

**DEPARTMENT OF CHEMICAL ENGINEERING**

**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

**Amended Course Plan (Due to Covid 19)**

<b>COURSE PLAN – PART I</b>						
<b>Course Title</b>	<b>PROCESS FLOW SHEETING</b>					
<b>Course Code</b>	<b>CL 654</b>	<b>No. of Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
			2	1	0	3
<b>Course Code of Pre-requisite subject(s)</b>	<b>The students should have already learnt the chemical engineering fundamentals.</b>					
<b>Session</b>	<b>JANUARY 2020</b>	<b>Section</b>	<b>NA</b>			
<b>Name of Faculty</b>	<b>Dr.P.Kalaichelvi</b>	<b>Department</b>	<b>Chemical Engineering</b>			
<b>Email</b>	<a href="mailto:kalai@nitt.edu">kalai@nitt.edu</a>	<b>Telephone No.</b>	<b>0431-2503110</b>			
<b>Course Type</b>	<b>Programme Core</b>					
<b>Syllabus (approved in BoS)</b>						
<p align="center"><b>Syllabus approved in BOS for students admitted from 2018-19 onwards.</b></p> <p><b>Flowsheeting</b> Introduction, Symbols, Flowsheet presentation with examples, Manual flowsheet calculation, Constraints and their applications in flowsheet calculations, Types of flow sheets, Synthesis of steady state flow sheet.</p> <p><b>Sequential modular approach and equation solving methods to flowsheeting</b> Solution, partitioning and tearing a flowsheet, convergence of tear streams with suitable Example, Degree of freedom analysis. Selection, decision and tearing of variables in a flowsheet with simple and complex examples, Flowsheeting software viz., VISIO, DWSIM and ASPEN</p> <p><b>Instrumentation standards</b> Instrumentation Standards - significance of codes and standards – overview of various types - Introduction of various Instrumentation standards – review, interpretation and significance of specific standards - examples of usage of standards on specific applications.</p> <p><b>Piping and Instrumentation Diagram</b> Instruments for process variables and Symbols, control strategies for unit operations, Safety Instrumented Systems, Abbreviations and Identification for Instruments: - Mechanical Equipment, Electrical Equipment, Instruments and Automation Systems, Logic diagrams, Instrument loop diagram, Line symbols and Line designations.</p> <p><b>Applications of Flowsheet and P&amp;I D</b> Applications of P &amp; I D in design stage -Construction stage - Commissioning stage - Operating stage - Revamping stage - Applications of P &amp; I D in HAZOPS and Risk analysis.</p>						
<b>COURSE OBJECTIVES</b>						

1. The major objective is to understand how to invent chemical process flowsheets, how to generate and develop process alternatives, and how to evaluate and screen them quickly.
2. To simulate the steady-state behaviour of process flowsheets using a suitable simulation software.
3. To utilize the flowsheet to propose a preliminary P&I diagram

### **COURSE OUTCOMES (CO)**

<b>Course Outcomes (CO)</b>	<b>Aligned Programme Outcomes (PO)</b>
Upon completion of the course, the students will be able to	
Understand the input/output structure of a flowsheet for a given manufacturing unit and synthesis a preliminary flowsheet.	<b>1,3,4,8</b>
Identify design constraints for flowsheet calculation	<b>2,4</b>
Able to do flowsheet calculation	<b>2,4,12</b>
Develop preliminary P&I Diagram based chemical process flowsheet	<b>1,2,4,7,8,9,10,11,12</b>
Apply P&I D for safety analysis	<b>1,2,4,5,6,7,8,9,10,11,12</b>

### **COURSE PLAN – PART II**

#### **COURSE OVERVIEW**

This course provide details on arriving at a manual and computersied process flowsheet for a given chemical process. On completion of the course students will learn to analyse process flowsheet and also develop priliminary Process and Instrumentation Diagram and use it for safety analysis.

#### **COURSE TEACHING AND LEARNING ACTIVITIES**

<b>S.No.</b>	<b>Week/Contact Hours</b>	<b>Topic</b>	<b>Mode of Delivery</b>
1.	Week 1	Introduction	Chalk and Talk
2.	Week 1	syllabus discussion	Chalk and Talk
3.	Week 1	methodology	Chalk and Talk
4.	Week 2	Class exercise for PFD	Chalk and Talk
5.	Week 2	Types, streams, information requirement	Chalk and Talk
6.	Week 2	Basis for flowsheet calculation	Chalk and Talk
7.	Week 3	Flowsheet calculation for individual units	Chalk and Talk
8.	Week 3	Manual flowsheet calculation – example	Chalk and Talk
9.	Week 3	Flowsheet calculation using spreadsheet	Chalk and Talk
10.	Week 4	Flowsheeting software	Demo
11.	Week 4	Assignment evaluation 1	Based on demo

