

Third Year BSc. (Fire & Safety)

IMPLEMENTATION-2017-18

Semester-5

ELECTIVE COURSE (EC-05)

Credit: 2

Paper No: EC-301 Industrial Hygiene and Occupational Health

Unit 1: Introduction to Industrial Hygiene and Occupational Health

1. Meaning of Industrial hygiene
2. Meaning of occupational health
3. Difference between industrial hygiene and occupational health
4. Work co-ordination between industrial hygienist and safety officer
5. Ergonomics
6. First Aid
7. Poisoning first aid and Antidotes

Unit 2: Various Health Hazards & Controls

1. Forms of chemical agents and biological agents for health hazards
2. Routes of entry of hazardous substances into the body
3. Eight key steps for assessing the health risk
4. Methods of control

5. Effects of vibration and its prevention measures
6. Causes and effects of stress and its prevention strategies
7. MAH controls
8. Types of skin hazards

Unit 3: Industrial Sanitation

1. Introduction
2. Safe water supply
3. Collection and disposal of liquid & solid wastes
4. Safe food supply
5. Control of insects & rodents
6. Sanitary facilities & other personal services
7. Maintenance of general cleanliness
8. Causes of occupational dermatitis
9. Types of occupational dermatitis
10. Treatment

Unit 4: The Pulmonary Diseases

1. Introduction
2. Properties of dust
3. Atmospheric dust concentrations & particle size
4. Classification of dust based on its effect in the body
5. Anatomical factors in dust injuries
6. Physiological factors in dust injuries

7. Dust causing pulmonary fibrosis
8. A study of cancerous tissue
9. Benign versus Malignant Tumours
10. Definition of carcinogenic chemical
11. The risk associated with occupational & environmental carcinogens

Paper No: EC-301 Industrial Hygiene and Health

Reference book list for Industrial Hygiene and Health

- Fundamental of industrial safety and health- K U Mistry

Paper No: EC-301 Explosive, Radioactive Materials & Communication

UNIT-1 Explosive-I

- Interaction of fire and explosion parameters with response performance
- Characteristics of active fire and explosion protection systems, manufacturer, possession and sale of explosives.
- Protection systems
- Explosion and combustion, general classification of Explosives
- Gun-powder, Nitrate mixture, Nitro compounds, Chlorate mixture, fulminate, Ammunition, fireworks and lox
- Functional and fire fighting classification.

UNIT-2 Explosive-II

- Dust explosion, dust control,
- Explosion venting, suppression
- BLEVE, UVCE
- Explosion detection, transportation of explosives, detonator, analysis and repair (4 materials)

UNIT-3: RADIOACTIVE MATERIALS

- Principles of radiation
- Dissymmetry, radiation protection standards, Handling & prevention of radiation emergencies
- Fire fighting and rescue problems in the presence of radiation hazards

UNIT-4: COMMUNICATION TECHNOLOGY AND CONTROL CENTER

1. Introduction, definition and importance of communication system in fire
2. Design and operation of communication control centre
 - Communication facilities in the control centre
 - Communications centre equipment
 - Computer aided dispatch
 - Call response and dispatch
 - Receiving and dispatching emergencies calls
3. Fire department radio system and their types
4. Processing communication within department
 - Data collection system
 - Incident related data
 - Operational data
 - Administrative / Management data
5. Internal communication of fire services
 - Reports and circulars
 - Endorsement and memorandum
 - Agendas
 - Managerial communication
 - Oral and written communication

Paper No: EC-301 Explosive, Radioactive Materials & Communication

Reference book list for Explosive, Radioactive Materials & Communication

- Advance electronic communication system – Wayne Tomasi
- Explosive identification guide – Mike Pickett
- Hazardous material response and operation – Chris Hawley
- Decontamination for Hazardous Material Emergency – Timothy V. Henry

➤ **GENERAL ENGLISH: (As prescribed by Gujarat University)**

CORE COURSE 1 (CC 1):

Credit: 4

Paper No: 301 Special Fire Hazard

Unit 1: Introduction to concept of Special Fire Hazard

1. Concept of SFH
 - a. Areas under special fire hazard
2. Principles of life safety and objectives.
3. SEVESO Directive, COMAH, DSEAR regulations ATEX Directives
4. Basic fire safety strategy in high rise building.
5. Categories of special structures.

