

**DEPARTMENT OF CHEMICAL ENGINEERING**  
**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

<b>COURSE PLAN – PART I</b>			
<b>Name of the programme and specialization</b>	<b>M.Tech Chemical Engineering</b>		
<b>Course Title</b>	<b>Industrial safety and risk management</b>		
<b>Course Code</b>	<b>CL 613</b>	<b>No. of Credits</b>	<b>3</b>
<b>Course Code of Pre-requisite subject(s)</b>	<b>CLPC15,CLPC17, CLPC 20, CLPC 21</b>		
<b>Session</b>	<b>Jan 2021</b>	<b>Section (if, applicable)</b>	<b>NA</b>
<b>Name of Faculty</b>	<b>Dr.K.N.Sheeba</b>	<b>Department</b>	<b>Chemical Engineering</b>
<b>Email</b>	<b>sheeba@nitt.edu</b>	<b>Telephone No.</b>	<b>9952842613</b>
<b>Name of Course Coordinator(s) (if, applicable)</b>	<b>Dr. P.Kalaichelvi</b>		
<b>E-mail</b>	<b>chloffice@nitt.edu</b>	<b>Telephone No.</b>	<b>0431 2503101</b>
<b>Course Type</b>	<input type="checkbox"/> <b>Core course</b> <input checked="" type="checkbox"/> <b>Elective course</b>		
<b>Syllabus (approved in BoS)</b>			
<p>Process Safety Management; Responsibility; OSHA and EPA Regulations, Properties of Toxic Materials; Industrial Hygiene, Vaporization Rates; Dilution; Ventilation, Source Modeling: Leakage Rates of Liquids and Gases; Flashing and Boiling; Two Phase Flow, Toxic and Flammable Release and Dispersion Modeling. Fires and Explosions; Flammability, MOC; Explosions, Detonations, Blast Damage, Protection and Prevention; Inerting and Purging; Static Electricity; Ventilation</p> <p>Chemical Process Safety: Decomposition &amp; Runaway Reactions, Initiating factors Reactive Chemical Hazard, Assessing Reaction Hazard; Tools for evaluating thermal explosion, steps to Reduce Reactive Hazards</p> <p>Process Plant Design: Flow Diagrams; Piping and Instrumentation Diagram, Control System, Alarms, Chemical Plant Layout: Passive protection, Active Protection, Emergency Shutdown System, Safety Integrity Level, Inherent Safety Techniques. Relief Systems; Relief Sizing for Liquid, Gas, and Two-Phase Flow; Dust Explosions</p> <p>Hazard Identification &amp; Risk Assessment: The Process of Risk Management Hazard Identification, Evaluation (Risk Assessment, Risk Matrix), Risk Control Implementation, Action and Recommendation Hazard Evaluation Techniques: Quantitative, Qualitative Safety Review, Process / System Checklists, Dow Fire and Explosion Index, What-If Analysis, HAZOP. Reliability, Probability Distribution, Demand and Failure, Fault Tree Analysis (FTA), Minimal Cut Set Identification, Event Tree Analysis.</p> <p>Tutorial</p> <p>Accident Investigations – nuclear and other chemical process plants, Student Presentations of Term Project Reports–Case Studies, Design Problems, Quantitative Methods, etc.</p>			

