Course code	Course Name	L-T-P-Credits	Year of Introduction
CH404	SAFETY ENGINEERING IN PROCESS PLANTS	3-0-0- 3	2016

Prerequisite : Nil

Course Objectives:

- To impart the basic concepts of industrial safety.
- To develop understanding about safety practices in industries and emergency procedures.
- To understand about chemical hazards and risks.

Syllabus

Introduction to safety, accidents, safety data sheet, work permit system. Hazards-classification and consequence of hazards. Prevention and identification techniques of hazards. Safety audits, analysis and inspections. Fire, fire fighting techniques. Case study of safety provisions in factories**.**

Expected Outcome

The students will be able to

- i. Implement safety in processes.
- ii. Analyze the chemical hazards in plants.
- iii. Analyze the Process Reliability and Human Errors.

Text Books

1. Bhaskara Rao- "Safety in Process Plant Industries" Khanna Publications.
2. Daniel Crowl- " Chemical Process Safety" 3rd edition, Pearson Publications
3. R.K.Jain & Sunil S Rao, Industrial Safety, Health and Environment Management Systems, Khanna Publishers

Reference Books:

1. Encyclopedia of Occupational Health & Safety, International labour Office, Geneva
2. Frank P. Lees- "Loss Prevention in Process Industries" ,Vol.1,2&3,Second Edn, Butterworth-Heinemann.1996
3. Grialdi, J. V., and Simonds, R.H., Safety Management, AITBS Publishers & Distributors, New Delhi
4. Guidelines for Hazard Evaluation Procedure. Centre for Chemical Process Safety.AICHE,1992
5. K.V. Raghavan and A. A. Khan : Methodologies in Hazard Identification and Assessment Manual by CLRI, December 1990.
6. Kumar, A., Chemical Process Synthetics and Engineering Design, Tata McGraw Hill, New Delhi
7. Ralph King, Safety in the Process Industries, Butterworth-Heinemann
8. Slote, L., Handbook of occupational safety & Health, John Wiley & Sons, New York.
9. V.C Marshal : Major Chemical Hazards – Ellis Harwood Ltd., Chichester, U.K. 1987.
10. Wells. G. L, Safety in Process Plant Design, George Godwin Ltd, London.

Course Plan			
Module	Contents	Hours	Sem. exam marks
I	Introduction to safety: Concept and importance of industrial safety. Fundamental safety tenets. Safety in the site selection and lay out. Accidents- Classification Cost of accidents. Key safe practices in chemical industry for accident prevention programme. Material safety data sheet. Work permit system	7	15%
II	Chemical hazards classification. Consequence of chemical hazards. Physical hazards- Atmospheric contaminants, Sound, Light, Radiation, Pressure, Temperature. Electrical hazards- electric shock, flash over, lightning Strokes. Mechanical hazards. Environmental hazards.	7	15%
FIRST INTERNAL EXAMINATION			
III	Prevention techniques for hazards. Hazard area classification. Safety in transportation of hazardous chemicals by road-HAZCHEM CODE, TREM CARD Relief system and Detectors. T.L.V, STEL, TLV-C, IDLH, UFL, LFL. Hazard identification techniques- Dow index and Toxicity index	7	15%
IV	Safety Inspections, safety Audits, Job- safety Analysis, Hazard Survey and analysis, HAZOP, Fault tree analysis, failure mode and effect analysis, Event tree analysis, examples. Consequence of chemical hazards. Probit equations, FN curves, Risk-individual risk, societal risk.	7	15%
SECOND INTERNAL EXAMINATION			
V	Hazards due to Fire-Pool fire, Jet fire, Flash fire, Explosion-UVCE, BLEVE, Toxic release, Runaway Reaction. Fire pyramid. Types of fire extinguishers and its handling. Types of built in extinguishing systems. Fixed fire protection systems. Firefighting techniques. Flame proof equipments.	7	20%
VI	Emergency planning-onsite and offsite emergency planning, Mock drill. Health hazards due to Chemical exposure. Safety provisions in the Factories Act, Salient features of Petroleum Act. The concept of inherent safety.	7	20%
END SEMESTER EXAM			

Question Paper Pattern

Maximum Marks: 100   Exam Duration: 3 Hours

Part A: There shall be **Three questions** uniformly covering Modules 1 and 2, each carrying 15 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in one main question with a total of 15 marks for all the subdivisions put together.
(2 x15= 30 Marks)

Part B: There shall be **Three questions** uniformly covering Modules 3 and 4, each carrying 15 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in one main question with a total of 15 marks for all the subdivisions put together.
(2 x15= 30 Marks)

Part C: There shall be **Three questions** uniformly covering Modules 5 and 6, each carrying 20 marks, of which the student has to answer any **Two questions**. At the most 4 subdivisions can be there in one main question with a total of 20 marks for all the subdivisions put together.
(2 x20= 40 Marks)