Unit 2: Aviation Fire Operations

1. Introduction to aircraft and parts
 - a. Materials of construction
 - b. Details of construction
 - c. Fuel tanks, construction of tanks and different aviation fuels.
 - d. Different engines and APU
2. Aircraft fires
 - a. Engine fire
 - b. Wheel fire
 - c. Cabin fire
 - d. Vapour cloud explosion in fuel tanks
3. Rescue from civil aircrafts
 - a. Approach to aircraft with engines running
 - b. Main passenger doors
 - c. Emergency stairs and escape slide

- d. Break-in points
 - e. Safety straps
4. Categorisation of airports
5. Airport fire hazards
 - a. Intro to airport fire hazards: landside and airside
 - b. Terminal buildings
 - c. Aircraft hangars
 - d. Fuel storage farms and associated facilities
 - e. Engine test facilities
 - f. General industrial and commercial facilities
 - g. Electrical plant facilities
 - h. Communication equipment facilities
 - i. Aircraft fuel servicing
6. Hazards in airport terminal building
7. Airport emergency planning and procedure
 - a. Pre-planning before an emergency: onsite and offsite emergency planning
 - b. Operation during an emergency
 - c. Support and documentation after emergency
8. Types of emergencies
 - a. Local standby
 - b. Low visibility standby
 - c. Full emergency
9. Triage and medical care
 - a. Triage principles and categories
 - b. Casualty identification tags and their use.
 - c. Operational siting during air crash or emergency (triage identification)

Unit 3: Gas Plants, Refineries, Chemical and Petro Chemical industry hazards

- Fire Fighting, Fire Prevention and protection and safety measurements for the above mentioned industries
- Salvage and protection from disaster fallout for these industries

Unit 4: Onshore, Offshore, Power Plant, fuel storage and LNG fire hazards

1. LNG introduction & MSDS of LNG
2. Fire fighting and control

3. Types of offshore platforms, Fire hazards in offshore platforms, Safety measure in offshore platforms
4. Power plant and energy generation hazards and fire prevention and fire fighting in these industries

Paper No: 301 Special Fire Hazard

Reference book list for Special Fire Hazard

- Aircraft incidents – HM Fire Services Publication
- Petrochemical incidents - HM Fire Services Publication
- DSEAR Regulations
- COMAH Regulations
- SEVESO Directives I. II. III
- ATEX Directives

Paper No: 301 Salvage and Fire Accident Investigation

Unit 1: Introduction to Salvage

1. Fire Service Act 1947
2. Concept of salvage
3. Importance of salvage and objectives
4. Why salvage is necessary
 - a. Water damage
 - b. Damage from heat and smoke
 - c. Damage from fire
5. Phases of salvage
 - a. Before fire fighting
 - b. During fire fighting
 - c. After fire fighting

Unit 2: Salvage operations

1. Salvage equipment and problems during salvage work
2. Salvage covers
 - a. Types of salvage covers
 - b. Use
 - c. Maintenance
3. Salvage procedure
4. Operational measure for salvage work

Unit 3: Elementary of Fire Investigation

1. Legal implications of fire investigation
2. What is accident investigation and its importance
3. Accident investigation methodology
4. Management of incident and collection of information
 - a. Role of investigator
 - b. Evidence at the scene
 - c. Witness statements and misleading information
 - d. Locating seats of fire
 - e. Silent witness

- f. Documenting the scene – investigation report
- g. Protecting the crime scene
 - i. During fire fighting
 - ii. During investigation
- h. Sequence of documents
5. Basic steps for accident investigation
6. What is arson
 - a. Types of arson
7. Arson investigation techniques
 - a. Visual inspection
 - b. Note taking
 - c. Photography
 - d. Forensic investigation
8. Importance of fire investigation for fire safety design.
9. Lessons learned by accident investigation and use by insurance companies.

