

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM**

**COURSE TITLE: ESTIMATING, COSTING AND ENGINEERING CONTRACTING  
(COURSE CODE: 3351905)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Mechanical Engineering	5 <sup>th</sup> Semester

### 1. RATIONALE

This course is designed to develop the ability in the students to evaluate materials, consumables and process costs in the monetary units. Hence, it will help to increase the productivity of the organization and conservation of valuable resources. This course will also help in developing the skills required in the process of decision making and to plan, use, monitor and control resources optimally and economically. This will also be helpful in budgeting. The realm of this course is enlarged to estimate the process costs for fluid and thermal applications also.

### 2. LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies:

- Plan, use and control resources optimally and economically.
- Estimate production/operation cost for budgeting and analysis.

### 3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning objectives in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- i. Calculate material cost of given component/product.
- ii. Identify and estimate elements of cost in various processes.
- iii. Perform break even analysis to calculate break even quantity.
- iv. Investigate the problem of cost and suggest their solution using cost reduction techniques.
- v. Interpret given model of balance sheet and profit loss account.
- vi. Prepare simple engineering contracts.

### 4. TEACHING AND EXAMINATION SCHEME

<b>Teaching Scheme (In Hours)</b>			<b>Total Credits (L+T+P)</b>	<b>Examination Scheme</b>				
				<b>Theory Marks</b>		<b>Practical Marks</b>		<b>Total Marks</b>
<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>ESE</b>	<b>PA</b>	<b>ESE</b>	<b>PA</b>	
2	0	2	4	70	30	20	30	150

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

## 5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit – I</b> <b>Introduction.</b>	1a.Explain the terminology of ECC- cost elements, overheads, selling price and catalogue price. 1b.Explain need, scope & importance of ECC in industries. 1c.Compare costing and estimating.	1.1 Need, Scope & importance of ECC in industries. 1.2 Difference between costing and estimating. 1.3 Terminology associated with various cost elements and their classification. 1.4 Terminology associated with overheads, their classification and allocation. 1.5 Determination of selling price and catalogue price.
	1d. Select appropriate method of depreciation and calculate it.	1.6 Depreciation and obsolescence: Definition, types, different methods of calculating depreciation, numeric examples.
	1e. Calculate machine hour rate (MHR) and process hour rate (PHR).	1.7 Concept of Machine Hour Rate (MHR) and process hour rate (PHR). 1.8 Method to calculate MHR for any machine/machine tool. 1.9 Method and example to calculate MHR of Lathe, Milling, Drilling, Grinding and Press tool. 1.10 Method to calculate PHR for any process. 1.11 Method and example to calculate PHR of running diesel generating set, running air conditioner, running refrigerator, welding and gas cutting.
<b>Unit – II</b> <b>Break even analysis.</b>	2a. Classify costs.	2.1 Classification of costs as fixed and variable costs. 2.2 Relationship between the costs and quantity of production.

	2b. Construct break even chart and determine break even quantity from given data.	2.3 Break Even Chart : i. Definition of Break Even Point (BEP) and its needs in industry. ii. Procedure of construction of Break Even Chart. iii. Assumptions made in constructing Break even chart. iv. Calculation of BEP analytically and graphically. v. Margin of safety, its importance and its derivation. vi. Effect of changing various parameters on BEP. vii. Numeric examples.
<b>Unit –III</b> <b>Cost estimation of welding.</b>	3a. List Factors effecting arc welding cost 3b. Estimate cost of consumables and production for gas cutting and welding of a given job.	3.1 Elements of cost in arc welding. 3.2 Factors effecting arc welding cost. 3.3 Estimating cost elements for: i. Consumables in arc welding and gas cutting. ii. Gas cutting. iii. Arc welding. 3.4 Estimation of production cost of given welding job for above methods.
<b>Unit –IV</b> <b>Cost estimation of forging and casting.</b>	4a. Estimate cost of material, forging dies and production cost for a forging component.  4b. Estimate cost of material, pattern and production for a casting component.	4.1 Cost terminology associated with forging shop. 4.2 The procedure of calculating material cost of a product for forging shop (including input weight, cut weight, forged weight etc.). 4.3 Procedure of estimating cost of forging dies. 4.4 Procedure of estimating forging cost. 4.5 Given the forged component, estimate forging cost. 4.6 Cost terminology associated with foundry shop. 4.7 The procedure of calculating material cost of a product for foundry shop. 4.8 Procedure of estimating cost of pattern making. 4.9 Procedure of estimating foundry cost. 4.10 Given the casting component, estimate foundry cost.

