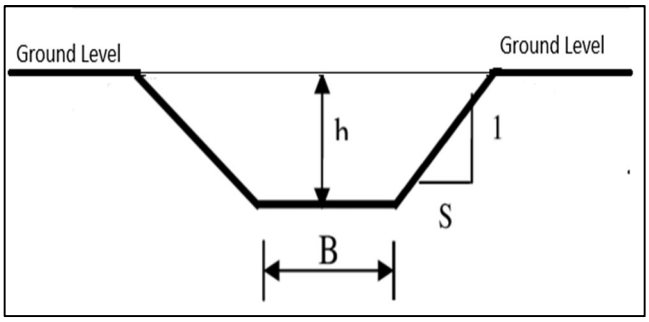
- Presmoidal formula:
- Volume of earthwork = $\frac{D}{3}\{A_0 + 4A_1 + 2A_2 + 4A_3 + 2A_4 + \cdots \ldots \ldots . . + 2A_{n-2} + 4A_{n-1} + A_n\}$

$$V = \frac{D}{3}\{A_0 + A_n + 4(A_1 + A_3 + \cdots . + A_{n-1}) + 2(A_2 + A_4 + \cdots + A_{n-2})\}$$

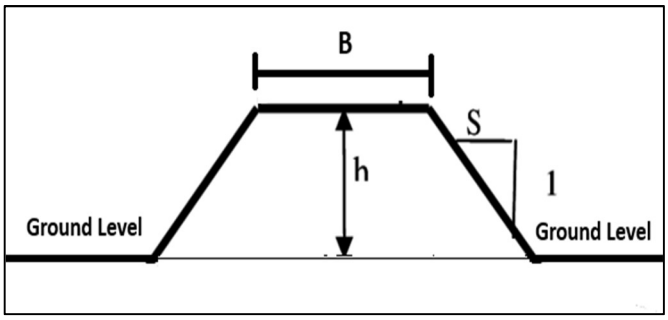
V = (First Area +last Area + 4 X ∑Odd areas + 2 X ∑ Even Areas)

Where, V= Volume of earthwork. D= Distance between the section.
Earthwork in embankment marked positive and earthwork in cutting marked negative to reduce the confusion in calculation of earthwork.

VII. Typical cross section of earthwork in embankment and cutting:



Cross Section in Cutting



Cross Section in Embankment

VIII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawing of road or canal.	Drawing showing the plan, longitudinal and cross-section road or canal.	03 nos
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	03 nos

IX. Precautions to be followed:

1. Drawing related to the road or canal construction should read carefully.
2. Depth should be calculated carefully from the given ground elevations.
3. Area of cross section at various point should be calculated precisely.
4. Precisely add allowance in earthwork quantity by considering the compaction and other wastage.

X. Procedure:

1. Read the data/drawing carefully.
2. Calculate the depth of filling or cutting from given ground and formation level.
3. Calculate the cross-sectional area at desired point by using formula $Bd+Sd^2$.
4. Use the trapezoidal formula to calculate the earthwork in cutting or in embankment for given road or canal section.
5. Finally, the quantity of earthwork will get in terms of m^3.

XI. Earthwork Calculations using presmoidal formula:

(Subject teacher should provide the problem of earthwork calculation)

Example:

Earthwork Calculations by Prismoidal method:

Formation Level Calculations:

Zero depth Calculations *(if necessary):*

XII. Result:

XIII. Interpretation of results:

XIV. Conclusions:

XV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Distinguish between trapezoidal and presmoidal method of earthwork calculation.
2. State the procedure of balancing of earthwork for any road.

Space for Answer

XVI. References/Suggestions for further reading.

- IS:1200: Part 01-1992 Methods of measurement of building and civil engineering works, Part 1: Earthwork.
- IS:1200: Part 27-1992 Method of measurement of building and civil engineering works, Part 27: Earthwork done by mechanical appliances.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculation of quantity of earth work	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 21 **Determination of the earth quantity in embankment and in cutting using mid sectional area method.**

I. Practical Significance:

In the construction work of road, canal, railway laying etc. earthwork is needed to do and it plays vital role. As volume of earthwork is large in such construction work, it is necessary to calculate the volume of earthwork to minimize the overall cost of construction by balancing the earthwork. The mid sectional area method of determining earth quantities in embankment and cutting quick approach by calculating volumes based on average cross-sectional areas, simplifying estimation processes. It also helps to maintain accuracy and consistency in earthwork calculations, minimizing errors and optimizing project outcomes.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop competency in measurement of earthwork by mid sectional area method.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 21.1- Use the mid sectional area method to determine the earth work quantity in embankment and cutting.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

The volume of earthwork can be calculated by using the mid sectional area method. the volume of earthwork is calculated by multiplying the area of section with the distance between two sections. While calculating the area of section the breadth and mean depth of section is considered.

- Volume of earthwork by using mid-section area method:

  $V = A \times L$,

  Where,

  V= Volume of earthwork.

  L= Distance between the consecutive sections.

