GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester - V

Course Title: Estimating & Costing
(Course Code: 4355003)

Diploma programme in which this course is offered	Semester in which offered
Diploma in Architectural Assistantship	5th Semester

1. RATIONALE

The syllabus for Estimating and Costing is carefully designed to equip students with a comprehensive understanding of the fundamental principles and best practices associated with estimating and costing in the context of construction projects. This course aims to prepare students for the inevitable challenges they will encounter in the construction industry, where they will be tasked with accurately assessing the costs of materials, labor, and equipment, while effectively managing budgets and timelines. By engaging in this course, students will acquire the essential skills necessary to calculate the estimated construction cost of a building. Moreover, they will develop a proficiency in discerning between present material and labor costs. An additional benefit of studying Estimating and Costing is that it enables students to grasp the profound impact that design choices have on the overall project cost. Armed with this knowledge, students can make informed design decisions that not only satisfy the aesthetic requirements of their clients but also adhere to the project's financial constraints. For architects, estimating the construction cost of a designed building is of paramount importance. It facilitates the ability to work within budgetary limitations while also enabling clients to plan and arrange the necessary finances at different stages of the construction process. Ultimately, this course empowers students to thrive in the field of architecture by cultivating efficiency and effectiveness in their work.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills so that students are able to acquire following competency:

- **Calculate the estimated construction cost of a given building and prepare different types of detailed estimates through rate analysis**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Select the modes of measurements for different items of works.
b) Prepare approximate estimate of a civil engineering works.
c) Prepare detailed estimate of a civil engineering works.
d) Justify the rates for given items of work using rate analysis techniques.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical/Studio Marks		Total Marks
L	T	P/S	C	CA	ESE	CA	ESE	
2	0	2	3	70	30	25	25	150

Legends: ***L****-Lecture; T – Tutorial/Teacher Guided Theory Practice;* ***P/S*** *– Practical/studio;* ***C*** *– Credit,* ***CA*** *- Continuous Assessment;* ***ESE*** *- End Semester Examination.*

5. SUGGESTED PRACTICAL/STUDIO EXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs. T*hey are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'*.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	a. Measure at least 10 Construction items using different modes. b. Draft specification of at least 10 construction items.	I	6
2	a. Prepare approximate estimate using various methods.	II	4
3	Prepare Estimate of following: a. Detailed estimate of a bungalow. b. R.C.C. Slab, Beam, Column with footing.	III	12
4	Perform Rate Analysis of at least 10 Construction items.	IV	6
	Total Hrs.		**28**

Note

i. *More* ***Practical/Studio Exercises*** *can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list****.***

ii. *Study report, data collection and analysis report must be assigned in a group. Teacher has to discuss about type of data (which and why) before group start their site visits.*

iii. *The following are some* ***sample*** *'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed* ***Practical/Studio Exercises*** *of this course required which are embedded in the COs and ultimately the competency.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Calculation of quantities	40
2	Preparing measurement sheet, abstract sheet	20
3	Accuracy of work submitted	10
4	Neatness of work submitted	10
5	Timely submission of completed work	10
6	Answering viva voce questions	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Measuring Tape, Laser measure tape	1
2	Interactive board with LCD overhead projector.	1-4

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfil the development of this competency.

a) Work as a leader/a team member.
b) Follow ethical practices.
c) Social and Functional Competence of design.
d) Participates in class discussions and present the design effectively, Generate new ideals.
e) Practice environmentally friendly methods and design processes.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year.
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit –I **Fundamentals of Estimating and Costing**	**1a.** Define Estimating. **1b.** Classify Estimates. **1c.** Enlist methods of preparing Approximate Estimate and Detailed Estimate **1d.** Understand different modes of measurement **1e.** Describe importance, types and principles of specifications **1f.** Interpret and use brief specifications for given item of construction **1g.** Draft Specifications of basic construction items	1.1 Definition: Estimating and Costing. 1.2 Objectives of Estimating. 1.3 Types of Estimating: 1.3.1 Approximate Estimate. 1.3.2 Detailed Estimate. 1.4 Roles and responsibility of Estimator. 1.5 Modes of measurement and desired accuracy in measurements for different items of work as per prevailing IS Code. 1.6 Rules for deduction in different items of work as per prevailing IS Code. 1.7 Specifications: Importance and types 1.7.1 Principles of drafting specifications. 1.7.2 Detailed specifications of items of building work as per PWD.
Unit– II	**2a.** Define purpose of approximate estimates	2.1 Definition and purpose of approximate estimates. 2.2 Methods of preparing approximate

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Approximate Estimates	**2b.** Prepare approximate estimate using various methods	estimate 2.2.1 Service unit method. 2.2.2 Plinth area method. 2.2.3 Cubical content method. 2.2.4 Typical bay method.
Unit – III Detailed Estimates	**3a.** State and explain data required for Estimating and Costing. **3b.** Find out quantities of different construction items as per mode of measurement **3c.** Prepare detailed estimate **3d.** Prepare bar bending schedule **3e.** Prepare estimate for basic RCC structures **3f.** Prepare measurement sheet and abstract sheet in Microsoft Excel	3.1 Detailed Estimate: Definition and Purpose. 3.2 Data required for detailed estimate. 3.3 Methods of detailed estimate: 3.3.1 Long wall and short wall method. 3.3.2 Center line method. 3.4 Bar bending schedule. 3.5 Detailed estimate of RCC slab, RCC beam, RCC column with footing. 3.6 Detailed estimate of a bungalow. 3.7 Billing – Abstract sheet – Measurement Sheet – Excel Sheet.
Unit – IV Rate Analysis	**4a.** State and explain data required for rate analysis. **4b.** Explain task work. **4c.** Prepare rate analysis. **4d.** Conduct survey for current market rates.	4.1 Rate analysis: Definition, purpose and importance. 4.2 Factors affecting rate analysis. 4.3 Task work: 4.3.1 Factors affecting task work. 4.3.2 Task work for various skilled and unskilled labour. 4.4 Schedule of rates and market survey. 4.5 Rate analysis of various building items.

