NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF CHEMICAL ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	**M. Tech (Chemical Engineering)**		
Course Title	**PINCH ANALYSIS AND HEAT EXCHANGER NETWORK DESIGN**		
Course Code	**CL619**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	Basic of Heat transfer, Mathematics, Process Design		
Session	**January 2020**	**Section (if, applicable)**	**Not Applicable**
Name of Faculty	**Dr. A. Arunagiri**	**Department**	**Chemical Engineering**
Official Email	**aagiri@nitt.edu**	**Telephone No.**	**91-431-2503114**
Name of Course Coordinator(s) (if, applicable)	**Dr K M Meera Sheriffa Begum**		
Official E-mail	**meera@nitt.edu**	**Telephone No.**	**91-431-2503109**
Course Type (please tick appropriately)	☑ **Elective course**		

Syllabus (approved in BoS)

Basics: Thermo dynamical review of the process, Pinch concept, significance of pinch, pinch in grid representation, Threshold problems, capital cost implication of the pinch.

Targeting: Heat exchanger networks, energy targeting, area targeting, unit targeting, shell targeting, cost targeting, super targeting, and continuous targeting.

Pinch Methodology: Problem representation, temperature enthalpy diagram, simple match matrix. Heat content diagram, Temperature interval diagram.

Pinch Design and Optimization: Networks for maximum energy recovery, Pinch design method, Flexibility criteria of the pinch, CP table, the tick of heuristic, case studies, optimization of heat exchanger network optimality for a minimum area network, Sensitivity analysis.

Energy and Resource Analysis of various processes: Batch process, flexible process, distillation process, evaporation process, reaction process, process using mass separating agent. Heat pipes and Heat pumps

Reference Books:

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

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	
MAPPING OF COs with POs	
Course Outcomes	**Programme Outcomes (PO)** **(**Enter Numbers only**)**
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 PLAN – PART II

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 TEACHING AND LEARNING ACTIVITIES **(** Add more rows)

S.No.	Week/ Contact Hours	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 Batch processes, flexible process	Lecture, Tutorials & Discussion
12	12	Energy and Resource Analysis of Batch processes distillation process,	Lecture, Tutorials & Discussion
13	13	Energy and Resource Analysis evaporation process, reaction process	Lecture, Tutorials & Discussion
14	14	Process using mass separating agent. Heat pipes and Heat pumps	Lecture, Tutorials & Discussion

COURSE ASSESSMENT METHODS (shall range from 4 to 6**)**

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test – I, (Written Exam)	Febraury - II week	1 Hour	20%
2	Cycle Test – II, (Written Exam)	March - IV Week	1 Hour	20%
3	Seminar & Assignments (Oral Examination)	As per schedule given by the faculty	20 Mins	10%
CPA	Compensation Assessment*	April - II Week	1 Hour	20%
4	Final Assessment *	April - IV Week	3 hours	50%

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

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 compensation assessment to be specified**)**

1. All the students are expected to attend all the classes and Tests without fail.
2. Compensation assessment will be conducted for the students who failed to attend the regular assessment process during the course due to genuine reasons.
3. A minimum of 30% should be scored in the final assessment for a pass. The passing minimum for all the courses shall be the maximum of 35% or Class Average/2.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

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

FOR APPROVAL

Course Faculty	CC-Chairperson	HoD
(Dr A ARUNAGIRI)	(Dr M MATHESWARAN)	(Dr K M MEERA S BEGUM)

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		Maximum of 35% (or) (Class Average/2)

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.