  A=Area of Section = $(Bd+Sd^2)$

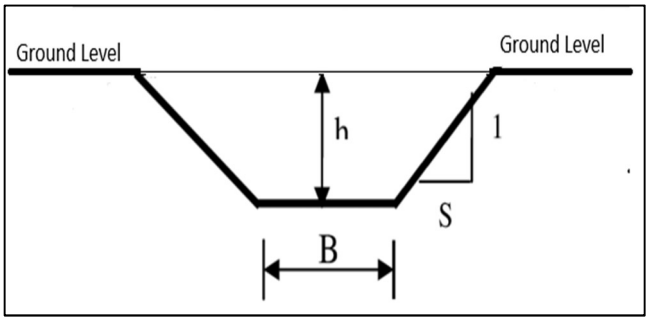
  B = Breadth of section,

  d = Mean Depth of section

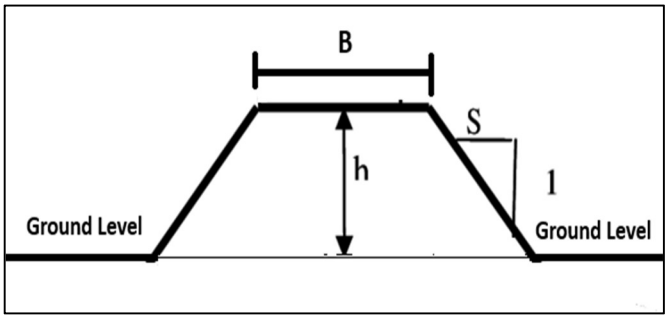
  S =slope of cutting/filling of earthwork.

Earthwork in embankment marked positive and earthwork in cutting marked negative to reduce the confusion in calculation of earthwork.

VII. Typical cross section of earthwork in embankment and cutting:



Cross Section in Cutting



Cross Section in Embankment

VIII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawing of road or canal.	Drawing showing the plan, longitudinal and cross-section road or canal.	01 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.
03	Level Sheet	Sheet showing the reduced level of road or canal longitudinal profile.	01 nos.

IX. Precautions to be followed:

1. Drawing related to the road, canal. railway line construction should read carefully.
2. Depth should be calculated carefully from the given ground elevations.
3. Area of cross section at various point should be calculated precisely.

X. Procedure:

1. Read the data/drawing carefully.
2. Calculate the depth of filling or cutting from given ground and formation level.
3. Calculate the cross-sectional area at desired point by using formula $Bd+Sd^2$.
4. Use the trapezoidal formula to calculate the earthwork in cutting or in embankment for given road or canal section.
5. Finally, the quantity of earthwork will get in terms of cu.m

XI. Earthwork Calculations using Mid-sectional area method:

(Subject teacher should provide the problem of earthwork calculation)

Example:

Formation Level Calculations:

Zero depth Calculations *(if necessary)*:

Earthwork Calculations mid sectional area method:

Sr. No.	Chainage (m)	Depth (m)		Mean Depth (m)		Total Cross-Sectional Area (m^2)	Distance between adjacent Chainages (m)	Quantity of earthwork between two chainage points. V=A x L (m^3)	
		In Cutting	In Filling	In Cutting	In Filling	$Bd+Sd^2$		In Cutting	In Filling

Sr. No.	Chainage (m)	Depth (m)		Mean Depth (m)		Total Cross-Sectional Area (m^2)	Distance between adjacent Chainages (m)	Quantity of earthwork between two chainage points. V=A x L (m^3)	
		In Cutting	In Filling	In Cutting	In Filling	$Bd+Sd^2$		In Cutting	In Filling

XII. Result:

XIII. Interpretation of results:

XIV. Conclusions:

XV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Distinguish between Mean Section and Mid-Section area method.
2. State the minimum specification of earthwork for railway track.

Space for Answer

XVI. References/Suggestions for further reading.

- IS:1200: Part 01-1992 Methods of measurement of building and civil engineering works, Part 1: Earthwork.
- IS:1200: Part 27-1992 Method of measurement of building and civil engineering works, Part 27: Earthwork done by mechanical appliances.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculation of quantity of earth work	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 22 **Determination of the earth quantity in embankment and cutting using mean area method.**

I. Practical Significance:

In the construction work of road, canal, railway laying etc. earthwork is needed to do and it plays vital role. As volume of earthwork is large in such construction work, it is necessary to calculate the volume of earthwork to minimize the overall cost of construction. The mean area method for calculating earth quantities in embankment and cutting provides practical benefits by averaging cross-sectional areas, simplifying volume estimation. This method supports efficient resource management and cost control, ensuring projects stay within financial constraints.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop the competency in measurement of earthwork by mean sectional area method.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 22.1- Use the mean area method to determine the earth work quantity in embankment and cutting.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

The volume of earthwork can be calculated by using the mean section area method. The volume of earthwork is calculated by multiplying the mean area of section with the distance between two sections. While calculating the area of section the breadth and depth of section is considered.

- Volume of earthwork by using mean-section area method:

  $V = A \times L$,

  Where,

  V= Volume of earthwork.

  L= Distance between the consecutive sections.

  A=Area of Section = $(Bd+Sd^2)$

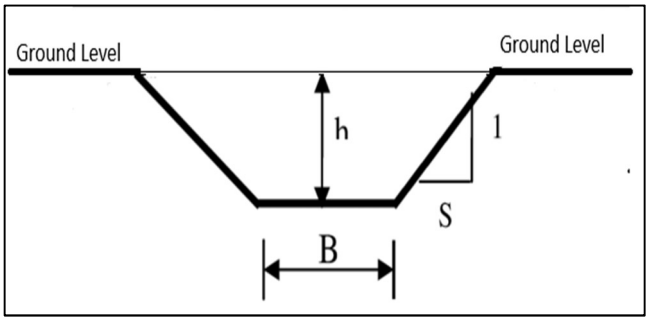
  B = Breadth of section,

  d = Mean Depth of section

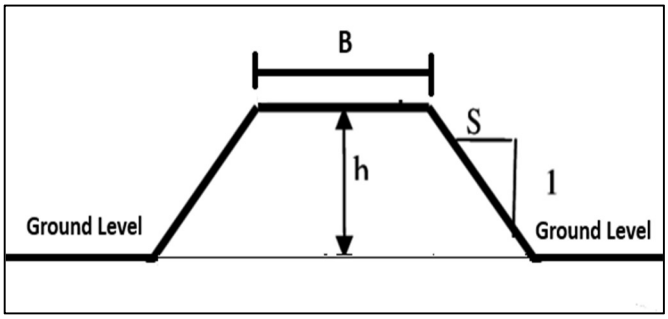
  S =slope of cutting/filling of earthwork.