Unit 4: Case Studies for Fire Investigation

1. Domestic Fire Case Studies
2. Industrial Fire Case Studies
3. Dust Explosion Case Studies
4. Special Fire Hazard Case Studies

Paper No: 301 Salvage and Fire Accident Investigation

Reference book list for Salvage and Fire Accident Investigation

- Kirk's fire investigation – Brady Fire.
- Scientific protocols for Fire Investigation – Boca Raton
- The investigation of major disaster.
- Fire service manual – The stationery office publication

Paper No: 301 Combustion Products & Its effects on Life Safety

Unit 1: Combustion Fundamentals

- Pyrolysis and combustion
- Combustion products generation from fires and industries
- Products of combustion and its individual effects and toxic properties
- Monitoring equipments

Unit 2: Effects of Combustion products on environment and human health

- Effects on environment
- Effects on Humans
- Effects from inhalation and indirect consumption

Unit 3: Prevention measures and suppression of toxic smoke generation

- Prevention of toxic effects
- Carbon Dioxide
- Carbon Monoxide
- Sulphur oxides
- Nitrogen oxides
- Lead

Unit 4: Physiological effects of combustion products and its prevention

- Effects on fire fighters and victims of fire
- Effects of Irritant and non-irritant smoke on fire fighters
- Effects of Asphyxiation from combustion products

**Paper No: 301 Combustion Products & its Effects on life
safety**

**Reference book list for Combustion Products & its Effects on Life
Safety**

- Combustion by products and Their Health Effects: Summary of the 10th
International Congress
- Toxic Air, The case of cleaning up coal fired power plants, American Lung
Association
- Environmental effects of Toxic materials from Oil and Gas Combustion by Joao
Vicente de Assuncao
- Toxicity of Plastics and Rubber in Fire, by P J Fardell
- Physiological effects of combustion products, hazards of combustion products, by
David Purser

Practical: - T.Y. B.Sc. (Fire & Safety)

SEMESTER V

CORE COURSE-1 (CC 1):

Credit: 3

Paper No: CC-1-Prac.-302

PRAC. Special Fire Hazard

1. Preparation of Fire safety policy (including life safety policy) for high rise building.
2. Airport visit and study of fire safety procedure on the premises including brief report.
3. Offshore platform fire & explosion case study video and brief report.
4. Aircraft fire case study video and brief report.
5. Study of Crash Fire Tender at airport.
6. Study of rescue from civil aircraft accident.
7. Study of computer room fire hazard.
8. 120 day table top exercise (airport rescue services)

Paper No: CC-2-Prac.-302

PRAC. Accident Investigation

1. Study of any fire / explosion accident from video and its brief report.
2. Study of role of various agencies in fire investigation
3. Study of factors influencing fire investigation
4. Study of importance of witness and forensic evidence
5. Tutorial based practical to understand the damage from fire and fire fighting procedures.
6. Apply the phases of salvage for residential building.
7. Apply the phases of salvage for shopping mall.
8. Use of salvage equipment and its application.

Paper No: CC-3-Prac.-302

PRAC. Combustion Products & its Effects on Life Safety

1. Study of effects of irritants and non-irritant smoke products on humans and fire fighting operations
2. Study of effects of CO, CO₂ and SO on humans
3. Measuring levels of toxins in smoke with different equipments
4. Study of asphyxiating products from smoke
5. Measuring equipments for asphyxiating products and its use
6. Study of preventing measures and first aid measures in case of inhalation and effects on different body parts
7. Study of asphyxiation effects from combustion products of different combustible materials
8. Study of measuring equipments used for combustion products toxins

T.Y.BSc. (Fire & Safety)

IMPLEMENTATION-2017-18

Semester-6

ELECTIVE COURSE (EC-6)

