*Placed at the meeting of*
*Academic Council*
*held on 12.12.2019*

# APPENDIX - G
# MADURAI KAMARAJ UNIVERSITY

*(University with Potential for Excellence)*

**Syllabus for New Course**

## B.Sc.(Fire and Safety Management)(Semester)

## Semester Pattern - CBCS

(With effect from the Academic year 2019-2020 onwards)
Regulations and Scheme of Examinations

### 1. INTRODUCTION OF THE PROGRAMME:

The Bachelor of Science programming Fire and Safety Management is offerby Madurai Kamaraj University. It is an Undergraduate Degree course in Science stream. The course is designed to learn about tackling accidents and disasters related to fires. After having completed this course there is various job opportunity has been in the field of manufacturing companies, airports, five-star hotels, fire-stations insurance companies, chemical and pharmaceutical firms, educational institutions, etc. The Three-Year (Six Semester) course equips students with all the required skills, knowledge and attitude to efficiently discharge responsibilities in Government sectors and Industrial Undertakings sector as skilled Fire and Safety professionals. The program is related to Infrastructure Management and covers the study of simulated fire fighting exercises along with applied physics, chemistry and mathematics. B.Sc. (Fire and Safety Management) Degree course also includes a detailed study of subjects like town planning, disaster mitigation, hydraulics, Fire communication systems and salvage investigation. It involves study of subjects that deals with the designing of safer Fire resistant equipments and plants, in depth understanding of the Science of Fire, its hazards and control measures, etc.The duration of the course is three years and the course opens many job scopes after its completion. Hence it is felt a specialized Degree in Fire and Safety Management is a requirement of the day.

### 2. ELIGIBILITY FOR ADMISSION:

A candidate for admission to B.Sc. (Fire and Safety Management) shall be required to have passed the Higher Secondary Course Examination conducted by the Government of Tamil Nadu or an Examination accepted as equivalent there by the Madurai Kamaraj University.

Age: The Maximum limit to admit a candidate in B.Sc.(Fire and Safety Management) is 25 Years and for SC/ST Students 3 Year of relaxation can be given

2.1. Duration of the Programme: 3 Years

2.2. Medium of Instructions : English

**3. OBJECTIVES OF THE PROGRAMME:**

The main objectives of the programme are to:

To educate and train a person to a skilled level of expertise in the domain area of Fire and Safety

To enable the students to acquire knowledge of Fire and Safety Studies

To provide an opportunity for further developing those skills which are important to leaning,e.g. library skills, study skills, and so forth

To develop safety professionals for both technical and management through systematic and quality based study programmes

**4. OUTCOME OF THE PROGRAMME:**

Learning Outcomes: After completion of the course students will be expected to be able to

Understand how to protect the people and themselves from the fire

Learn how to make a self-decision to save others by different techniques.

Describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.

**5. CORE SUBJECT PAPER:**All the core papers are mentioned inside the course structure.

**6. SUBJECT ELECTIVE PAPER:**

All subject elective papers are mentioned inside the course structure.

**7. NON- MAJOR ELECTIVE PAPER:**

Non Major elective paper as prescribed by any discipline approved by the University.

**8. UNITIZATION:**

Each Subject is segregated into five unites with each unit consisting of equal distribution of major concepts.

**9. PATTERN OF SEMESTER EXAM:**

Examination will be conducted at the end of each semester. Each Semester has two patterns of examination namely Internal (25 marks) and external (75 marks).

**10. SCHEME FOR INTERNAL ASSESSMENT:**

The Internal assessment will be as follows:

| | | |
|---|---|---|
| Test | = | 10Marks (Average of the best two tests) |
| Assignment | = | 5 Marks |
| Seminar/ Group Discussion | = | 5Marks |
| Peer-Team-Teaching | = | 5 Marks |
| Total | = | 25 Marks |

## 11. EXTERNAL EXAM:

External Examination will be conducted as semester exams as per University norms with common question paper for all affiliated colleges.