Earthwork in embankment marked positive and earthwork in cutting marked negative to reduce the confusion in calculation of earthwork.

VII. Typical cross section of earthwork in embankment and cutting:



Cross Section in Cutting



Cross Section in Embankment

VIII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawing of road or canal.	Drawing showing the plan, longitudinal and cross-section road or canal.	01 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.
03	Level Sheet	Sheet showing the reduced level of road or canal longitudinal profile.	01 nos.

IX. Precautions to be followed:

1. Drawing related to the road, canal. railway line construction should read carefully.
2. Depth should be calculated carefully from the given ground elevations.
3. Area of cross section at various point should be calculated precisely.

X. Procedure:

1. Read the data/drawing carefully.
2. Calculate the depth of filling or cutting from given ground and formation level.
3. Calculate the cross-sectional area at desired point by using formula $Bd+Sd^2$.
4. Use the trapezoidal formula to calculate the earthwork in cutting or in embankment for given road or canal section.
5. Finally, the quantity of earthwork will get in terms of cu.m

XI. Earthwork Calculations using Mid-sectional area method:

(Subject teacher should provide the problem of earthwork calculation)

Example:

Earthwork Calculations mean area method:

Sr. No.	Chainage (m)	Depth (m)		Total Cross-Sectional Area (m^2)	Mean Cross Sectional Area (m^2)	Distance between adjacent Chainages (m)	Quantity of earthwork between two chainage points. $V = A \times L$ (m^3)	
		In Cutting	In Filling		$Bd+Sd^2$		In Cutting	In Filling

Sr. No.	Chainage (m)	Depth (m)		Total Cross-Sectional Area (m^2)	Mean Cross Sectional Area (m^2)	Distance between adjacent Chainages (m)	Quantity of earthwork between two chainage points. $V = A \times L$ (m^3)	
		In Cutting	In Filling		$Bd+Sd^2$		In Cutting	In Filling

XII. Result:

XIII. Interpretation of results:

XIV. Conclusions:

XV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the minimum specification of earthwork for Canal.
2. State the method of earthwork calculation and also write the suitability.

Space for Answer

XVI. References/Suggestions for further reading.

- IS:1200: Part 01-1992 Methods of measurement of building and civil engineering works, Part 1: Earthwork.
- IS:1200: Part 27-1992 Method of measurement of building and civil engineering works, Part 27: Earthwork done by mechanical appliances.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculation of quantity of earth work	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 23 **Preparation of detailed estimate of W.B.M. Road using relevant open-source software (Part I)**

I. Practical Significance:

Before the commencement of road construction, quantity calculation of various item of work is needed to carry out. After quantity calculation the estimate of road has prepared. Estimate preparation can be done by the open-source software available in market. Use of software in estimate preparation provides ease and accuracy in calculation of quantities with less time in compare with manual work.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop skills of using open-source software for quantity calculation and estimate preparation.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 23.1 Use the relevant open-source software to prepare detailed estimate of the WBM Road.

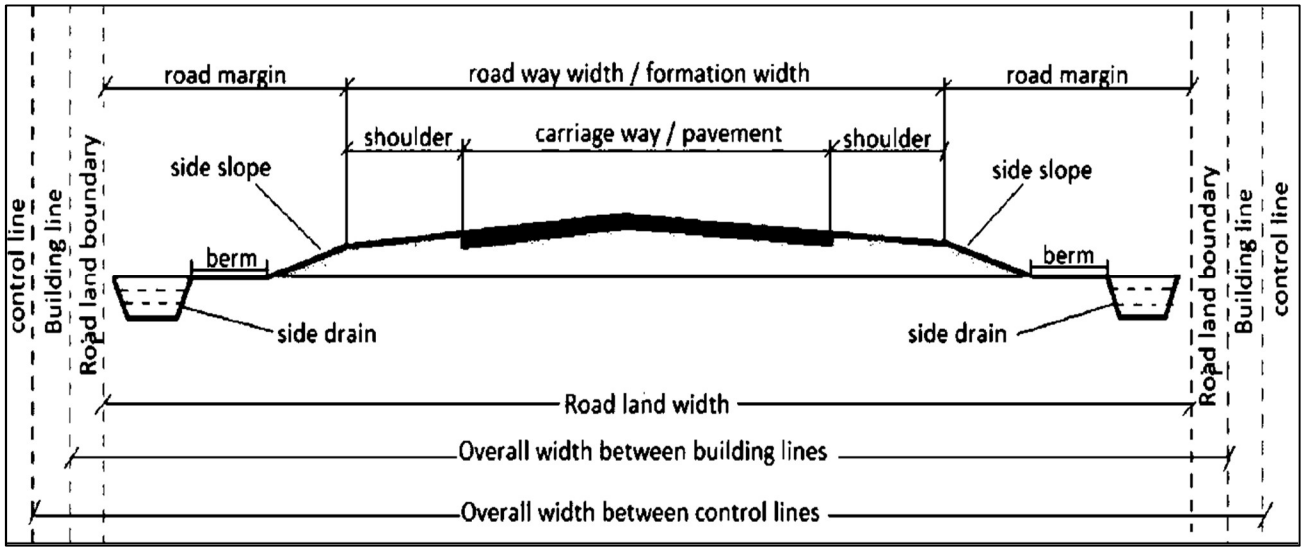
V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

WBM is an abbreviation for Water Bound Macadam Road, the most commonly used road construction method for over 100 years. The Water Bound Macadam Road is named after Scottish engineer John Loudoun Macadam, who invented and built the WBM road. Water-bound macadam roads have a wearing surface consisting of clean and crushed aggregates that are mechanically interlocked by the rolling Process and bound with each other by the filler material (screening) and water that is laid on the subgrade or base course.