Credit: 2

Paper No: EC-302 Explosion & Fire Dynamics

\Unit 1: Introduction to explosion characteristics

1. Background / introduction
 - a. Buncefield explosion case study
 - b. Other similar explosion incidents
2. Explosion hazards
3. Stoichiometry for gases
 - a. Introduction
 - b. Calculation for air
 - c. Calculation for O₂
4. Stoichiometry for general hydrocarbons and wood(Air to fuel ratio)
5. Application of stoichiometry
 - a. Naptha storage tank example
 - b. Burner startup
 - c. Boiler firebox explosion

Unit 2: Flammability limits and theories

1. Lean limit and Rich limit
2. LEL & UEL measurement techniques and equipments
3. Minimum ignition energy
4. Relation between auto-ignition temperature and flash point
5. Effect of temperature and pressure on flash point
6. Classification of flammable materials
7. Vapour tank explosion
 - a. TWA flight 800 Disaster

Unit 3: Explosion prevention and protection

1. Explosion prevention techniques
 - a. Ventilation
 - b. Separation
 - c. Physical barriers
 - d. Alternative techniques
2. Preventing the formation of explosive atmosphere
3. Explosion protection systems
 - a. Protection techniques
 - i. Containment
 - ii. Isolation
 - iii. Suppression
 - iv. Venting
 - b. Ventilation for explosion protection system
 - c. Explosion protection using inert gases
4. Flame arrestors and quenching distance

Unit 4: Fire dynamics

1. Specific heat capacity
 - a. H_c Air, H_c O₂
2. Radiation
3. Flame spread
 - a. Solid surface
 - b. Liquid surfaces
 - c. O₂ enriched atmosphere
4. Phases of fire development
 - a. Smouldering combustion
 - b. Spontaneous ignition
 - c. Flashover
 - d. Backdraught
5. Compartment fires and unconfined fires.
 - a. Enclosures
 - b. Phases of fire development and growth period
 - c. Flashover and fully developed fire
6. Human behaviour in fire
 - a. Movement speeds and flow rates
 - b. Motivation to evacuate
7. causes of delay before evacuation
8. Numerical examples: 81, 82, 83, 89, 99.

Paper No: EC-302 Explosion & Fire Dynamics

Reference Book List For Explosion & Fire Dynamics

- An introduction to fire dynamics – Dougal Drysdale
- Enclosed Fire Dynamics – Bjorn karlsson, Jammes G Quintiere.

Paper No: EC-302 Disaster Management

Unit 1: Understanding of disaster and its typology.

1. Meaning and significant of disaster
2. Understanding the global view of disaster
3. Disaster profile of India.
4. Essentials of disaster preparedness
 - Planning
 - Communication
 - leadership and co-ordination
5. Typology of Disaster
 - Earthquake, cyclone, flood, fire, epidemics, etc.

Unit 2: Essential response measures for disaster.

1. Preparedness and mitigation
 - Disaster mapping
 - Disaster mitigation
 - Disaster preparedness plan
 - Predictability forecast warning
 - Land zoning for disaster
2. Relief measures for disaster
 - Search rescue and evacuation
 - Shelter for victims
 - Clearance of debris

- Live stock and relief measures
- 3. Reconstruction and rehabilitation
 - Rehabilitation as a social and economical aspect
 - Reconstruction as a means of development.

Unit 3: Disaster management and community awareness.

1. Human behaviour and response in disaster
2. Information organisation and dissemination
3. Emergency health operation
4. Hygiene and sanitation
5. Drinking water
6. Food and nutrition
7. Community health during the disaster
8. Community participation
9. Public awareness program

Unit 4: role of various organisations and skill assessment.