<p><b>Unit –V</b></p> <p><b>Cost estimation of machined part.</b></p>	<p>5a. Estimate the machined part cost for lathe, drilling, milling and shaping operations.</p>	<p>5.1 The terminology associated with machine shop estimation.</p> <p>5.2 Procedure to estimate material cost.</p> <p>5.3 Procedure of estimating cost of machined part for following operations:</p> <ul style="list-style-type: none"> <li>i. Lathe operations (Facing, outside/inside turning, boring, drilling on lathe, grooving and out side threading).</li> <li>ii. Drilling operations (Drilling, reaming, tapping).</li> <li>iii. Shaping operations.</li> <li>iv. Milling operations (Face milling, side and face cutting, end milling, key way milling and gear forming).</li> <li>v. Cylindrical grinding operations (Plain cylindrical grinding).</li> </ul> <p>5.4 For given machined part, estimate material cost and machining cost.</p>
<p><b>Unit – VI</b></p> <p><b>Estimation of process cost.</b></p>	<p>6a. Identify the elements required to estimate the process cost.</p> <p>6b. Estimate the cost of processes required based on given set of input.</p>	<p>6.1 Understand importance of estimating various process costs.</p> <p>6.2 Procedure and steps to estimate cost for following processes:</p> <ul style="list-style-type: none"> <li>i. Producing power using diesel generating set (cost per hour and cost per unit).</li> <li>ii. Power produced at thermal power plants. (Cost per unit).</li> <li>iii. Pouch packaging. (Cost per pouch).</li> <li>iv. Heat exchanger, cooling or heating. (Cost per hour).</li> <li>v. Ice plant. (Cost per unit weight).</li> </ul> <p>6.3 Given the required set of input, estimate the cost of processes specified above.</p>
<p><b>Unit – VII</b></p> <p><b>Budgeting and contracting.</b></p>	<p>7a. Explain various budgetary and accounting terminologies.</p> <p>7b. Prepare simple budget.</p> <p>7c. Interpret given contract terms and conditions.</p> <p>7d. Select parameters, terms and conditions to be</p>	<p>7.1. Define budget and budgetary control.</p> <p>7.2. Purpose of budget.</p> <p>7.3. Various types of budgets.</p> <p>7.4. Benefits of budget.</p> <p>7.5. With given example, interpret industrial budget.</p> <p>7.6. Prepare simple budget given</p>

	included in contract.	<p>required input data.</p> <p>7.7. Explain various accounting terminology like book value, Net Present Value, Work in progress, Gross Domestic Product (GDP), balance sheet terminology, etc.</p> <p>7.8. Define contracts, its characteristics and advantages.</p> <p>7.9. Types of contract.</p> <p>7.10. Tendering, manual tendering and E-tendering.</p> <p>7.11. Provision of different conditions in a contract.</p> <p>7.12. Documents required in an engineering contract (explain).</p> <p>7.13. Prepare a contract for a given input situation.</p>
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## 6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction.	3	4	0	0	4
II	Break even analysis.	3	2	2	4	8
III	Cost estimation of welding.	3	2	2	4	8
IV	Cost estimation of forging and casting.	6	4	4	7	15
V	Cost estimation of machined part.	5	4	4	7	15
VI	Estimation of process cost.	4	3	3	4	10
VII	Budgeting and contracting.	4	3	3	4	10
		28	22	18	30	70

**Legends:** R = Remember U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

**Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### General Notes:

- If midsem test is part of continuous evaluation, unit numbers I, II, III and V are to be considered.
- Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.

