



Subject Code: 01CH0502
Subject Name: Cleaner Production
B.Tech. Year: III (Semester-V)

Objective: With industrialization hitting its peak across the globe, we face so many challenges to save our planet. The prime objective of this course is to shift the focus from waste treatment to waste minimization.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, student will be able to:

1. Relate the role of Cleaner Production in sustainable development in Chemical Industries.
2. Appraise the Energy conservation via Cleaner Technology Options.
3. Connect Cleaner Production & Cleaner Technology as Remedial Measures for Mitigating Climate Change
4. Judge the Green Process options available for the conventional processes being followed in Chemical Industries.

Pre-requisite of course: Knowledge of fundamentals of environment studies- Green Chemistry.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	CSE	Internal (I)	Viva (V)	Term work (TW)	
4	2	0	5	50	20	30	25	25	150

CONTENTS

Unit	Topics	Contact Hours
1	Introduction and concept theory of cleaner production.	3
2	Role of C.P. in survival and sustainable development of Chemical Industries.	3
3	Six steps methodology, Designation team, Analyse process steps, opportunities, selecting cleaner production solutions.	3
4	What is good Housekeeping? , Overview of Good House Keeping, What is needed to implement good housekeeping? Check lists for GHK, Process Modification / Changes, Process Technology Innovations, Equipment Modification, Reuse and Recycle.	8
5	Principles and Concepts of Green Chemistry, Thermodynamics, Reaction	7



	Engineering, unit operation – Adsorption, Absorption, Extraction. & Environmental biotechnology in C.P.	
6	Introduction to Energy Audit Methodology, detail of Energy Audit and Energy Conservation, Energy conservation via Cleaner Technology Options, Use of clean fuels inclusive of H ₂ as a clean fuel of tomorrow.	5
7	C.P. & C.T. as Remedial Measures for Mitigating Climate Change, Ozone layer depletion and current practices to avoid depletion.	4
8	Resource recovery / by product recovery from manufacturing process for small scale industries by Cleaner Production Technology (CPT).	4
9	Designing Cleaner Production – Green Processes	4
10	Implementation of C.P and C.T.	3
11	Typical case studies of C.P of Chemical Engineering industries.	4
	Total Hours	48

List of Tutorial Activities:

1. Analysis of Cleaner production practices in production of Methanol.
2. Use of Heat Exchangers as cleaner production devices.
3. To conduct Energy Audit for Campus.
4. To evaluate Cleaner Production application in campus.
5. To perform task on Good Housekeeping concept.
6. To analyse the Cleaner Production methodology.
7. Case studies regarding success stories in Cleaner Production.
8. Case studies on waste utilization from specific industries.

References:

1. Cleaner Production Worldwide, 1993, United Nations Environment Programme, Industry and Environment, Paris, France, 1993
2. Cleaner Production: Training Resource Package, UNEP IE, Paris, 1996
3. Clean Technology for manufacture of Specialty Chemicals, Editor-W. Hoyle and M. Lancaster, Royal Society of Chemistry, U.K.
4. Engineers Guide to Cleaner Production Technologies by Paul M. Randall

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process



Distribution of theory marks					
Remember	Understand	Apply	Analyse	Evaluate	Create
15%	20%	15%	15%	5%	-

Instructional Method:

- The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

Online Web Resources:

- www.scew.gov.au/.../anzecc-ppr-towards-sustainability-achieving-cleane
- www.unep.org/Pdf/Capacity_building.pdf
- www.iisd.ca/consume/unep.html

Design Based Problems (DP)/ Open Ended project (OEP):

In the beginning of the session, subject faculty will allot an OEP / DP to the students. Students will be free to choose a topic of their choice which will be relevant to the syllabus and they will either prepare a working model/ report / presentation / poster on their topic.