VII. Typical drawing of W.B.M. Road c/s in road in embankment:



VIII. List of Open-source Software:

Sr. No.	Open-source Software	Link for Download
01	Estimate	https://estimate.wanhive.com
02	MS-Office (MS-Excel)	https://www.microsoft.com/en-in/microsoft-365/free-office-online-for-the-web
03	Open Office (Excel)	https://www.openoffice.org/download/index.html

IX. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawing of road or canal.	Drawing showing the plan, longitudinal and cross-section road or canal.	01 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.
03	Level Sheet	Sheet showing the reduced level of road or canal longitudinal profile.	01 nos.

X. Precautions to be followed:

1. Drawing of WBM road should understand carefully.
2. Depth of filling layer should get carefully calculated.
3. Area of cross section at various point should be calculated precisely.

XI. Procedure:

1. Understand the data/drawing carefully.
2. List out the item of work needed to execute for the road construction.
3. Get the standard specification for every item of construction as per the requirement. (For specification of work students can use S.S.R.)
4. Calculate the depth of cutting and filling at various section carefully bu using appropriate method.
5. Find out the quantity of each item of work listed in step no 02 by using available open-source software.
6. Find out the rate of item of work form the latest updated SSR.

XII. Earthwork Calculations using Mid-sectional area method:

(Subject teacher should provide the drawing of W.B.M. road for detailed estimate.)
(Students should attach the print of Measurement sheet and abstract sheet.)

Example:

XIII. Result:

XIV. Interpretation of results:

XV. Conclusions:

XVI. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. List out the software available in market for estimate.
2. List out the item of work of WBM and BBM type of road.

Space for Answer

XVII. References/Suggestions for further reading.

- IS:1200: Part 01-1992 Methods of measurement of building and civil engineering works, Part 1: Earthwork.
- IS:1200: Part 27-1992 Method of measurement of building and civil engineering works, Part 27: Earthwork done by mechanical appliances.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVIII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculation of quantity and prepare measurement & abstract sheet using software	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 24 **Preparation of detailed estimate of W.B.M. Road using relevant open-source software (Part II)**

I. Practical Significance:

Before the commencement of road construction, quantity calculation of various item of work is needed to carried out. After quantity calculation the estimate of road has prepared. Estimate preparation can be done by the open-source software available in market. Use of software in estimate preparation provide ease and accuracy in calculation of quantities with less time in compare with manual work.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop skills of using open-source software for quantity calculation and estimate preparation.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 24.1 Use the relevant open-source software to prepare detailed estimate of the WBM Road. (Part II).

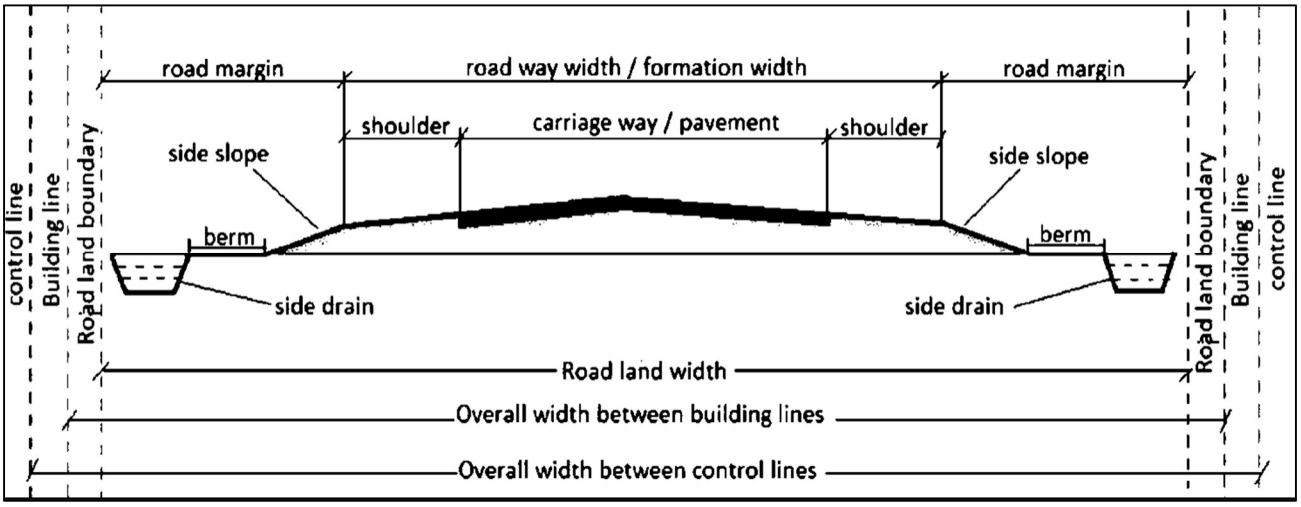
V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

WBM is an abbreviation for Water Bound Macadam Road, the most commonly used road construction method for over 100 years. The Water Bound Macadam Road is named after Scottish engineer John Loudoun Macadam, who invented and built the WBM road. Water-bound macadam roads have a wearing surface consisting of clean and crushed aggregates that are mechanically interlocked by the rolling Process and bound with each other by the filler material (screening) and water that is laid on the subgrade or base course.

VII. Typical drawing of W.B.M. Road c/s in road in embankment:



VIII. List of Open-source Software:

Sr. No.	Open-source Software	Link for Download
01	Estimate	https://estimate.wanhive.com
02	MS-Office (MS-Excel)	https://www.microsoft.com/en-in/microsoft-365/free-office-online-for-the-web
03	Open Office (Excel)	https://www.openoffice.org/download/index.html

IX. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawing of road or canal.	Drawing showing the plan, longitudinal and cross-section road or canal.	01 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.
03	Level Sheet	Sheet showing the reduced level of road or canal longitudina profile.	01 nos.

