

Fire, Safety and Hazard Analysis

- 1.1 Course Number: CH201
- 1.2 Contact Hours: 2-0-0 Credits: 06
- 1.3 Semester-offered: 4th Year- Even
- 1.4 Prerequisite: NA
- 1.5 Syllabus Committee Members: Dr. Shweta and Dr. Deepak Dwivedi

2. **Objective:** Safety is one of the key dimensions of engineering asset management. The objective of this course is to impart knowledge on different facets and aspects of risk, hazards, and their assessment techniques in industry. Another is to inculcate knowledge about the consequences of fire, explosions, and toxic releases. Based upon the industry requirements, risk-based and hazard-based methods to estimate the potential impact of fire will be discussed.

3. Course Content:

Unit wise distribution of content and number of lectures

Unit	Topics	Sub topics	Lectures
1	Industrial safety and Accident causation	Introduction, Development of safety programmes in process industry, Loss prevention, Accident causation: Heinrich-Domino theory; Human error model; Petersen's accident/ incident model; Epidemiological models; System models; Multiple causation theory	5
2	Toxicology	Effects on health, Toxicological studies, Dose-Response, Compartment models.	3
3	Combustion and Explosions	Theory of fire, combustion and explosion – Mechanism; causes; hazard; models; preventive and control measures	7
4	Hazard Identification and Risk Assessment	Hazard Identification: Preliminary Hazard Analysis; Hazard and operability study (HAZOP); Fault Tree Analysis (FTA); Event Tree Analysis (ETA), Risk analysis techniques: Quantitative Risk Analysis (QRA); Bow Tie diagrams; Layers of Protection Analysis (LOPA), Systems safety management: Management task; Managerial roles and skills; Management by objective.	9

5	Case studies	Safety and hazard assessment in different industries including Oil & Gas industry; Disaster management planning; Design for safety	4
		Total	28

4. **Readings**

4.1 Text Books:

1. Daniel A Crowl and Joseph F. Louvar, Chemical process safety, Fundamentals with applications, 2nd ed., Prentice Hall (2002).
2. Lees FP, Loss Prevention in Process Industries, Volume I & II, 2nd ed., Butterworth Heinemann, (2004).

4.2 Reference Books:

1. HAZOP Guide to Best Practice, Frank Crawley, Malcolm Preston, and Brian Tyler, 2nd ed., IChemE (2008).
2. Basic Guide to system safety, Jeffrey W. Vincoli, John Wiley & Sons, Inc., Hoboken, New Jersey (2014).
3. Health, Safety and Accident Management in the Chemical Process Industries, Ann Marie Flynn and Louis Theodore, Marcel Dekker, Inc. NW (2002).
4. Guidelines for Chemical Process Quantitative Risk Analysis. 2nd ed., John Wiley & Sons, Inc., Hoboken, New Jersey (2000).

5. **Outcome of the Course:**

After completion of this course, the student will be able to

- Explain the basic concepts of accident causation in the process industry.
- Identify the typical sources of risk in a process plant through hazard analysis, identification, and estimation.
- Understand fire and explosion, preventive methods, relief, and its sizing methods.
- Conduct assessments, produce safe operational working procedures, and create inherently safer designs.