1. Role of District administration
2. Role of Military and Para-military forces
3. Role of Ministry and department at centre level and state level.
4. Role of Non Government Organisation
5. Role of international agencies
6. Role of media
7. Skill assessment on:
 - Monitoring
 - Evaluation
 - Review
 - Damage assessment

Paper No: EC-302 Disaster Management

Reference Book List For Disaster Management

- Disaster management – B Narayan
- Disaster management and preparedness – Larry Collins

Paper No: 303 Fire Safety Risk Assessment & Management

Unit 1: Introduction

1. Introduction to fire safety risk assessment and management.
 - a. Why fire risk is important.
 - b. Where is FSRAM done
 - c. Who is responsible for FSRAM and how does he meet the requirement.
 - d. Definitions: Risk, hazard, disaster, disaster management, vulnerability.
 - e. Risk elements and types of risk.
 - f. Case studies: King's Cross underground station fire, Woolworth store fire.
2. Stake holders and corporate governance.

Unit 2: Procedure for Risk Assessment

1. Main rules of fire safety risk assessment.
2. 5 steps of FSRA.
3. When should FSRA be done.
 - a. Construction and planning stage.
 - b. After construction.
 - c. After occupying the place.
 - d. Major change in structure or when new process is introduced.
 - e. After any accident.

- f. At regular intervals.
- 4. Fire safety policy for an organization.
- 5. Exercise of FSRA.

Unit 3: Types of Risk Assessment

- 1. Types of Risk assessment
 - a. Point based
 - b. Quantitative
 - c. Qualitative
- 2. Safety Audit
 - a. Hazard detection techniques
 - b. Chart for risk acceptance and reduction
- 3. Fault tree analysis
 - a. Use of 'AND' or 'OR' gates for risk assessment

Unit 4: Risk management

- 1. Risk management.
 - a. Term management
 - b. Characteristics of risk management
 - c. Function of risk management (figure)
 - d. Key aspects and steps for risk management
- 2. Fire safety risk management implementation
 - a. Management structure and responsibilities.
- 3. Role of public in fire safety management.

Paper No: 303 Fire Safety Risk Assessment & Management

Reference Book List For Fire Safety Risk Assessment & management

- Fire Safety – Employer’s guide – The stationary office publication

Paper No: 303 Fire Safety Design

Unit 1: Sprinkler Design

1. Introduction to Standards used in India and Abroad

- I. TAC
- II. IS
- III. NFPA 13
- IV. BS EN 12845: 2004
- V. BS 9251 : 2005

2. Types of sprinkler systems

Types by operation

- 1.1 Wet
- 1.2 Dry
- 1.3 Pre – action
- 1.4 Deluge

Types of Layout

- I. Centre Fed
- II. End Fed
- III. Grid
- IV. Loop

3. Design and Layout

- I. Components of Sprinklers system
- II. Types of Sprinkler Head
- III. Deflector Plates
- IV. Effective Ranges of a Sprinkler and the Whole System

4. Hydraulic Calculations
 - I. Hydraulic Calculations
 - II. K – Factor
5. Pump Capacity & Water Supply & Storage

Unit 2: Detection & warning systems, emergency lighting.

1. Detection and warning systems
 - a. Intro to types of systems
 - b. Automatic fire detection and principles of operation
 - c. Smoke, Radiation and Heat Detectors, Line Detectors, Beam Detectors.
 - d. Detector Positioning
 - e. Control Panel & its Functions
2. Emergency lighting
 - a. Minimum Illuminance level
 - b. Defined escape routes/ undefined routes
 - c. Identification of escape routes and signs
 - d. Emergency lighting design
 - e. Sighting of essential escape lighting and additional escape lighting

Unit 3: Smoke Control Systems (Ventilation and pressurization)

1. Introduction
2. Essential features of smoke ventilation system
3. Forces responsible for smoke movement.
4. Effect of wind, stack effect

5. Natural, mechanical and tactical ventilation
6. Impulse and extraction fan
7. Basics of pressurisation
8. Where pressurisation is used

Unit 4: Gaseous and DCP system

1. CO2 Flooding systems and designing
2. HFC 227ea (FM 200)
3. FK 5-1-12
4. IG-01
5. IG-55
6. IG-100
7. IG-541
8. FE-13
9. Potassium Carbonate
10. Purple K
11. Halotron 1
12. DCP systems and design

