

Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Estimating and Costing
Course Code : 22503

1. RATIONALE

In the construction of any civil structure, specifications of the civil work are the significant parameters in deciding the cost of the project. In construction, it is often required to use the local material for which the rates are varying in greater extent across the country. The rate analysis justifies the rates to be finalized for various items of works based on local market survey for budget provision. Therefore there emerges the need of a discipline to suggest a specific scientific technique to determine the quantities and cost of the materials along with its justification. Thus, this course provides the necessary knowledge and skills in developing the competency in the areas mentioned above in professional manner. Today being the era of technology, a provision has also been made to use the various software’s for more accuracy and speedy determination of quantities.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Prepare the estimate of civil engineering works.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Select the modes of measurements for different items of works.
- Prepare approximate estimate of a civil engineering works.
- Prepare detailed estimate of a civil engineering works.
- Justify the rate for given items of work using rate analysis techniques.
- Use relevant software for estimating the quantities and cost of items of works.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
Max	Min	Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40

()*: Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.



5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

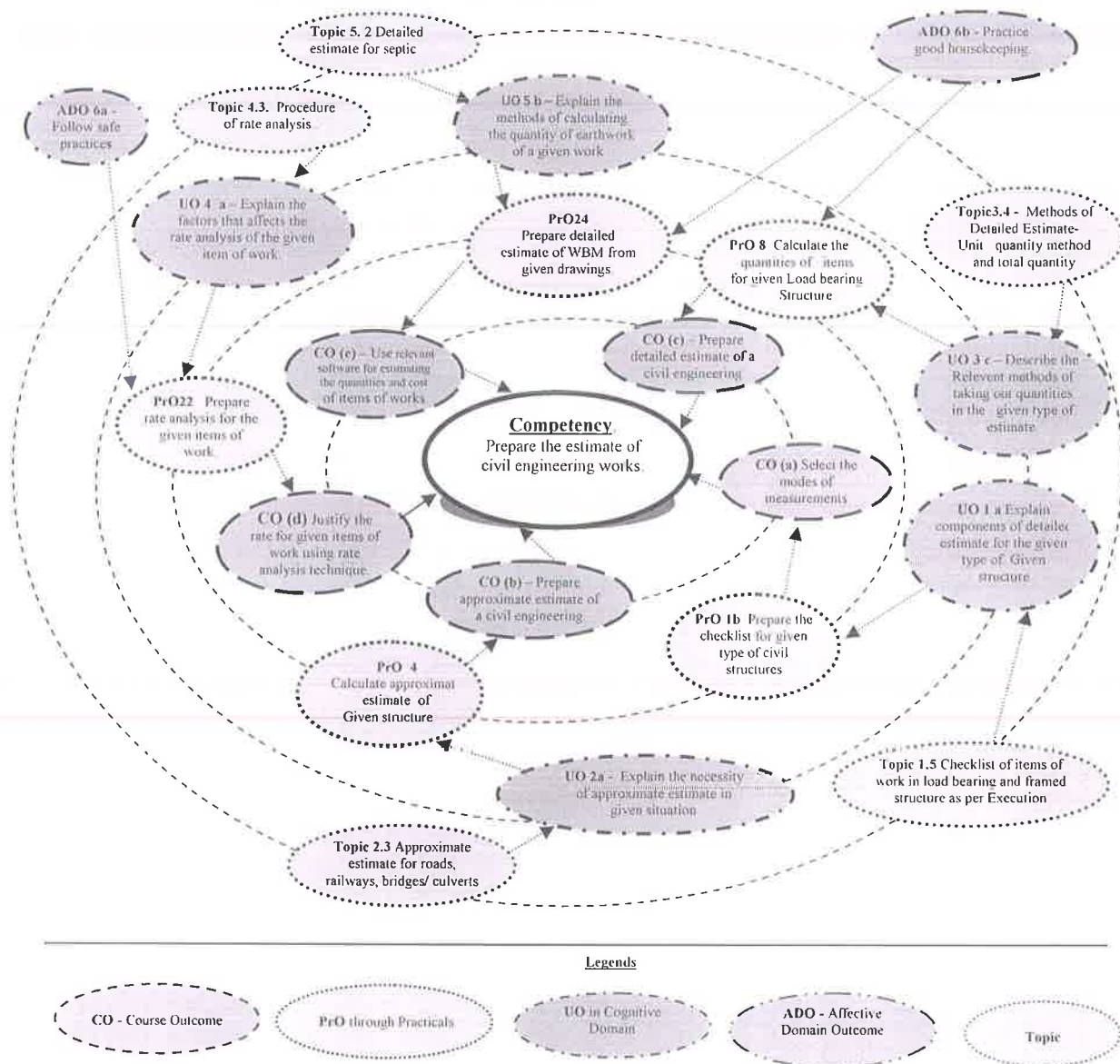


Figure 1 - Course Map

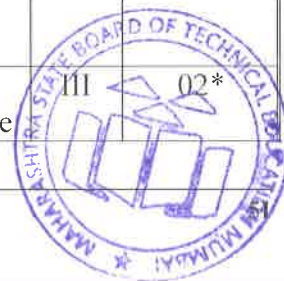
6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Prepare the check list of items to be executed with units for detailed estimate of the given structure from the given drawing.	I	02*
2.	Prepare a report on market rates for given material, labour wages, hire charges of tools & equipments required to construct the	IV	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	given structure as mentioned in at Serial number 1 above.		
3.	Prepare the detailed Specification for the given items using DSR (for any ten item)	I	02*
4.	Prepare the approximate estimate for the given civil engineering works.	II	02*
5.	Prepare approximate estimate for the given civil engineering works.	II	02*
6.	Prepare bill of quantities of given item from actual measurements. (any four items).	III	02*
7.	Prepare bill of quantities of given item from actual measurements. (any four items).	III	02*
8.	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).	III	02*
9.	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).	III	02*
10.	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).	III	02*
11.	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).	III	02
12.	Prepare detailed estimate from the given set of drawings using “standard measurement and abstract format” for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building) .	III	02*