X. Precautions to be followed:

1. Drawing of WBM road should understand carefully.
2. Depth of filling layer should get carefully calculated.
3. Area of cross section at various point should be calculated precisely.

XI. Procedure:

1. Understand the data/drawing carefully.
2. List out the item of work needed to execute for the road construction.
3. Get the standard specification for every item of construction as per the requirement. (For specification of work students can use S.S.R.)
4. Calculate the depth of cutting and filling at various section carefully bu using appropriate method.
5. Find out the quantity of each item of work listed in step no 02 by using available open-source software.
6. Find out the rate of item of work form the latest updated SSR.

XII. Earthwork Calculations using Mid-sectional area method:

(Subject teacher should provide the drawing of W.B.M. road for detailed estimate.)
(Students should attach the print of Measurement sheet and abstract sheet.)

Example:

XIII. Result:

XIV. Interpretation of results:

XV. Conclusions:

XVI. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. What is detailed estimate?
2. Enlist the provisions made in IS:1200 with special reference to earthwork calculation.

Space for Answer

XVII. References/Suggestions for further reading.

- IS:1200: Part 01-1992 Methods of measurement of building and civil engineering works, Part 1: Earthwork.
- IS:1200: Part 27-1992 Method of measurement of building and civil engineering works, Part 27: Earthwork done by mechanical appliances.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVIII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculation of quantity and prepare measurement & abstract sheet using software	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 25 Preparation of detailed estimate for small septic tank

I. Practical Significance:

The preparation of a detailed estimate for a small septic tank is essential for accurate cost projection, efficient resource allocation, and effective project management. It ensures compliance with regulatory standards, maintains construction quality, and mitigates risks, thereby facilitating timely and budget-conscious completion of the project.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop skills of preparation of detailed estimate.

III. Course Level Learning Outcome (COs):

- CO 3- Prepare detailed estimate of a civil engineering works.

IV. Laboratory Learning Outcome (LLO):

- LLO 25.1- Prepare the detailed estimate for small septic tank from given set of drawing. (Part I)

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

While preparing a detailed estimate for a small septic tank encompasses principles of cost estimation methods. This method guide the estimation process, ensuring accurate cost projection, compliance with regulations, efficient resource allocation, and effective risk mitigation. Integrating these theories enables the creation of comprehensive estimates that support successful project execution within budgetary and regulatory constraints.

VII. Typical drawing of road c/s in road in embankment:

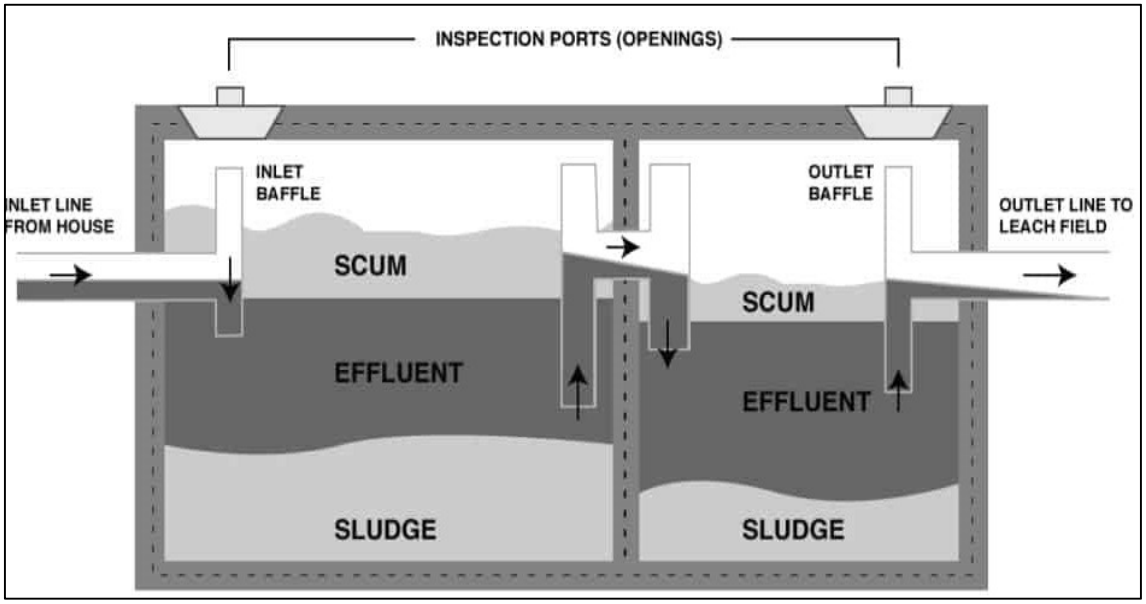


Figure 25.1 Typical Cross Section of Septic tank.

VIII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Drawing of septic tank.	Drawing showing the plan and cross-section of septic tank.	01 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.

IX. Precautions to be followed:

1. Drawing of septic tank should understand carefully.
2. All dimension should be verified accurately.
3. Rate of various item of work should be accurately verified from SSR.

X. Procedure:

1. Understand the data/drawing carefully.
2. List out the item of work needed to execute for the septic tank construction.
3. Write the standard specification for every item of construction as per the requirement. (For writing specification of work students can use S.S.R.)
4. Find out the quantity of each item of work listed in step no 02 and write the same in measurement sheet.
5. Use the appropriate method to calculate the quantity of item of work.
6. Find out the rate of item of work form the latest updated SSR.
7. Prepare the abstract sheet by providing the rates to the given item of construction.

