

Fire, Safety and Hazard Analysis

- 1.1 Course Number: CH201
- 1.2 Contact Hours: 2-0-0 Credits: 6
- 1.3 Semester-offered: 2nd Year-Even
- 1.4 Prerequisite: NA
- 1.5 Syllabus Committee Member: Dr. Shweta and Dr. Deepak Dwivedi
2. **Objective:** The objective of the course is to Introduce the concept of process safety in Industry and understanding the hazard of fire and its analysis.
3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Industrial safety and loss trends	Loss prevention; Development of safety programmes in process industry. Accident causation: Heinrich-Domino theory; Human error model; Petersen's accident/ incident model; Epidemiological models; System models; Multiple causation.	4
2	Toxicology	Effects on health, Dose-Response, Threshold Limit Value -TLV, etc.	5
3	Combustion and explosions	Theory of combustion and explosion – vapor clouds – flash fire – jet fires – pool fires – unconfined vapor cloud explosion, shock waves - auto-ignition – boiling liquid expanding vapor explosion .Production of fire; Fire development; Severity and duration; Classification of fires; causes, detection, reventive measures, Inertisation. Explosions: Mechanism, causes, characteristics, preventive and control measures.	6
4	Hazard Analysis	Hazard: Identification (HAZID); Occupational hazard; Preliminary Hazard Analysis (HAZAN); Hazard and operability study (HAZOP).Hazard control: Engineering and management controls; Assessment of the frequency of incidents including Fault Tree Analysis (FTA) and Event Tree Analysis (ETA); Risk analysis techniques, i.e. matrices, qualitative, semi-quantitative and Quantitative Risk Analysis (QRA), Bow Tie diagrams, Layers of Protection Analysis (LOPA). Risk analysis and management. Systems safety management: Management task; Managerial roles and skills; Management by objective.	8

5	Case studies	Safety and hazard assessment in different industries, including O & G industry; Disaster management planning; Design for safety, maintenance and fault diagnosis.	5
		Total	28

4. Readings

4.1 Textbook:

1. Crowl, D.A. and Louvar, J.F., "Chemical Process Safety: Fundamentals with Applications", Pearson Prentice Hall, Inc.
2. T.A. Kletz, 'Hazop & Hazan: Identifying and Assessing Process Industry Hazards', CRC Press

4.2 Reference books:

1. Wills, G.L., "Wells: Safety in Process Plant Design", John Wiley & Sons Inc.
2. Lees, F.P., "Loss Prevention in Process Industries", Volume I & II, Butterworth Heinemann.
3. Pandey, C.G., "Hazards in Chemical Units: a Study", Oxford IBH Publishing Co., New Delhi.

5 Outcome of the Course:

Students will gain sufficient understanding about fire hazards in industry. They will learn how to analyze those and conduct assessment of risk. Further, they will have the experience to carry out simple hazard analysis studies adequately, recognizing the limits to that understanding, and appreciate the standards required to conduct various process safety analysis.