13.	Prepare detailed estimate from the given set of drawings using “standard measurement and abstract format” for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building) .	III	02*
14.	Prepare detailed estimate from the given set of drawings using “standard measurement and abstract format” for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building) .	III	02*
15.	Prepare detailed estimate from the given set of drawings using “standard measurement and abstract format” for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building) .	III	02*
16.	Prepare detailed estimate from the given set of drawings using “standard measurement and abstract format” for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart ,lead statement (G+1 Building) .	III	02
17.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule	III	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	(footing,column,beam,lintel with chajja, slab)		
18.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing,column,beam,lintel with chajja, slab)	III	02*
19.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing,column,beam,lintel with chajja, slab)	III	02*
20.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing,column,beam,lintel with chajja, slab)	III	02*
21.	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing,column,beam,lintel with chajja, slab)	III	02
22.	Prepare the rate analysis for the given five item of works	IV	02*
23.	Prepare the rate analysis for the given five item of works	IV	02
24.	Prepare detailed estimate of W.B.M.Road of one kilometer length from the given drawing.	V	02*
25.	Prepare detailed estimate of W.B.M.Road one kilometer length from the given drawing.	V	02
26.	Prepare detailed estimate of small Septic tank from the given set of drawings.	V	02*
27.	Prepare detailed estimate of small Septic tank from the given set of drawings.	V	02
28.	Prepare detailed estimate of well from the given set of drawing.	V	02*
29.	Prepare detailed estimate of well from the given set of drawing.	V	02
30.	Use the relevant software to prepare detailed estimate of any one of the WBM Road/Septic Tank/ well.	V	02*
31.	Use the relevant software to prepare detailed estimate of any one of the WBM Road/Septic Tank/ well.	V	02*
32.	Use the relevant software to prepare detailed estimate of any one of the WBM Road/Septic Tank/ well.	V	02
	Total		64

Note

- i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Calculation of quantities.	40
b.	Preparing measurement sheet	20
c.	Preparing Abstract sheet	20
d.	Answer to sample questions	10



S. No.	Performance Indicators	Weightage in %
e.	Submit report in time	10
Total		100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a. Practice good housekeeping.
- b. Follow the provisions laid in IS 1200.
- c. Practice to follow DSR.
- d. Demonstrate working as a leader/a team member.
- e. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1.1	Computer system (Any computer system with basic configuration)	30,31,32
1.2	Available Software of estimating and Costing.	30,31,32