XI. Preparation of detailed estimate of Septic tank:

(Subject teacher should provide the drawing of Septic tank)

Example:

Abstract Sheet

Sr. No.	Item of Work	Quantity	Unit	Rate/unit	Amount	Remark

Abstract Sheet

Sr. No.	Item of Work	Quantity	Unit	Rate/unit	Amount	Remark

Abstract Sheet

Sr. No.	Item of Work	Quantity	Unit	Rate/unit	Amount	Remark

Abstract Sheet

Sr. No.	Item of Work	Quantity	Unit	Rate/unit	Amount	Remark

Measurement Sheet

Sr. No.	Item of Work	No	L (m)	B (m)	D (m)	Quantity	Unit	Remark

Measurement Sheet

Sr. No.	Item of Work	No	L (m)	B (m)	D (m)	Quantity	Unit	Remark

Measurement Sheet

Sr. No.	Item of Work	No	L (m)	B (m)	D (m)	Quantity	Unit	Remark

Measurement Sheet

Sr. No.	Item of Work	No	L (m)	B (m)	D (m)	Quantity	Unit	Remark

Measurement Sheet

Sr. No.	Item of Work	No	L (m)	B (m)	D (m)	Quantity	Unit	Remark

Measurement Sheet

Sr. No.	Item of Work	No	L (m)	B (m)	D (m)	Quantity	Unit	Remark

XII. Result:

XIII. Interpretation of results:

XIV. Conclusions:

XV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. List out the software available in market for estimate.
2. Plan the dimension of the small septic tank for the G+01 residential bungalow.

Space for Answer

XVI. References/Suggestions for further reading.

- IS:1200: Part 01-1992 Methods of measurement of building and civil engineering works, Part 1: Earthwork.
- IS:1200: Part 02-1974 Methods of measurement of building and civil engineering works, Part 1: Concrete Works.
- IS:1200: Part 03-1976 Methods of measurement of building and civil engineering works, Part 1: Brickwork.
- IS:1200: Part 12-1976 Methods of measurement of building and civil engineering works, Part 1: Plastering & Pointing.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVII. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculation of quantity and prepare measurement & abstract sheet	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 26 **Prepare the rate analysis for the given five item of work.**

I. Practical Significance:

Rate analysis is the art of determining the actual expenditure incurred for executing any particular item of construction. It helps to ensure the proper budget and resource allocation to execute the construction work. Rate analysis helps for effective project planning which leads to execute the work in given time limit.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop skills of rate analysis preparation for any item of work.

III. Course Level Learning Outcome (COs):

- CO4 - Fix the rate for the given item of work using relevant rate analysis technique.

IV. Laboratory Learning Outcome (LLO):

- LLO 26.1 Prepare the rate analysis for the given five item of work.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Rate analysis in construction revolves around systematically determining the cost of various construction activities which involves following:

a) Quantity estimation: It helps to find out the quantity of material, manpower, machinery and funds required for the work completion.
b) Resource estimation: Quantity of each component is known well before the commencement of work, resources can be get allocated to complete the work in time.
c) Cost estimation: Fund required for the completion of work also get calculated, it helps to manage the smooth flow of funds for work completion in time.
d) Risk and contingencies planning: Planning of risk and contingencies can be get managed.
e) Proper formulation of work specification.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Item of work.	Detailed specification of given item work.	01 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.

VIII. Precautions to be followed:

1. Drawing of WBM road should understand carefully.
2. Depth of filling layer should get carefully calculated.
3. Area of cross section at various point should be calculated precisely.

IX. Procedure:

1. Understand the data/drawing carefully.
2. List out the item of work needed to execute for the road construction.
3. Write the standard specification for every item of construction as per the requirement. (For writing specification of work students can use S.S.R.)
4. Find out the quantity of each item of work listed in step no 02.
5. Calculate the depth of cutting and filling at various section carefully.
6. Use the appropriate method to calculate the quantity of earthwork in cutting and filling.
7. Find out the rate of item of work form the latest updated SSR.

X. Prepare the rate analysis for the given five item of work.

(Note: Subject teacher should provide the item of work for rate analysis.)

Example 01:

Example 02:

Example 03:

Example 04:

Example 05:

XI. Result*:*

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the market rate of any ten types of material required in civil engineering works.
2. Enlist the provisions made in IS:1200 with special reference to earthwork calculation.

Space for Answer

XV. References/Suggestions for further reading.

- IS:1200: Part 01 to Part 28 Methods of measurement of building and civil engineering works.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVI. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculate quantity of resources required and total amount	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 27 **Carry out survey and prepare a report on different categories and types of labor required for completion of various items of work on site. (Visit and compare any three sites).**

I. Practical Significance:

By conducting a detailed survey for determining the various category of labor required for construction site requires a detailed observation and analysis. Such a survey helps to allocate the manpower as per the requirement such as skilled, semi-skilled and un skilled manpower requirement. It also helps to complete the construction within time limit by controlling the cost incurred for manpower.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop skills effective manpower allocation as per its requirement and task work.

III. Course Level Learning Outcome (COs):

- CO4 - Fix the rate for the given item of work using relevant rate analysis technique

IV. Laboratory Learning Outcome (LLO):

- LLO 27.1- Carry out survey of different categories of labor it's types, and no of labor for different item of work on site and prepare its report.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Labor categorization in construction focusses on efficient resource allocation/management by providing the categories in labor into skilled, semi-skilled, and unskilled types. This helps to optimize the project timelines, controlling costs, ensuring safety compliance, and maintaining quality standards. These categories enable construction head to deploy resources strategically to enhance productivity, and to minimize risks associated with site work.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Access to under Construction site.	Students should have the access of under construction site of at least three different sites.	03 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.

