NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE TEMPLATE			
Course Title	**PINCH ANALYSIS AND HEAT EXCHANGER NETWORK DESIGN**		
Course Code	**CL 619**	**No. of Credits**	**3**
Department	**Chemical Engineering**	**Faculty**	**Dr. A. Arunagiri**
Pre-requisites, Course Code	Basic of Heat transfer, Process Design, Thermodynamics		
Course Coordinator(s), (if, applicable)	**Dr. P. Sivashanmugam**		
Other Course Teacher(s)/Tutor(s)	-		
Telephone No.	**0431-2503114**		
Email	**aagiri@nitt.edu**		
Course Type	**Elective course**		

COURSE OVERVIEW

The students will imparted awareness on the recovery of waste heat from process streams using the concept of Pinch analysis, minimizing the utility requirements, networking of heat exchangers, optimizing the energy cost, capital cost, and number of units and energy resource analysis of different process.

COURSE OBJECTIVES

Understanding Pinch concept, Application to Process Heat Exchange Networking, Identification of Energy Minimization in the Process, Retrofitting Concepts and Setting up Targets for Energy Minimization

COURSE OUTCOMES (CO)

After completion of the course, a student can able to	**Aligned Programme Outcomes (PO)**
1. Understand the pinch concept and process thermodynamics	**1,2,3,4,5,9,11**
2. Identify minimum energy targets	**1,2,3,4,5,9,10,11**
3. Identify different choices and constraint during heat exchange networking	**1,2,3,4,5,9,10,11**
4. Apply strategies for retrofitting existing process plant, integration of energy demands of multiple processes	**1,2,3,4,5,9,10,11**

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week	Topic	Mode of Delivery
1	1	Thermodynamic review of the process, Pinch concept, significance of pinch, pinch in grid representation	Lecture, Tutorials & Discussion
2	2	Threshold problems, capital cost implication of the pinch	Lecture, Tutorials & Discussion

3	3	Heat exchanger networks, energy targeting	Lecture, Tutorials & Discussion
4	4	Area targeting, unit targeting, shell targeting, cost targeting	Lecture, Tutorials & Discussion
5	5	Super targeting, and continuous targeting	Lecture, Tutorials & Discussion
6	6	Problem representation, temperature enthalpy diagram	Lecture, Tutorials & Discussion
7	7	Simple match matrix, Heat content diagram	Lecture, Tutorials & Discussion
8	8	Temperature interval diagram, Networks for maximum energy recovery, Pinch design method	Lecture, Tutorials & Discussion
9	9	Flexibility criteria of the pinch, cp table, the tick of heuristic, case studies	Lecture, Tutorials & Discussion
10	10	Optimization of heat exchanger network optimality for a minimum area network, Sensitivity analysis	Lecture, Tutorials & Discussion
11	11	Energy and Resource Analysis of various processes	Lecture, Tutorials & Discussion
12	12	Batch process, flexible process, distillation process, evaporation process, reaction process	Lecture, Tutorials & Discussion
13	13	Process using mass separating agent. Heat pipes and Heat pumps	Lecture, Tutorials & Discussion

COURSE ASSESSMENT METHODS

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test – 1, (Written Exam)	Febraury Second week	1 Hour	20%
2	Cycle Test – 2, (Written Exam)	March Third Week	1 Hour	20%
3	Seminar & Assignments (Oral Examination)	As per schedule given by the faculty	15 minutes	10%
4	End Semester (Written Exam)	April	3 hour	50%

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. V. UdayShenoy, *Heat Exchanger network synthesis,* Gulf Publishing Co, USA, 1995.
2. D. W. Linnhoff et al., *User Guide on Process Integration for the efficient use of Energy*, Institution of Chemical Engineers, U.K., 1994.
3. James M. Douglas, *Conceptual Design of Chemical Process*, McGraw Hill, New York, 1988.
4. Anil Kumar, *Chemical Process Synthesis and Engineering Design,* Tata McGraw Hill New Delhi, 1977.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

Students indirect feedback will be collected twice during the course, one in the mid of the course and one at the end of the course.

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

1. All the students are expected to attend all the classes and Tests without fail.
2. It is advised to maintain the attendance above 70%. On Duty claims to attend the Institute approved co curricula and extracurricular activities should be forwarded by the competent authorities.
3. Students absenting from cycle tests, on genuine reason, may appear for retest only once.
4. Plagiarism in Assignments, Malpractices in Assessments in any form is strictly prohibited.
5. The passing minimum will be 33.3% of class maximum marks or 50% of class average marks.

ADDITIONAL COURSE INFORMATION

The Faculty is available in the Room No. 105, Chemical Engineering Department. Contact Email Id: aagiri@nitt.edu.

FOR SENATE'S CONSIDERATION

7.2.17	8/2/17	
Course Faculty	**CC-Chairperson**	**HoD**
(Dr. A. ARUNAGIRI)	**(Dr. N. SAMSUDEEN)**	**(Dr. P. SIVASHANMUGAM)**