

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. SEMESTER: IV CHEMICAL ENGINEERING

Subject Name:- Cleaner Production

SR NO.	COURSE CONTENTS
1.	Introduction Cleaner production definition: Evaluation of cleaner production, Cleaner production network, Area covered by cleaner production (what is not cleaner production?). Difference between cleaner production and other. End of the pipe treatment to curb pollution, prerequisites of cleaner production.
2.	Cleaner production technique 2.1 Waste reduction at source (a) Good house keeping (b) Process changes: change in raw material, better process, control, equipment modification and technology changes. 2.2 Recycling: on site recovery and reuse creation of useful byproducts. 2.3 Product modification.
3.	Cleaner production methodology 3.1 Making team for cleaner production 3.2 Analyzing process steps 3.3 Generating C.P opportunities 3.4 Selection of C.P solution 3.5 Implementing C.P solution
4	Energy audit: as a part of cleaner production. 4.1 Energy audit's need and scope. 4.2 Types of energy audit

	<p>4.2.1 Preliminary or walk through energy audit</p> <p>4.2.2 Detailed energy audit</p> <p>4.2.3 Methodology of energy audit</p> <p>4.2.4 Energy balance and identifying the energy conservation opportunities.</p>
5	<p>Financial analysis of cleaner production</p> <p>5.1 Gathering base line information.</p> <p>5.2 Determining the capital or investment cost</p> <p>5.3 Establishing lifetime of equipment and annual depreciation.</p> <p>5.4 Determine revenue implication of the project.</p> <p>5.5 Estimating change in operating cost.</p> <p>5.6 Calculating incremental cash flow.</p> <p>5.7 Assessing project's viability</p>
6	<p>Cleaner production application</p> <p>C.P in chemical process industry,</p> <p>Practical ways & means to save material loss in loading/unloading and unit operations equipment like distillation column, drying and other equipments like heat exchanger, vacuum unit, conveying, etc.</p> <p>Practical ways & means for energy saving in industries.</p>
7	Case Studies of cleaner production.

Textbooks:

1. Training manual package by NCPC

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.