

DEPARTMENT OF MECHANICAL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	Safety in Chemical Industries		
Course Code	ME 654	No. of Credits	3
Course Code of Pre-requisite subject(s)	ME 653	ME 655	ME 657
Session	JANUARY	Section (if, applicable)	
Name of Faculty	Dr.K.Ramamurthi	Department	MECHANICAL
Email	k.ramamurthi@gmail.com	Telephone No.	9444139330
Name of Course Coordinator(s) (if, applicable)	Dr.S.P.Sivapirakasam		
E-mail	spshivam@nitt.edu	Telephone No.	9944547215
Course Type	Core course		
Syllabus (approved in BoS)			
SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM DESIGN			
Design process, conceptual design and detail design, assessment, inherently safer design chemical reactor, types, batch reactors, reaction hazard evaluation, assessment, reactor safety, operating conditions, unit operations and equipments, utilities.			
Pressure system, pressure vessel design, standards and codes- pipe works and valves- heat exchangers- process machinery- over pressure protection, pressure relief devices and design, fire relief, vacuum and thermal relief, special situations, disposal-flare and vent systems failures in pressure system.			
PLANT COMMISSIONING AND INSPECTION			
Commissioning phases and organization, pre-commissioning documents, process commissioning, commissioning problems, post commissioning documentation			
Plant inspection, pressure vessel, pressure piping system, non destructive testing, pressure testing, leak testing and monitoring- plant monitoring, performance monitoring, condition, vibration, corrosion, acoustic emission-pipe line inspection.			
PLANT MAINTENANCE, MODIFICATION AND EMERGENCY PLANNING			
Management of maintenance, hazards- preparation for maintenance, isolation, purging, cleaning, confined spaces, permit system- maintenance equipment- hot works- tank cleaning, repair and demolition- online repairs- maintenance of protective devices- modification of plant, problems- controls of modifications.			

Emergency planning, disaster planning, onsite emergency- offsite emergency, APELL

STORAGES AND TRASPORATION

General consideration, petroleum product storages, storage tanks and vessel- storages layout segregation, separating distance, secondary containment- venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief- fire prevention and protection- LPG storages, pressure storages, layout, instrumentation, vapourizer, refrigerated storages- LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages, other chemical storages- underground storages- loading and unloading facilities- drum and cylinder storage- ware house, storage hazard assessment of LPG and LNG

Hazards during transportation – pipeline transport

PLANT OPERATIONS

Operating discipline, operating procedure and inspection, format, emergency procedures hand over and permit system- start up and shut down operation, refinery units- operation of fired heaters, driers, storage- operating activities and hazards- trip systems- exposure of personnel.

Specific safety consideration for Cement, paper, pharmaceutical, petroleum, petro-chemical, rubber, fertilizer and distilleries.

COURSE OBJECTIVES

- 1) To provide knowledge on design features for a process industry and safety in the operation of various equipment in industry.
- 2) To understand the various hazards and prevention in commissioning
- 3) To recognize and identify the safe operation of equipment in process industry.
- 4) To plan and trained for emergency planning in a process industry.
- 5) To get fundamental knowledge on safe storage of chemicals.

<u>Course Outcomes</u>	<u>Aligned Programme Outcomes (PO)</u>
1) This course would make familiar of safe design of equipment which are the essential to chemical industry and leads to design of entire process industries.	1,3,7,9,10,11
2) Course would be helpful to understand the design of pressure systems.	1,2,3,4,7,10
3) Students would understand the problems and find innovative solutions while industries facing problems in commissioning and maintenance stages.	1,2,3,5,6,7,9,10,11
4) Students can prepare the emergency planning for chemical industry problems	1,2,3,4,5,6,7,10,11
5) Students would be able to create safe storage systems	1,2,3,5,6,9,10,11

COURSE PLAN – PART II

COURSE OVERVIEW

Safety in Chemical Industries (SCI) mainly deals with all safety aspects related to the process industries. It identifies various safety related issues that occur at each and every stage of a process or chemical industry starting from Design, Research and Development, Construction,

