

GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING (COMPUTER AIDED PROCESS DESIGN) (16)

CLEANER PRODUCTION IN CHEMICAL INDUSTRIES (CPCI)

SUBJECT CODE: 2721610

SEMESTER: II

Type of course: Open Elective (M.E.CAPD)

Prerequisite: Knowledge of fundamentals of environment studies

Rationale: Know about role of C.P. in development in Chemical Industries.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Topics	Teachin g Hrs.	Module Weightage
1	Introduction to Cleaner Technology (CT), Technology adoption for Cleaner Production (CP).	3	7
2	Role of C.P. in survival and sustainable development of Chemical Industries.	3	7
3	Cleaner Production: The basis, necessity and potential.	3	7
4	C.P. tools, techniques, methodology and applications.	3	7
5	Overview of Good House Keeping, Process Modification / Changes, Process Technology Innovations, Equipment Modification, Reuse and Recycle.	4	7
6	Principles and Concepts of Green Chemistry, Thermodynamics and Reaction Engineering Principles for C.P., Role of Environmental Biotechnology in C.P.	4	7
7	Use of Unit Operations – Adsorption, Absorption and Extraction in C.P.	3	7
8	Energy Audit and Energy Conservation, C.P. & C.T. and energy efficiency integration, Energy conservation via Cleaner Technology Options, Use of clean fuels inclusive of H ₂ as a clean fuel of tomorrow. C.P. Options with special reference to Energy Conservation in Thermal Power Plants.	4	7
9	C.P. & C.T. as Remedial Measures for Mitigating Climate Change, Ozone layer depletion and current practices to avoid depletion.	4	7
10	Resource recovery / by product recovery from manufacturing process by Cleaner Production Technology (CPT) with special reference to Small Scale Industries.	4	7
11	Industrial waste minimization and Waste Minimization Circles.	4	6
12	Hazard Prevention by C.P. Technology Alternatives.	4	6
13	Designing Cleaner Production – Green Processes	4	6

14	Cleaner Production and Cleaner Technology implementation	3	6
15	Typical case studies w.r.t. Petrochemicals and Polymers, Chlor-alkali industries, Dyes & Intermediates, Bulk drug and Pharmaceuticals, Distilleries and Sugar industries, Pesticide Manufacture, Cement Manufacture, Textile industries, Electroplating Units, Specialty Chemicals inclusive of environmentally benign solvents etc.	4	6

Reference Books:

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
5. Green Chemistry : Environmentally Benign Reactions by V. K. Ahluvalia
6. Chemical Process Safety: Learning from case Histories, R. E. Sanders, Oxford Butter Worth Publication.

Course Outcome:

After learning the course the students should be able to:

- Know about role of C.P. in development in Chemical Industries.
- Learn the Energy conservation via Cleaner Technology Options.
- Understand the C.P. & C.T. as Remedial Measures for Mitigating Climate Change
- Learn the Importance of good housekeeping..
- Understand the Energy conservation via Cleaner Technology Options.
- Learn about how to do Industrial waste minimization.
- Study about the Green Processes in Chemical Industries.

List of Experiments:

Tutorials/Presentation based on above topics.

Open Ended Problems:

1. Tools for Cleaner Production.
2. Sustainable use and management of natural resources.
3. Eco-Efficiency and Cleaner Production: Sustainable Consumption & Production
4. Role of Biotechnology in Development and Sustainability

Major Equipment:

BOD,COD, Muffle Furnace, Carbon Residue Apparatus , Water Quality Analyzer etc.

List of Open Source Software/learning website:

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

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the

students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.