

UG Department: **Chemical Engineering**
Course Code: **CH418** Course Name: **Process Modifications for Green Technology and Energy Integration**
Credit: **3** L-T-P: **3-0-0**
Version: **1** Approved on:
Prerequisite Course: **Heat Transfer, Mass Transfer, Chemical Technology, Pollution Control, Chemical Reaction Engineering**

Different types of contactors and their characteristic features, sections and subsections of a typical chemical plant, start-up and shut-down procedures, typical trouble shooting options associated with different sections. Demonstration of a collection of typical raw materials, intermediates and finished products.

Critical review of industrial contactors; Solvent selections: economic considerations and process requirements for specific cases. Cooling and chilling processes used in various industries, adsorbent selection for specific use, significance of various parts of binary and multi-component (crude) distillation columns, absorption towers, dryers etc. Design variations for drying of milk, fertilizer powder and granules, soap-lye, bricks, cloth, paper etc.

Introduction to Heat Exchanger Networks- Minimum heating and cooling requirements, Minimum number of exchangers, area estimates, Design of minimum-energy Heat Exchanger Networks, Loops and Paths, Reducing the number of exchangers, Stream splitting, Heat and power integration, Heat and distillation.

Process intensification with ultrasound waves: ultrasound, cavitation, sonochemistry, enhancement of chemical reaction, emerging areas, applications and advantages over conventional processes, scale-up issues and limitations,

Exothermic, catalytic and non-catalytic reactors: design methodology and heat recovery options with reference to specific industries, e.g., SO₂ and NH₃ converters, fluid-bed pyrite roaster, kneeder, etc. Design methodology and mode of heat supply to endothermic reactors: cement kiln, lime kiln, reformer, naphtha cracker, water-gas reactor, etc. Process modifications in chlor-alkali industries. Economic and environmental considerations for ethanol production based on petrochemical and agro feed stocks.

Natural gas and its usage for favorable economic and environmental considerations. Variations in the reactor configurations for polyethylene (HDPE and LLDPE) production. Design considerations of a polypropylene reactor for product particle size control.

Books

1. Rao, M. G. and Sittig, M., "Dryden's Outlines of Chemical Technology", Affiliated East West Press, 1997.
2. Douglas, J. M., Conceptual Design of Chemical Processes, McGraw Hill, 1988.
3. Austin, G.T., "Shreve's Chemical Process Industries", 5th Edn., McGraw-Hill, 1985.
4. Levenspiel, O., "Chemical Reaction Engineering," 3rd Edn., John Wiley, 1999.
5. Smith, J. M., "Chemical Engineering Kinetics," 3rd Edn., McGraw-Hill, 1981.
6. Peters, M. S. and Timmerhaus, K. D., Plant Design and Economics for Chemical Engineers, 3rd ed., 1981.