Commissioning, Production, Modification, Shutdown and Maintenance and Decommissioning and provides suitable solutions. It gives practical solutions regarding Emergency planning in process and chemical industries. It discuss briefly about various hazards associated with storage and transportation of chemicals.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	1-2	Design process, conceptual design and detail design, assessment, inherently safer design chemical reactor, types, batch reactors, reaction hazard evaluation, assessment, reactor safety, operating conditions, unit operations and equipments, utilities.	Chalk and talk and Power point presentation
2	3-4	Pressure system, pressure vessel design, standards and codes- pipe works and valves- heat exchangers- process machinery- over pressure protection, pressure relief devices and design, fire relief, vacuum and thermal relief, special situations, disposal- flare and vent systems failures in pressure system.	Chalk and talk and Power point presentation
3	5-6	Commissioning phases and organization, pre-commissioning documents, process commissioning, commissioning problems, post commissioning documentation	Chalk and talk and Power point presentation
4	7-8	Plant inspection, pressure vessel, pressure piping system, non destructive testing, pressure testing, leak testing and monitoring- plant monitoring, performance monitoring, condition, vibration, corrosion, acoustic emission- pipe line inspection	Chalk and talk and Power point presentation
5	9-10	Management of maintenance, hazards- preparation for maintenance, isolation, purging, cleaning, confined spaces, permit	Chalk and talk and Power point presentation

4				
CPA	Compensation Assessment*			
5				
6	Final Assessment *	18 th Week	3 hours	50 %

***mandatory; refer to guidelines on page 6**

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

1. Students can meet the faculty at any stage in the course duration in case he/she finds difficulty in understanding the concept.
2. Feedback form issued to students to express their comments about the course after completing the syllabus. Students are requested to give genuine feedback about the course.
3. Student knowledge about the topic covered in this course will be judged based on marks obtained in the written examination.

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

MODE OF CORRESPONDENCE (email/ phone etc)

Students can reach course faculty by fixing appointment through E-mail (spshivam@nitt.edu) or phone (9944547215)

ATTENDANCE :

1. The minimum attendance for appearing for the semester examination is 75%.
2. Those students, whose attendance falls below 75% but above 50% in a subject, shall attend mandatory classes before the semester examinations to qualify to write semester exam.
3. The students who are having attendance less than 50% has to redo the course in next semester.

COMPENSATION ASSESSMENT

1. Attending all the assessments are MANDATORY for every student.
2. One Compensation Assessment (CPA) will be conducted for those students who are being physically absent for any of the assessment and it covers the entire contents of the course.
3. At any case, CPA will not be considered as an improvement test.

ACADEMIC HONESTY & PLAGIARISM


1. The minimum attendance for appearing for the semester examination is 75%.

2. Those students, whose attendance falls below 75% but above 50% in a subject, shall attend mandatory classes before the semester examinations to qualify to write semester exam.
3. Relative grading will be adopted for the course.
4. Plagiarism is applied during the Assignment grading, based on which mandatory corrective actions are taken.

ADDITIONAL INFORMATION

Students can reach course faculty by fixing appointment through E-mail (spshivam@nitt.edu) or phone (9944547215)

FOR APPROVAL

Subject Coordinator 

CC-Chairperson 

HOD 

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. This is not applicable for project work/industrial lectures/internship.
- d) The policy for attendance for the course should be clearly specified.
- e) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.

		system- maintenance equipment- hot works- tank cleaning, repair and demolition- online repairs- maintenance of protective devices	
6	11-12	Emergency planning, disaster planning, onsite emergency-offsite emergency	Chalk and talk and Power point presentation
7	13-14	General consideration, petroleum product storages, storage tanks and vessel- storages layout segregation, separating distance, secondary containment- venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief- fire prevention and protection- LPG storages, pressure storages, layout, instrumentation, vapourizer, refrigerated storages- LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages	Chalk and talk and Power point presentation
8	15-16	Operating discipline, operating procedure and inspection, format, emergency procedures hand over and permit system- start up and shut down operation, refinery units- operation of fired heaters, driers, storage- operating activities and hazards- trip systems- exposure of personnel.	Chalk and talk and Power point presentation
9	17-18	Specific safety consideration for Cement, paper, pharmaceutical, petroleum, petro- chemical, rubber, fertilizer and distilleries.	Chalk and talk and Power point presentation

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test - 1	6 th week	1 hours	20%
2	Cycle Test - 2	11 th week	1 hours	20%
3	Assignment	14 th Week	-	10%