VIII. Precautions to be followed:

1. Follow the safety protocols during the construction site visit.
2. Maintain the objective of survey during site visit.
3. Keep the proper record of all the observations done on site.
4. Respect the privacy norms of construction company involved in survey.

IX. Procedure:

1. Identify the at least three different types of construction site for survey.
2. Visit the construction site and conduct the survey by observation and interview of the personnel (like site engineer/supervisor/labor etc.) available on site.
3. Identify the major category of labor require don site and their functions.
4. Analyze the labor quantity required for the type of work on site.
5. Review and analyze the data collected to identify patterns and trends in labor requirements.
6. Compare actual findings with initial project estimates or benchmarks to assess accuracy.
7. Organize the report into sections such as introduction, methodology, findings, analysis, and recommendations.

X. Survey report on labor requirement for different categories and types of labor required for completion of various items of work on site.

(Note: Subject teacher should assign the construction site for each batch separately.)

Report of Site Visit 01

01 Name of Site: .....

02 Address of Site: .....

.....

03 Contact person of site: .....

04 Type of structure: .....

05 Total area of structure: .....

06 Approximate Cost of structure: .....

Sr. No.	Item of Work	Category of labor	Particulars of job	No. of labor required	Rate/day

Sr. No.	Item of Work	Category of labor	Particulars of job	No. of labor required	Rate/day

Report of Site Visit 02

01 Name of Site: .....

02 Address of Site: .....

.....

03 Contact person of site: .....

04 Type of structure: .....

05 Total area of structure: .....

06 Approximate Cost of structure: .....

Sr. No.	Item of Work	Category of labor	Particulars of job	No. of labor required	Rate/day

Sr. No.	Item of Work	Category of labor	Particulars of job	No. of labor required	Rate/day

Report of Site Visit 03

01 Name of Site: .....

02 Address of Site: .....

.....

03 Contact person of site: .....

04 Type of structure: .....

05 Total area of structure: .....

06 Approximate Cost of structure: .....

Sr. No.	Item of Work	Category of labor	Particulars of job	No. of labor required	Rate/day

Sr. No.	Item of Work	Category of labor	Particulars of job	No. of labor required	Rate/day

XI. Result*:*

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the market rate of any ten types of skilled/semi-skilled/unskilled/labor in civil engineering works.
2. State the taskwork of any ten types of items of work with relevant type of labor.

Space for Answer

XV. References/Suggestions for further reading.

- IS:1200: Part 01 to Part 28 Methods of measurement of building and civil engineering works.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVI. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Prepare survey report on different categories and types of labor required for constriction items	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 28 **Preparation of chart reflecting all values pertaining to valuation of residential building with their significance.**

I. Practical Significance:

Valuation is the process of determining the market value of a property. For the valuation of property needs to create a comprehensive chart which involves detailed several key values like market value, assessed value, replacement cost, income approach value, comparable sale value etc. each value serves a distinct purpose for determining the valuation of property.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop skills of preparing charts required for valuation of residential building.

III. Course Level Learning Outcome (COs):

- CO5 - Conduct the process of the valuation for the specified purpose.

IV. Laboratory Learning Outcome (LLO):

- LLO 28.1 Prepare the chart reflecting all values pertaining to valuation of residential building with their significance.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Residential building valuation requires fundamental principles and methodologies for determining property worth/value. Market value of a property is derived from the interaction of supply and demand in the market and forms the basic property price. It comprises the cost of replacement of property, property depreciation etc. While fixing the property valuation the income generating potential of property is also considered.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Building Project	Detailed information about building project.	01 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.

VIII. Precautions to be followed:

1. Ensure that all data used in the valuation process, such as property details, comparable sales, and market trends, are accurate and reliable.
2. Conduct a thorough inspection and evaluation of the property to assess its condition, amenities, and overall quality.

IX. Procedure:

1. Data collection: Collect the all-reliable relevant data of property.
2. Property Inspection: Visit the property and do the thorough inspection of property and assess the

condition of property.

3. Valuation Methods: Apply appropriate valuation methods such as cost approach, and income approach based on the property type.
4. Final Valuation Report: Prepare a comprehensive valuation report based on detailed findings, ensuring compliance with professional standards and client requirements.

X. Preparation of chart reflecting all values pertaining to valuation of residential building:

(Note: Subject teacher should provide the locally available residential building for valuation.)

Example: *(Write all the details of building of which the valuation report will prepare).*

1. **Market Survey:** Student's should visit to the locality and find out the recent sell price of various properties by verbal communication with local person/Real Estate agents etc. & Significant search from the public domain.

Sr. No.	Property type	Property Address	Size (m^2)	Age (years)	Special Features	Date of sold	Sale Price (per m^2)
01							
02							
03							
04							
05							
Average Sell Price:			**Average Size:**			**Average Age:**	

2. **Comparative market analysis:** Students should compare the subject property with the similar properties that have recently sold or are currently on the market.

Sr. No.	Details of Same Property	Property Address	Size (m^2)	Age (years)	Special Features	Date of sold	Sale Price (per m^2)
01							
02							
03							
04							
05							
Average Sell Price:			**Average Size:**		**Average Age:**		

3. **Cost Approach Valuation:** Students should find out the present market value of land, building construction, maintenance cost just to assure the cost of replacement for the property.

Sr. No.	Component	Estimated Cost
01	Land Value	
02	Site preparation	
03	Construction Cost	
	Total Cost:	
	Cost per m^2/sq.ft	

4. **Income approach of property:** Students should evaluate potential income from rent (per year) to determine value of property.