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
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<p>Unit – I Fundamentals of estimating and costing</p>	<p>1a. Explain the procedure of the detailed estimate for the given structure.</p> <p>1b. Prepare the checklist for the given type of the civil structure.</p> <p>1c. Select the mode of measurements for given items of work as per IS: 1200.</p> <p>1d. Describe the required specifications for the given item of structure.</p> <p>1e. Apply the rules of deduction as per IS 1200 for calculating the quantities of a structure.</p> <p>1f. Explain the salient features of the administrative and technical approval for the given project.</p> <p>1g. Classify the given type of estimate on the basis of the purpose and type of work.</p>	<p>1.1 Estimating and Costing – Meaning, purpose, Administrative Approval, Technical Sanction and Budget provision.</p> <p>1.2 Types of estimates – Approximate estimate and detailed estimate.</p> <p>1.3 Detailed Estimate- of New work.</p> <p>1.4 Types and Uses of Estimates: Revised estimate, supplementary estimate, revised and supplementary estimate, repair and maintenance estimate, renovation Estimate.</p> <p>1.5 Roles and responsibility of Estimator.</p> <p>1.6 Checklist of items of work in load bearing and framed structure as per Execution.</p> <p>1.7 Modes of measurement and Desired accuracy in measurements of different items of work as per IS:1200.</p> <p>1.8 Rules for deduction in Masonry work , Plastering and Pointing and Painting work as per IS:1200.</p> <p>1.9 Description / specification of items of building work as per PWD /DSR.</p> <p>1.10 Standard formats of Measurement sheet, Abstract sheet, Face sheet.</p>
<p>Unit -II Approximate Estimates</p>	<p>2a. Explain the necessity of approximate estimate in the given situation.</p> <p>2b. Describe the methods used in determining the approximate estimate for the given structure.</p> <p>2c. Prepare the approximate estimate for given civil engineering works.</p> <p>2d. Select the relevant method of approximate estimate for the given structure.</p> <p>2e. Calculate approximate cost of the given structure.</p>	<p>2.1 Approximate estimate- Definition, Purpose.</p> <p>2.2 Methods of approximate estimate - Service unit method, Plinth area rate method, Cubical content method, Typical bay method, Approximate quantity method.</p> <p>2.3 Approximate estimate for roads, Railways, bridges/culvert, irrigation projects and water supply projects.</p> <p>2.4 Numericals on service unit method and Plinth area rate method.</p>



<p>Unit-III Detailed Estimate</p>	<p>3a. Describe the procedure of preparation of detailed estimate for the given civil structure.</p> <p>3b. Identify the data required for given type of estimate.</p> <p>3c. Describe the relevant methods of taking out quantities in the given type of estimate.</p> <p>3d. Calculate the quantities of the given items for the given Load bearing structure.</p> <p>3e. Calculate the quantities of the given items (of footing, column, beam, Lintel, chajja , slab and Brickwork) for the given RCC Framed structure.</p> <p>3f. Calculate the approximate quantity of steel for the given RCC member such as footing, column, beam, Lintel, chajja and slab.</p> <p>3g. Prepare the bill of quantity for the given type of civil work.</p>	<p>3.1 Detailed Estimate- Definition and Purpose, Data required for detailed estimate, Procedure of preparation of detailed estimate- Taking out quantities and Abstracting.</p> <p>3.2 Methods of Detailed Estimate- Unit quantity method and total quantity method.</p> <p>3.3 Long wall and Short wall method (out to out and in to in method or PWD method), Centre line method.</p> <p>3.4 Bar bending schedule.</p> <p>3.5 Steel requirement for footing, column, beam, Lintel, chajja and slab.</p> <p>3.6 Provisions in detailed estimate: contingencies, work charged establishment, centage charges, water supply and sanitary Charges and electrification charges.</p> <p>3.7 Prime cost, Provisional sum, provisional Quantities, Bill of quantities, Spot items or Site items, Day work.</p>
<p>Unit –IV Rate Analysis</p>	<p>4a. Explain the factors that affect the rate analysis of the given item of work.</p> <p>4b. Describe Procedure of rate analysis for the given item of work.</p> <p>4c. Mention task work for given type of work.</p> <p>4d. Prepare rate analysis for the given items of work.</p> <p>4e. Describe the factors affecting the task work for the given situation.</p>	<p>4.1 Rate Analysis : Definition, purpose, importance and factors affecting.</p> <p>4.2 Lead (Standard and Extra), lift, overhead charges, water charges and contractors profit,</p> <p>4.3 Procedure of rate analysis.</p> <p>4.4 Task work- Definition, factors Affecting, types. Task work of different skilled labour for different items.</p> <p>4.5 Categories of labours, their daily wages, types and number of labours for different items of work</p> <p>4.6 Load carrying capacity of different types of vehicles, transportation of materials and their hire -charges.</p> <p>4.7 Preparing rate analysis of different items of work- PCC,RCC work in (column, beam, lintel, slab), brick masonry. stone masonry, Vitrified tile flooring, plastering, , Wood work for doors.</p>
<p>Unit –V Estimate for Civil</p>	<p>5a. Calculate the earthwork quantity for the given civil engineering works.</p>	<p>5.1 Earthwork - Quantities for roads Bunds and canal by – Mid sectional area method. mean sectional area</p>