<b>COURSE OBJECTIVES</b>			
To distinguish, analyze by core engineering knowledge, design and operations to ensure safe operation of process plant			
To provide knowledge on risk, hazard and their assessment techniques in Industry			
<b>COURSE OUTCOMES (CO)</b>			
<b>Course Outcomes</b>			<b>Aligned Programme Outcomes (PO)</b>
1. Identify the potential hazards and hazardous conditions associated with the processes and equipment in chemical process industries.			<b>PO1, PO3, PO4</b>
2. Apply engineering fundamentals to the analysis and prediction of performance under unsafe conditions			<b>PO1, PO2, PO3, PO4, PO5, PO7</b>
3. Perform PHA analysis of chemical processes and evaluate the safety performance			<b>PO1, PO4, PO6, PO10, PO11</b>
4. Work effectively in teams to develop problem solving skills and to prepare and present a professional project report.			<b>PO6, PO7, PO8</b>
<b>COURSE PLAN – PART II</b>			
<b>COURSE OVERVIEW</b>			
This course is intended to understand the principles of industry safety and its level of implementation in chemical industries.			
<b>COURSE TEACHING AND LEARNING ACTIVITIES</b>			
<b>S.No.</b>	<b>Week/Contact Hours</b>	<b>Topic</b>	<b>Mode of Delivery</b>
1	1 <sup>st</sup> Week-7 <sup>th</sup> Week	Process Safety Management; Responsibility; OSHA and EPA Regulations, Properties of Toxic Materials; Industrial Hygiene, Vaporization Rates; Dilution; Ventilation, Source Modeling; Leakage Rates of Liquids and Gases; Flashing and Boiling; Two Phase Flow, Toxic and Flammable Release and Dispersion Modeling	MS Teams
2	8 <sup>th</sup> week-9 <sup>th</sup> week	Fires and Explosions; Flammability, MOC; Explosions, Detonations, Blast Damage, Protection and Prevention; Inerting and Purging; Static Electricity; Ventilation	MS Teams
3	10 <sup>th</sup> week-11 <sup>th</sup> week	Chemical Process Safety: Decomposition & Runaway Reactions, Initiating factors Reactive Chemical Hazard, Assessing Reaction Hazard; Tools for evaluating thermal explosion, steps to Reduce Reactive Hazards	MS Teams

4	12 <sup>th</sup> week-14 <sup>th</sup> week	Hazard Identification & Risk Assessment: The Process of Risk Management Hazard Identification, Evaluation (Risk Assessment, Risk Matrix), Risk Control Implementation, Action and Recommendation Hazard Evaluation Techniques: Quantitative, Qualitative Safety Review, Process / System Checklists, Dow Fire and Explosion Index, What-If Analysis, HAZOP. Reliability, Probability Distribution, Demand and Failure, Fault Tree Analysis (FTA), Minimal Cut Set Identification, Event Tree Analysis	MS Teams
5.	15 <sup>th</sup> week	Tutorial Accident Investigations – nuclear and other chemical process plants, Student Presentations of Term Project Reports– Case Studies, Design Problems, Quantitative Methods, etc.	MS Teams
6.	15 <sup>th</sup> week End of semester	Compensation Assessment(CPA) Final Assessment	

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

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I	5 <sup>th</sup> week	1 hour	25
2	Assignment/Seminar	7 <sup>th</sup> week	20 minutes	20
3	Assessment II	10 <sup>th</sup> week	1 hour	25
CPA	Compensation Assessment*	15 <sup>th</sup> week	1 hour	25
6	Final Assessment *	End semester	2 hours	30

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

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

Feedback from students during class committee meetings.  
Feedback during end semester examinations.

**COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)**

**MODE OF CORRESPONDENCE (email/ phone etc):** The Course Coordinator is available for consultation the Department. Queries may also be emailed to the Course Coordinator directly at sheeba@nitt.edu

**COMPENSATION ASSESSMENT**

All the assessments are compulsory. If a student fails to attend any one assessment due to genuine reasons, he/she will be permitted to appear for CPA. CPA may not be considered as an improvement test.

Grading and passing minimum are as prescribed by the regulations of the institute.

**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**

Textbooks, reference books Website addresses, journals, etc

1. Sam Mannan, Frank P. Lees, "Lees' Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control", 4th Edition, Butterworth-Heinemann, 2005.
2. H.H. Fawcett & W. S. Wood, "Safety and Accident Prevention in Chemical Operation", 2 nd Ed, Wiley Interscience, 1982.
3. Guide for Safety in the Chemical Laboratory Second edition 1977, Manufacturing Chemists Association. Van Nostrand Reinhold Company, New York.
4. Daniel A. Crowl & Joseph F. Louvar, "Chemical Process Safety, Fundamentals with Applications", 2nd Edition, Prentice Hall, Inc. ISBN 0-13-018176-5.

**FOR APPROVAL**

Course Faculty  **CC-Chairperson**  **HOD**   
Dr.K.N.SHEEBA Dr.T.Sivasankar

**Guidelines:**

- a) The number of assessments for a course shall range from 4 to 6.
- b) Every 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		40%

- 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.