

**FACULTY OF ENGINEERING & TECHNOLOGY**

**First Year Master of Engineering**

**Semester III**

**Course Code: 102330312**

**Course Title: Industrial safety**

**Type of course : Open Elective I**

**Course Objectives:**

This course is intended to impart knowledge on safety engineering fundamentals and safety management practices to engineering graduates and rendering professional expertise to the industrial and societal needs at national and global level subject to legal requirements. It also aims at effective functioning as an individual and as a member or leader in diverse teams and in multi-disciplinary settings so as to provide practical solutions to safety problems.

**Teaching & Examination Scheme:**

| Contact hours per week |          |           | Course Credits | Examination Marks (Maximum / Passing) |        |          |        |        |
|------------------------|----------|-----------|----------------|---------------------------------------|--------|----------|--------|--------|
| Lecture                | Tutorial | Practical |                | Internal                              |        | External |        | Total  |
|                        |          |           |                | Theory                                | J/V/P* | Theory   | J/V/P* |        |
| 3                      | 2        | 0         | 4              | 40/16                                 | 20/8   | 60/24    | 30/12  | 150/60 |

\* J: Jury; V: Viva; P: Practical

**Detailed Syllabus:**

| Sr. | Contents   | Hours |
|-----|--|-------|
| 1   | Fire and explosion: Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – fire stoppers – hydrant pipes – hoses – monitors – fire watchers.   | 08    |
| 2   | Principles of explosion-detonation and blast waves-explosion parameters – Explosion Protection, Containment, Flame Arrestors, isolation, suppression, venting, explosion relief of large enclosure-explosion venting-inert gases, plant for generation of inert gas rupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO <sub>2</sub> ) and halons-hazards in LPG, ammonia (NH <sub>3</sub> ), sulphur dioxide (SO <sub>2</sub> ), chlorine (Cl <sub>2</sub> ) etc. | 10    |
| 3   | Physical hazards: Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometry, hearing conservation programs vibration types, effects, instruments, surveying procedure,  | 10    |



|   |  |    |
|---|--|----|
|   | permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard non-ionizing radiations, effects, types, radar hazards, microwaves and radio-waves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control   |    |
| 4 | Chemical hazards: Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard. Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling  | 08 |
| 5 | Safety in chemical industry: safety in process design and pressure system design, safety during storage and transportation, 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, LPG storages, pressure storages, layout, instrumentation, vapourizer, refrigerated storagesLNG storages, hydrogen storages, toxic storages | 10 |
| 7 | Safety regulations: Factories act and rules - Workmen compensation act. Indian explosive act - Gas cylinder rules - SMPV Act - Indian petroleum act and rules. Environmental pollution act Manufacture, Storage and Import of Hazardous Chemical rules 1989 Indian Electricity act and rules. Overview of OHSAS 18000 and ISO 14000  | 08 |

### Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

| Distribution of Theory Marks |     |     |     |     |     | R: Remembering; U: Understanding; A: Application,<br>N: Analyze; E: Evaluate; C: Create |
|------------------------------|-----|-----|-----|-----|-----|---|
| R                            | U   | A   | N   | E   | C   |   |
| 15%                          | 30% | 15% | 15% | 15% | 10% |   |

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Reference Books:

|   |   |
|---|---|
| 1 | Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986.                           |
| 2 | Lees, F.P. "Loss Prevention in Process Industries" Butterworths and Company, 1996.                            |
| 3 | Fawcett, H.h. and Wood, "Safety and Accident Prevention in Chemical Operations" Wiley inters, Second Edition. |
| 4 | GREEN, A.E., "High Risk Safety Technology", John Wiley and Sons,. 1984  |
| 5 | K U Mistry, Fundaments of Industrial safety & health, SiddharthPrakashan, Ahmedabad                           |

| Course Outcome Statements  | %weightage |
|--|------------|
| To identify the causes of accident and explain various engineering control methods           | 25         |
| To impart basic understanding of storage, handling and transportation of hazardous materials | 25         |



|   |    |
|---|----|
| To explain fire and fire control methods  | 25 |
| To enlighten with the safety rules and regulations in industry.   | 25 |
| <ol style="list-style-type: none"><li>1. Prepare a chart of Indian safety standards</li><li>2. Identify different hazards in a given chemical plant</li><li>3. Identify different chemical hazards in a given chemical plant</li><li>4. Identify colour codes for pipelines</li><li>5. Identify colour codes for gas cylinders</li><li>6. Identify different safety symbols for chemical industry</li><li>7. Demonstrate Personal Protective Devices</li><li>8. Prepare a handouts of safe handling practices for hazardous chemicals</li><li>9. Safety and Hazard Management in Chemical Industry</li><li>10. Prepare a chart of Indian safety standards</li><li>11. Identify different hazards in a given chemical plant</li><li>12. Demonstrate Fire triangle and classes of fire</li><li>13. Demonstrate construction and working of different fire extinguishers</li><li>14. Apply HAZOP method using a case study</li></ol> |    |
| Video lectures available on the websites NPTEL.   |    |
| CDs available with some reference books for the solution of problems.   |    |
| Use of subject relevant software for the problems solving and analyzing the thermodynamic processes.  |    |

| <b>Curriculum Revision:</b>    |          |
|--------------------------------|----------|
| Version:                       | <b>1</b> |
| Drafted on (Month-Year):       | Apr-20   |
| Last Reviewed on (Month-Year): | Jul-20   |
| Next Review on (Month-Year):   | Apr-22   |