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	07	4	6	8	18
II	Approximate Estimates	04	2	2	4	08
III	Detailed Estimate	10	4	6	16	26
IV	Rate Analysis	07	4	4	10	18
Total		**28**	**14**	**18**	**38**	**70**

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

Note*: This specification table provides general guidelines to assist learners for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.*

10. SUGGESTED LEARNER ACTIVITIES

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

a) Survey market for current rates of material, labour and the construction items.
b) Visit nearby small construction site, where major construction activities carried out.
c) Prepare rate analysis of different construction items.
d) Draft specifications for various construction items.
e) Prepare estimate for given residential building drawing.
f) Compare the actual analysis of rates of items with the S.O.R.
g) Take measurements of any small building and calculate quantity and estimated cost.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide learner(s) in undertaking micro-projects.
c) ***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the learners for ***self-learning***, but to be assessed using different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Guide learners on how to address issues on non-specified drawing data, small variation in rates, etc.
g) Use relevant video/animation films to explain various concepts and processes related to basic Architectural design themes for Public Buildings.
h) Use different instructional strategies in classroom teaching.
i) Use the relevant architectural assignments in the given situation.
j) Guide learners on form, functions utility, method of construction, etc. to facilitate them to prepare estimated cost of structure.
k) Use the technique of table top discussions along with design jury sessions to teach the relevant content to the learners.
l) Adopt various strategies to enhance each learner's individual creative ability especially with reference to concept and form.

12. SUGGESTED DESIGN MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a learner that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of learners in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each learner 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 duration of the microproject should be about **14-16 (fourteen to sixteen) learner engagement hours** during the course. The learners ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the Co. Similar micro-projects could be added by the concerned course teacher:

a. Study of on-going constructions works and documentation of the provisions of Estimating and Costing in the form of a report with photographs and sketches.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Estimating and Costing in Civil Engineering (Theory and Practice)	B.N. Dutta	UBS Publishers Distributor Pvt. Ltd. New Delhi ISBN:9788174767295
2	Estimating and Costing in Civil Engineering	S.C. Rangwala	Charotar Publishing House PVT. LTD., Anand (Gujrat) Pin 388001 ISBN: 9789385039058
3	Estimating and Costing	M. C. Chakraborty	Monojit Chakraborti, Kolkata (2006) ISBN-10: 818530436X ISBN-13: 9788185304366
4	A textbook of Estimating and Costing	G. S. Birdie	Dhanpat Rai Publishing Company(P) Ltd.NewDelhi-110002 ISBN: 9789384378134
5	Estimating and Costing	Prof. V.N. Vazirani and Prof. S.P. Chandola	Khanna Publishers ISBN-10: 8174091270 ISBN-13: 978-8174091277
6	Hand book of Methods of Measurement of building works	SP 27:1987	BIS
7	PWD Schedule of Rates		
8	Manual of Specifications and Standards for DBFOT projects, EPC works		

14. SOFTWARE/LEARNING WEBSITES

A. https://onlinecourses.swayam2.ac.in/nou20_cs11/preview

B. www.cpwd.gov.in › Publication

15. PO-COMPETENCY-CO MAPPING

Semester V	Estimating and Costing (Course Code: 4355003)
	POs and PSOs

Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineer-ing Tools, Experimentation &Testing	PO 5 Engineer-ing practices for society, sustain-ability & environ-ment	PO 6 Project Management	PO 7 Life-long learning	* PSO 1 Planning & Design	#PSO 2 Execution
Competency	• **Calculate the estimated construction cost of a given building and prepare different types of detailed estimates through rate analysis.**								
Course Outcomes a) Select the modes of measurements for different items of works	3	1	-	-	2	-	1	-	3
b) Prepare approximate estimate of a civil engineering works	3	3	3	-	2	1	2	3	2
c) Prepare detailed estimate of a civil engineering works	3	3	3	-	2	2	2	3	2
d) Justify the rates for given items of work using rate analysis techniques	2	2	-	-	2	2	2	1	1

*Legend: '**3'** for high, '**2**' for medium, **'1'** for low and **'-'** for no correlation of each CO with PO/PSO.*

***PSO 1: Planning and Design:** Prepare architectural designs and all types of drawings with appropriate material specifications and application techniques as per specific requirements of the project.

#PSO 2: Execution: Work competently as assistants in architectural firms so as to contribute and coordinate both office work and execution on site

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No	Name and Designation	Institute	Contact No.	Email
1	Shri Bhaskar J. Iyer, HOD (Arch), Coordinator & Associate Dean	Government Polytechnic for Girls, Ahmedabad	9879474833	bhaskariyer2004 @gmail.com
2	Shri Hasmukh S. Patel, Lecturer	Government Polytechnic for Girls, Ahmedabad	9426026207	hspatelgpv@gmail.com
3	Shri Abhijit R. Rathod, Lecturer	Government Polytechnic for Girls, Ahmedabad	9925006100	arrathod1709@gmail.com