## 7. SUGGESTED LIST OF EXERCISES/PRACTICALS.

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

*Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.*

S. No.	Unit No.	Practical Exercises (outcomes in Psychomotor Domain)	Approx Hours. required
1.	I	<p><b>Preparatory activity:</b></p> <ol style="list-style-type: none"> <li>Write various equations to calculate area and volume of commonly used shapes.</li> <li>List densities of commonly used materials.</li> <li>Machining process parameters of various manufacturing processes (Covered in this course) for commonly used materials.</li> <li>Collect market rates for various consumables like diesel, welding rods, gas, cutting tools, electricity rates, etc. to be used in this course.</li> </ol>	02
2.	III, IV,V, VI	<p><b>Collection of parts:</b></p> <ol style="list-style-type: none"> <li>Collect the finished parts from industries/market/scrap merchants consisting:               <ol style="list-style-type: none"> <li>Welded parts (Minimum THREE).</li> <li>Casted parts (Minimum THREE).</li> <li>Forged parts (Minimum TWO).</li> <li>Parts having five to six machining operations like cutting, turning, threading, grinding, milling, shaping, drilling, etc.(Minimum FIVE).</li> </ol> </li> <li>Measure and prepare production drawings of all the parts using A4 size paper (Manually).</li> </ol> <p>Note: Each student will be assigned to bring at least one specified part so that all varieties of about 13 parts get collected in a batch. All parts must be brought in first week duration only. After getting approval of part, each student will prepare production drawing of the part he/she has brought on an A4 size paper (manually) and then the batch will interchange these drawing so that all students will have drawing of all physical parts collected by</p>	02

		the batch.	
3.	III	<b>Welding estimation:</b> <ol style="list-style-type: none"> <li>Determine raw material volume for all welded parts.</li> <li>Select welding rod to be used. Estimate quantity of welding rod required.</li> <li>Determine material and consumables costs.</li> <li>For each part, estimate welding cost. Show the assumptions and steps followed to estimate welding cost.</li> <li>Derive total cost of the part.</li> </ol>	02
4.	IV	<b>Casting estimation:</b> <ol style="list-style-type: none"> <li>Determine raw material volume for all casted parts (calculate input weight, cut weight, net weight, losses etc.).</li> <li>Prepare pattern drawings (production drawings with all dimensions, surface finishes, allowances, etc.) for all parts.</li> <li>Estimate pattern cost.</li> <li>Determine material and consumables costs.</li> <li>For each part, estimate casting cost. Show the assumptions and steps followed to estimate casting cost.</li> <li>Derive total cost of the part.</li> </ol>	04
5.	IV	<b>Forging estimation:</b> <ol style="list-style-type: none"> <li>Determine raw material volume for all forged parts.</li> <li>Prepare die drawings (production drawings with all dimensions, surface finishes, allowances, etc.) for all parts.</li> <li>Estimate dies cost.</li> <li>Determine material and consumables costs.</li> <li>For each part, estimate forging cost. Show the assumptions and steps followed to estimate forging cost.</li> <li>Derive total cost of parts.</li> </ol>	04
6.	V	<b>Machining estimation:</b> <ol style="list-style-type: none"> <li>Determine raw material volume for all machined parts.</li> <li>For each part, tabulate operation, cutting tool/s to be used and cutting parameters (speed, feed and depth of cut) to be used.</li> <li>Estimate raw material cost.</li> <li>For each part, estimate machining cost. Show the assumptions and steps followed to estimate machining cost.</li> <li>Derive total cost of parts.</li> </ol>	06
7.	VI	<b>Process estimation:</b> <ol style="list-style-type: none"> <li>Teacher will assign the input data. Estimate hourly rate of running diesel generating set. Show the assumptions and steps followed to estimate the rate.</li> <li>Teacher will assign the input data. Estimate hourly rate of running ice plant. Also estimate the rate to</li> </ol>	04