Sr.	Component	Estimated Cost
01	Property Name	
02	Rent Earned	
03	Any other income	
A	**Total Income:**	
01	Vacant commodity income loss.	
02	Maintenance Cost	
B	**Total Loss or Total outgoing:**	
C	**Net Income of property:**	

5. **Value Finalization:** Prepare a comprehensive valuation report documenting the property's details, analysis methods used, and the final determined value.

A. Land Valuation

Sr. No.	Particulars of property	Govt. Valuation	Fair Market Value
01	Market rate of land.		
02	Fair Market rate of land considering all parameters. (Like demand & supply etc.)		
03	**Total land area**		
04	**Total Value of Land**		

B. Valuation of Building:

Sr. No.	Particulars of property	Govt. Valuation (per m^2/per sq.ft)	Fair Market Value (per m^2/per sq.ft)
01	Replacement cost		
02	Income approach of property		
03	Rate Adopted (01+02)		
04	Covered Area		
05	**Total Value** (03 x 04)		

XI. Result*:*

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the factors affecting the market value of property?
2. How does the condition of a property impact its valuation?

Space for Answer

XV. References/Suggestions for further reading.

- Book: The Valuation of Real Estate by Arthur L. Schwartz.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVI. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Prepare chart required for valuation	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 29 Preparation of valuation report for the given building.

I. Practical Significance:

Valuation is the process of determining the market value of a property. A valuation report of a building is important for any legal transaction related to building or property. This is helpful for financial planning, legal compliance etc. related to property.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop skills of preparing the valuation report of residential building.

III. Course Level Learning Outcome (COs):

- CO5 - Conduct the process of the valuation for the specified purpose.

IV. Laboratory Learning Outcome (LLO):

- LLO 29.1- Determine the valuation of a given structure and submits the valuation report in prescribed formats.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Residential building valuation requires fundamental principles and methodologies for determining property worth/value. Market value of a property is derived from the interaction of supply and demand in the market and forms the basic property price. It comprises the cost of replacement of property, property depreciation etc. While fixing the property valuation the income generating potential of property is also considered.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Building Project	Detailed information about building project.	01 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.

VIII. Precautions to be followed:

1. Ensure that all data used in the valuation process, such as property details, comparable sales, and market trends, are accurate and reliable.
2. Conduct a thorough inspection and evaluation of the property to assess its condition, amenities, and overall quality.

IX. Procedure:

1. Data collection: Collect the all-reliable relevant data of property.
2. Property Inspection: Visit the property and do the thorough inspection of property and assess the condition of property.
3. Valuation Methods: Apply appropriate valuation methods such as cost approach, and income approach

based on the property type.

4. Final Valuation Report: Prepare a comprehensive valuation report based on detailed findings, ensuring compliance with professional standards and client requirements.

X. Preparation of valuation report of residential building:

(Note: Subject teacher should provide the locally available residential building for valuation. Subject teacher should ask the students to collect sample valuation report and with reference to the sample report prepare the valuation report.)

Example: *(Write all the details of building like name of building of which the valuation report will prepare).*

VALUATION REPORT

XI. Result*:*

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the environmental factors which affects the market value of property.
2. State the factors which affect the market price of land and any building.

Space for Answer

XV. References/Suggestions for further reading.

- Book: The Valuation of Real Estate by Arthur L. Schwartz.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVI. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Prepare valuation report for the given building	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 30 **Determination of the monthly rent of the given area of building from the given data.**

I. Practical Significance:

The process of determining the monthly rent of a building involves the various factors like location, size, condition, and market demand of property. This process helps the owner to fix the competitive rents of property which leads to enhance the income value of property. It is important for financial planning and ensuring the net income from property.

II. Industry/Employer expected outcome(s):

- This practical is expected to develop skills of monthly rent fixation of building.

III. Course Level Learning Outcome (COs):

- CO 5 - Conduct the process of the valuation for the specified purpose.

IV. Laboratory Learning Outcome (LLO):

- LLO 30.1 Determine the monthly rent of the given area of the building from the given data..

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of basic mathematics.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

The process of determining the monthly rent of a building works with a principle of demand and supply. As per the market condition and preferences of tenants the rent is finalized by considering the gross earnings and net outgoing required for maintaining the building or property. To ensure the profit aspect the owner has to do follow the process of rent fixation in accordance with the affordability of tenants.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Building Project	Detailed information about building project.	01 nos.
02	State schedules of rates.	Latest State schedules of rates published by PWD Maharashtra.	01 nos.

VIII. Precautions to be followed:

1. Ensure that all data used in the rent fixation process, such as gross earnings and net outgoing required for maintaining the property must be accurate and reliable.
2. Conduct a thorough inspection and evaluation of the property to assess its condition, amenities, and overall quality.

IX. Procedure:

1. Data collection: Collect the all-reliable relevant data of property.
2. Property Inspection: Visit the property and do the thorough inspection of property and assess the condition of property.
3. Financial Consideration: Calculate the gross earning and maintenance cost of building and sustainable rent level.

4. Rent Finalization: After calculation of gross earning, net outgoing fair return expected from owner finalize the monthly rent of building.

X. Preparation of valuation report of residential building:

(Note: Subject teacher should provide the problem of monthly rent fixation of residential building.)

Example:

XI. Result*:*

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Explain how the location of property affects the monthly rent of property.
2. State the factors which affect the monthly rent of building.

Space for Answer

XV. References/Suggestions for further reading.

- Book: The Valuation of Real Estate by Arthur L. Schwartz.
- SP:27: 1987 Handbook of Method of Measurement of Buildings Works.

XVI. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage
A.	**Process Related (15 marks)**	**60%**
1.	Calculation of parameter concerned	40%
2.	Individual/Teamwork	20%
B.	**Product Related (10 marks)**	**40%**
3.	Answers to practical related questions.	25%
4.	Submission of report on time.	15%
C.	**Total marks (25 marks)**	**100%**

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	