12.	Week 4	Partitioning with example	Chalk and Talk
13.	Week 5	Tearing a flowsheet with example and convergence of tear streams	Chalk and Talk
14.	Week 5	Equation based flowsheeting	Chalk and Talk
15.	Week 5	Example – simple process and complex process	Chalk and Talk
		<b>Assessment I</b>	
16.	Week 6	Introduction to P&I D	Chalk and Talk
17.	Week 6	Instrumentation Standards - significance of codes and standards	Chalk and Talk
18.	Week 6	review, interpretation and significance of specific standards	Chalk and Talk
19.	Week 7	usage of standards on specific applications	Chalk and Talk
20.	Week 7	Instruments for process variables and Symbols	Chalk and Talk
21.	Week 7	control strategies for unit operations	Chalk and Talk
22.	Week 8	control strategies for unit operations	Chalk and Talk
23.	Week 8	Safety Instrumented Systems	Chalk and Talk
24.	Week 8	Abbreviations and Identification for Instruments: - Mechanical Equipment, Electrical Equipment	Chalk and Talk
25.	Week 9	Instruments and Automation Systems, Logic diagrams, Instrument loop diagram,	Chalk and Talk
26.	Week 9	Line symbols and Line designations	Chalk and Talk
27.	Week 9	Assignment Evaluation 2	Presentation
		<b>Assessment II</b>	
28.	Week 10	Assignment Evaluation 3	Presentation
29.	Week 10	Propositional logics scheme for preliminary P&ID	Chalk and Talk
30.	Week 10	Assignment Evaluation 4	Presentation
31.	Week 11	P&I D during design stage	Chalk and Talk
32.	Week 11	Construction stage - Commissioning stage – P&I D	Chalk and Talk
33.	Week 11	Operating stage - Revamping stage – P&I D	Chalk and Talk
34.	Week 12	P&I D for HAZOP	Chalk and Talk

35.	Week 12	Assignment evaluation 5	Hard copy
36.	Week 12	Assignment evaluation 6	Hard copy
		<b>Compensation Assessment</b>	
		<b>Final Assessment</b>	

**COURSE ASSESSMENT METHODS (shall range from 4 to 6)- Amended due to Covid-19**

S.No	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I	End of 5 <sup>th</sup> week since commencement	1 hour	20%
2	Assessment II -2 nos of assignments +1 Viva			30%
3	Assessment III – (Assignment)	In between the course as mentioned in the course plan	Submissions, Presentations and Demo	20 % (Average)
4	CPA Compensation Assessment		1 hour	20%
5	Final Assessment*	At the end of Course	2 hours	30%

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

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

1. Ernest E. Ludwig, *Applied Process Design for Chemical and Petrochemical Plants*, Vol.I, Gulf Publishing Company, Houston, 1989.
2. Max. S. Peters and K.D.Timmerhaus, *Plant Design and Economics for Chemical Engineers*, McGraw Hill, Inc., New York, 1991.
3. Coulson and Richardson's Chemical Engineering Volume 6 - Chemical Engineering Design (4th Edition), Butterworth-Heinemann Ltd. UK.
4. Anil Kumar, *Chemical Process Synthesis and Engineering Design*, Tata McGraw Hill publishing Company Limited, New Delhi - 1981.
5. A.N. Westerberg, et al., *Process Flowsheeting*, Cambridge University Press, 1979.
6. Paul Benedek, *Steady state flow sheeting of Chemical Plants*, Elsevier Scientific Publishing company.
7. B.G.Liptak, "Instrumentation Engineers Handbook (Process Measurement & Analysis)", Fourth Edition, Chilton Book Co, CRC Press, 2005.

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

- 1) Feed back is planned to be collected thrice; At class committee meetings during the assessment period and one at the end of course as soon as classes are over.
- 2) The academic performance of the students will be assessed based on **Two** assessments by written test (each 20 marks), Assignment (20 marks) during the course and **One** final assessment (40 marks) at the end of course.

3) Suitable mapping of COs with POs will be made and attainment will be calculated.

**COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism etc.)**

**MODE OF CORRESPONDENCE (email/ phone etc)**

Email: kalai@nitt.edu

**ATTENDANCE**

- A uniform attendance policy for all courses is recommended. **At least 75% attendance in each course is mandatory.**
- The students with less than 75% in any course by the end of 9<sup>th</sup> week will be identified and complementary assignments may be given to them to be done during 10<sup>th</sup> week.
- **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.**

**COMPENSATION ASSESSMENT**

**One Compensation assessment** will be conducted only for absentees in either the Assessments or Assignment tests under Medical or Institute related activities.

**ACADEMIC HONESTY & 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 constituted with the 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**

The faculty handling the course is available for consultation and Queries may also be emailed to the Course Coordinator directly at [kalai@nitt.edu](mailto:kalai@nitt.edu)

**FOR APPROVAL**

Course Faculty:  **Dr.P.Kalaichelvi**

CC-Chairperson:  **Dr.S.SARAVANAN**

  
**HOD: Dr.K.M.Meera S.Begum**

**(Approved by CC Chairman and HOD)**

**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>B.Tech. Admitted in</b>				<b>P.G. admitted in 2019</b>
<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower	(Class average/2) whichever is greater.	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.