

**GUJARAT TECHNOLOGICAL UNIVERSITY , AHMEDABAD, GUJARAT**

**COURSE CURRICULUM  
COURSE TITLE: CLEANER PRODUCTION ENGINEERING  
(COURSE CODE: 3361304)**

Diploma Programme in which this course is offered	Semester in which offered
Environment Engineering	Sixth

**1. RATIONALE**

One of the major causes of pollution is industrial production, which is increasing day by day and hence cleaner production techniques have become necessary. The aim of this course is to educate students about 'Cleaner Production Techniques' and its application leading to pollution minimization. Students will acquire knowledge about environmental, economic and technological aspects of Cleaner Production Methods. The student will be exposed to methodology of cleaner production projects, methods of their implementing into industrial establishment and process of pollution prevention and reduction along with operating costs reduction and increase in safety of operation with the help of various case studies. Thus this course deals with an emerging area and hence important for environment engineers.

**2. COMPETENCY**

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

- **Employ strategies and methods to minimize pollution in industry for cleaner production.**

**3. COURSE OUTCOMES (COs)**

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

- Explain the concept and principles of cleaner production
- Suggest different unit operations in industrial production process to minimize pollutions.
- Plan good housekeeping practices for Industry/other places with concern of safety, hygiene and waste reduction.
- Suggest basic methods and techniques of pollution prevention during production.
- Suggest cleaner production methods for a given situation which will also lead to cost reduction in long run.

**4. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme (In Hours)			Total Credits (L+P+T)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
			C	ESE	PA	ESE	PA	
2	1	0	3	70	30	0	0	<b>100</b>

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

## 5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (In Cognitive Domain)	Topics and Sub-topics
<b>Unit-I Cleaner Production Concept</b>	1a. Justify the need for Cleaner Production 1b. Explain the Theory of cleaner production 1c. Describe the effect of Cleaner Production on industrial economy 1d. Discuss the Barriers to Cleaner Production	1.1 Theory of cleaner production 1.2 Effect of Cleaner Production on industrial economy 1.3 Need for Cleaner Production 1.4 Barriers to Cleaner Production.
<b>Unit-II Cleaner Production Methodology</b>	2a. Describe the methodology of Cleaner Production 2b. Explain total quality management concepts 2c. Describe CP options 2d. Interpret the CP Programme indicators and features.	2.1 Six step methodology for Cleaner Production 2.2 Total quality management concepts 2.3 Cleaner Production Options 2.4 Cleaner Production Programme Indicators
<b>Unit-III Good House Keeping</b>	3a. Justify the need to implement good housekeeping 3b. Prepare the check lists for good housekeeping.	3.1 Implementation of good housekeeping. 3.2 Check lists for good housekeeping.
<b>Unit-IV Pollution Prevention Methods</b>	4a. Explain the life cycle analysis of products 4b. Describe the ecologically friendly products, environmental designation, concept of eco-design	4.1 Life cycle analysis (LCA): target setting, data collection and processing, final evaluation by virtue of criteria 4.2 Ecologically friendly products, environmental designation, concept of eco-design
<b>Unit- V Case Studies on Cleaner Production</b>	5a. Explain of implementation of Cleaner Production in various industries with an emphasis on waste reduction and cost reduction	5.1 Cleaner production case study in following Industries Textile processing, Rice Mill Distillery unit, Paper mill, Dye manufacturing, Oil extraction,

**6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (Theory)**

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Cleaner Production Concept	4	03	03	00	06
II	Cleaner Production Methodology	6	04	06	06	16
III	Good house Keeping	2	02	02	02	06
IV	Pollution Prevention Methods	8	04	06	11	21
V	Case Studies on Cleaner Production.	8	04	07	10	21
<b>Total</b>		<b>28</b>	<b>17</b>	<b>24</b>	<b>29</b>	<b>70</b>

**Legends:** R = Remember, U = Understand, A= Apply and above Level (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.

**7. SUGGESTED TUTORIALS:**

In tutorials numerical or conceptual problems may be given to individual or group of students. Students should be first allowed to struggle on their own to find the solution, and should try their creativity. However, faculty should remain around the students and help them if they are not able to proceed.

It is better if real life problems are case studies are given where different groups of students may come with different solutions, which can be discussed in a larger group of student to generate more discussions. Following is the suggestive list of exercises; concerned faculty may change/add exercises to this list.

S. No.	Unit No.	Exercises for Tutorials	Approx. Hrs. Required
1	I	Solve given exercise based on different Cleaner Production Concepts/	01
2	II	Solve given exercise based on various methodologies used in Cleaner Production.	01
3	III	Solve given exercise based on need and different techniques of Good House Keeping	02
4	IV	Give feasible solutions on given case studies related to problem of cleaner production/Life cycle analysis of products.	04
5	V	Prepare technical report based on visit to an industry which is using cleaner production methods/techniques.(If visit is not possible then prepare a report on cleaner production methods for a type of industry by exploring internet)	06
Total Hours			14

**8. SUGGESTED STUDENT ACTIVITIES ( Home Assignment)**

- i. Prepare a report on cleaner production implementation in Industry after site visit
- ii. Prepare chart of process involved in cleaner production methodology
- iii. Prepare case studies in cleaner production implementation using internet

**9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)**

- i. Ask students to study different clean production techniques being used in nearby industries and present a report on them.
- ii. Arrange Expert lectures of engineers having experience of clean production techniques.
- iii. Show video clips of different clean production techniques.

**10. SUGGESTED LEARNING RESOURCES****(A) Books**

<b>S. No.</b>	<b>Title of Books</b>	<b>Author</b>	<b>Publication</b>
1	Cleaner Production: Environmental and Economic Perspectives	Misra Krishna B.	Springer, Berlin, Latest edition
2	Environmental Management Systems and Cleaner Production	Dr. Ruth Hillary	Wiley, New York, Latest edition

**(B) Software/Learning Websites**

- i. <http://www.gcpcgujarat.org.in/>
- ii. <http://www.unido.org/ncpc.html>

**11. COURSE CURRICULUM DEVELOPMENT COMMITTEE****Faculty Members from Polytechnics**

- **Prof. Jini Sunil**, Lecturer in Environmental Engineering, Shri K. J. Polytechnic, Bharuch
- **Prof .M.C. Sanandiya**, Lecturer in Environmental Engineering, Shri K. J. Polytechnic, Bharuch

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Prof . M.C. Paliwal** , Associated Professor, Department of Civil and Environment Engineering
- **Dr V.H.Radhakrishnan**, Professor, Department of Civil and Environment Engineering,