Engineering works	5b. Explain the relevant method(s) of calculating the quantity of earthwork of the given work 5c. Prepare detailed estimate for given civil engineering work. 5d. Use the relevant software for preparing the detailed estimate for the given work.	method, Prismoidal formula method and trapezoidal formula method. 5.2 Detailed estimate for septic tank, Community well. 5.3 Use of computer / softwares / programmes for detailed estimate Preparation of Civil Engineering Works works. (Questions on application of software from sub unit 5.3 above shall not be asked in theory exam.)
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Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of estimating and costing.	08	04	04	04	12
II	Approximate Estimate	04	02	00	04	06
III	Detailed Estimate	20	02	08	18	28
IV	Rate Analysis	08	02	04	06	12
V	Estimate for Civil Engineering works	08	00	06	06	12
Total		48	10	22	38	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare detailed estimate of single room of load bearing structure..
- Give seminar on relevant topic.
- Undertake micro-projects.
- Collect current DSR from PWD and prepare report on it.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:



- a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- b. '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e. Guide student(s) in undertaking micro-projects.
- f. Demonstrate students thoroughly before they start estimating..
- g. Encourage students to refer different websites to have deeper understanding of the subject.
- h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first two semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here:

- a. Compare the two detailed estimates collected from professionals along with your comments in the form of a report.
- b. Prepare approximate estimate of various types of building such as school building, hospital, auditorium, Hostel, irrigation project, bridge in the immediate vicinity of your area.
- c. Prepare detailed estimate of any load bearing structure using available software.
- d. Prepare detailed estimate of the framed structure using available software.
- e. Prepare rate analysis of Painting work using OBD, Plastic emulsion, Oil paint, luster paint.
- f. Prepare detailed estimate for the proposed new Bituminous Road of 1 km length.
- g. Prepare detailed estimate for the construction of Slab Culvert.
- h. Prepare detailed estimate for the construction of Pipe Culvert.
- i. Prepare estimate for Renovation of an existing building (any five items).
- j. Prepare Rate analysis using CSR/DSR (Current/District Schedule of Rates) Items by PWD Methods.(Any Five items)
- k. Prepare the report on the salient provisions made in IS:1200 with special reference to load bearing structure.

13. SUGGESTED LEARNING RESOURCES :

S. No.	Title of Book	Author	Publication
1	Estimating and Costing in	Datta, B.N.	UBS Publishers Distributors Pvt.



S. No.	Title of Book	Author	Publication
	Civil engineering		Ltd. New Delhi. ISBN:9788174767295
2	Estimating construction cost (fifth edition)	Peurifoy,Robert L. Oberlender,Garold	McGraw Hill Education, , New Delhi, 2005, ISBN-10: 0073398012 ISBN-13: 9780073398013
3	Estimating and Costing	Rangwala,S.C.	Charotar Publishing House PVT. LTD., Anand (Gujrat) Pin 388001 Reprint -2011
4	Estimating and Costing	Birdie,G.S.	Dhanpat Rai Publishing Company(P) Ltd.NewDelhi110002 ISBN : 978-93-84378-13-4
5	Civil Engineering Contracts and Estimates	Patil,B.S.	Orient Longman, Mumbai, Ed.2010 ISBN: 9788173715594, 8173715599
6	Estimating and costing, specification and valuation in civil engineering	Chakraborti,M.	Monojit Chakraborti, Kolkata (2006) ISBN-10: 818530436X ISBN-13: 978-8185304366

14. SOFTWARE/LEARNING WEBSITES

- a. www.ensoftindia.com
- b. www.newtonindia.com
- c. www.mahapwd.com