Paper No: 303 Fire Safety Design

Reference Book List For Fire Safety Design

- Approved document A – U.K.
- Approved Document B – U.K.
- British Standard 9999
- Tariff Advisory Committee
- NFPA fire design engineering

Paper No: 303 Health, Safety & Environment

Unit 1: Occupational health and safety management

1. General definitions: Health, safety, environment protection, occupational accident, hazard, risk, near misses, health and safety culture.
2. Key elements for health and safety system
3. Importance of health and safety policy, aim and objective of health and safety policy
4. Health and safety culture, factors influencing health and safety culture
5. Influencing factors for health and safety management

Unit 2: Safety elements

1. Philosophy of safety
 - a. Need of safety philosophy
 - b. Nature and subjects of safety philosophy
2. Safety psychology
 - a. Need of safety psychology
 - b. Meaning and aim of safety psychology
 - c. Factors affecting safety at work: attitude, aptitude, frustration, morale, motivation, individual differences.

Unit 3: Environment

1. Introduction and 5 elements
2. Environmental issues in fire protection
 - a. Halon and the ozone layer
 - b. Other special extinguishing agent
 - c. Water based fire protections
 - d. Fire protection measures
3. Environmental audit
 - a. Need
 - b. procedure
 - c. Benefit
4. Solid waste management
 - a. Definition
 - b. Classification
 - c. Characteristics of solid waste
 - d. Environment impact
 - e. Role of citizen

Unit 4: Various Pollution & its effects on Environment

1. Noise Pollution

- a) Introduction
- b) Fundamentals of noise
- c) Transmission of sound
- d) The ear and the measurement of hearing
- e) Noise control

2. Radiation

- a) Introduction
- b) The concept of injury by radiation
- c) Infrared radiation
- d) Corpuscular radiation
- e) Poisoning from radioisotopes

3. Water Pollution

- a) Introduction
- b) Sources of water pollution
- c) Water pollution monitoring
- d) Control of water pollution
- e) Treatment of domestic waste water
- f) Treatment of industrial waste water

Paper No: 303 Health, Safety & Environment

Reference Book List For Health, Safety & Environment

- Application of HAZOP and what if safety reviews to petroleum, petrochemical chemical industries.
- Developing effective safety system – Lan G. Wallace
- The health and safety at work act 1974 – K J walsh U.K.
- Process safety and environment protection –
- Natural resources and environment management.

Practical: - T.Y. B.Sc. (Fire & Safety)

SEMESTER 6

CORE COURSE-1 (CC 1):

Credit: 3

Paper No: CC-1-Prac.-304

PRAC. Fire Safety Risk Assessment and Management

1. Study of five step of risk assessment procedure.
2. Study and compare qualitative Vs qualitative risk assessment methods.
3. Study and application of matrix method for risk assessment.
4. Preparation and use of fault tree analysis.
5. Risk assessment of laboratory facility in college.
6. Risk assessment of hostel and canteen facility in college.
7. Table top exercise for risk assessment of any shopping mall OR high rise building.
8. Study of fire safety audit and preparation of fire safety audit check list for any industry of your choice.

Paper No: CC-2-Prac.-304

PRAC. Fire Safety Design

1. Design of hydrant system for a G + 7 storey structure.
2. Design of sprinkler system for college building and college laboratory.
3. Design of CO₂ flooding system for computer room and library.
4. Calculate the exit width of corridor and staircase for G + 5 storey building.
5. Selection and installation of luminaries for college laboratories and main building.
6. Installation and location of alarm system for allotted area.
7. Installation and location of alarm system in hostel building/sleeping hazard.
8. Design of MVW and HVW for tank protection.

Paper No: CC-3-Prac.-304

PRAC. Health, Safety & Environment

1. Students have to provide knowledge of their industrial training.
2. Submit draft report and make necessary changes as per advice.
3. Submission of project report.
4. Prepare and deliver a Presentation on their individual projects.