		<p>produce a Ton of ice with same data. Show the assumptions and steps followed to estimate the rate.</p> <p>c. Teacher will assign the input data. Estimate hourly rate of running heat exchanger. Show the assumptions and steps followed to estimate the rate.</p> <p>d. Teacher will assign the input data. Estimate unit rate of thermal power plant. Show the assumptions and steps followed to estimate the rate.</p>	
8.	ALL	<p><b>Mini Project and presentation:</b></p> <p>a. Sketch the parts taken in Design of Machine Elements (DME) under Mini project. The batch constituted in DME course is to be continued.</p> <p>b. Prepare process plans for each part.</p> <p>c. Estimate the material, consumables and manufacturing process (May be welding, forging, casting, machining, etc.) costs (as applicable). Also prepare required pattern/die drawings and estimate cost of them (if applicable).</p> <p>d. Estimate cost of parts and assembly. Show the assumptions and steps followed to estimate the costs.</p> <p>e. Present the work including work distribution, photographs and movies of actual project work using power point presentation.</p>	04
<b>Total Hours</b>			<b>28</b>

**Notes:**

- It is compulsory to prepare log book of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by teacher. PA component of practical marks is dependent on continuous and timely evaluation of exercises.
- Term work report must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written / hand drawn by student himself.
- Mini project and presentation topic/area has to be assigned to the students in the beginning of the term by batch teacher.
- Student activities are compulsory and are part of term work.
- For practical ESE part, students are to be assessed for competencies achieved. They should be given physical part/s and should be asked to estimate the material and process cost.

**8. SUGGESTED LIST OF STUDENT ACTIVITIES.**

Sr.No.	ACTIVITY.
1	Do market survey and find prevailing hourly rates of lathe, milling and drilling machines.
2	Do market survey and find prevailing hourly rates of renting diesel generating sets. Specify output (HP or kW).
3	Do market survey and find prevailing rates of commonly used engineering materials like MS, brass, copper, stainless steel, Aluminum, etc.

## 9. SPECIAL INSTRUCTIONAL STRATEGIES.

Sr.No.	Unit	Unit Name	Strategies.
1	I	Introduction	Power point presentations, live examples.
2	II	Break even analysis	Demonstration of method to construct with live examples.
3	III	Cost estimation of welding	Demonstration of method to estimate cost taking live demonstration at work shop place, steps based handouts.
4	IV	Cost estimation of forging and casting	Demonstration of method to estimate cost taking live examples,, live demonstration at work shop place, steps based handouts.
5	V	Cost estimation of machined part	Demonstration of method to estimate cost taking live examples, live demonstration at work shop place, steps based handouts.
6	VI	Estimation of process cost	Live examples, demonstration at site, steps based hand out.
7	VII	Budgeting and contracting	Power point presentations, live examples.

## 10. SUGGESTED LEARNING RESOURCES.

### A) List of Books.

Sr. No.	Title of Book	Author	Publication
1.	Mechanical estimating and costing.	Banga and Sharma	Khanna Publishers.
2.	Mechanical estimating and costing.	Shrimali and Jain	Khanna Publishers.
3.	Mechanical costing and estimation.	Singh and Khan	Khanna Publishers.
4.	Learning package in ECC.	NITTTR, Bhopal	NITTTR,Bhopal.

### B) List of Major Equipment/ Instrument with Broad Specifications.

- i. Vernier caliper, 150mm.
- ii. Micrometer, 0-25mm and 25-50mm.
- iii. Bevel protector.
- iv. Thread gauges.

### C) List of Software/Learning Websites.

- i. <http://calculatoredge.com/index.htm#mechanical>

## 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics:

- A.M.TALSANIYA-Lecturer in Mechanical Engineering, Sir BPI, Bhavnagar.
- R.M. RAJYAGURU, Lecturer in Mechanical Engineering. GP, Porbandar.

**Coordinator and Faculty Members from NITTTR Bhopal:**

- **Prof. S.K.Pradhan**, Associate Professor, Mechanical Engg. NITTTR, Bhopal.
- **Dr. A.K.Sarathe**, Associate Professor, Mechanical Engg. NITTTR, Bhopal