## 12. QUESTION PAPER PATTERN:

The Pattern of Question Paper will be as follows.

Time: 3 Hours Maximum Marks: 75

Section A: (10*1=10 Marks)

- Question No: 1 to 10 (Multiple Choice Pattern)
- Two question from each Unit
- Four Choices in each question
- No "None of these: choice.
- Section B: (5*7=35 Marks)
- Answer all questions either (a) or (b)
- Answer not exceeding two pages
- One question from each unit.
- Section C: (3*10=30 Marks)
- Answer should not exceed Four Pages. Answer any Three out of Five (One Question from each Unit).

## 13. SCHEME FOR EVALUATION

External Evaluation is done at the University level by Central Evaluation Procedure.

*PASSING MINIMUM*

Passing Minimum for the UG Course is 40% marks in Internal and External Separately.

### Model Question Paper

### FIRE AND SAFETY MANAGEMENT

Time: Three hours Maximum: 75marks

**SECTION - A**(10 x 1=10)

Answer ALL questions.

While conducting Luminol test, luminol reacts with hydrogen salt and forms:

(a) Di-anion (b) Cation (c) Anion (d) All of the above

Electrophoresis is mainly used for:

Differentiate the biological sample

To perform the human specific presumptive tests

DNA isolation from biological material

Separates the molecules

Restriction enzymes are used in one of these techniques:

(a). Sequencing (b). Genotyping (c).RFLP (d). Polymerization

Which of the following statement is false ?

Enzymes are differentiated by electrophoresis method

While DNA sequencing both forward and reverse primers are used (c). Amplification is done through PCR

(d). ABO blood grouping is mainly used for differentiating individuals

The fluorescence examination of the seminal stains indicates

(a). Pink color (b). White color (c).Blue color (d). Red color

The presumptive test for semen is

(a) Acid phosphatase test (b). Sodium alpha naphthyl test (c). Napthanildiazo test (d). Barbiturate test

For examination of diatoms sample should collect from

(a). Bone marrow (b). Blood (c). Tissue (d). Epithelial cells

A study of relationships between organisms and their environment

(a). Ethnology (b). Ecology (c).Monospecific (d). Monoecious

In wild life Forensics, identification of animals done by

(a). Grouping (b). Feathers (c).Twigs (d). Pug marks

Illegal way of trafficking animals

A. Kidnapping B. Poaching C. Harboring D. Smuggling

**SECTION-B** (5 x 7=35)

Answer all Questions by choosing either (a) or (b)

A) Describe the identification methods of blood? Forensic significance of biological materials. (OR)

b)Describe about the DNA markers and their uses in Forensic cases

A) Describe the identification method of Urine and its Forensic significance. (OR)

b)Explain about the Acid Phosphate Test.

A)What are Diatoms. Explain the identification methods of Diatoms and its specificity. (OR)

b)What are the different types of timber varieties encountered in forensic cases

A) Explain about the Forensic significance of Fiber evidence. (OR)

b)Define culpable homicide. When does it amount to murder?

A)Define about mitochondrial DNA. What is the forensic significance of mtDNA? (OR)

B)Give a detailed account on the experimental method of psychology.

**SECTION-C** (3 x 10=30)

Answer Any Three Questions

Explain the process of protection of biological evidence.

Write down the process of identification of blood.

Discuss the basic principles of DNA Extraction.

What are the characteristics of finger prints?

Write a note on crime scene reconstruction

**TEACHING METHODOLOGY**

To enhance the quality of students through creative and effective teaching the following teaching methodologies by classroom teaching methods, Practical training, Power Point Presentation classes, Guest lectures, Demonstrations and Internship for one month after each semester and study tour programmes.

**TEXT BOOKS**

The text books are mentioned below each individual paper.

**REFERENCE BOOKS**

The reference books are mentioned below each individual paper.

**RETOTALLING AND REVALUATION PROVISION**

Revaluation and re totaling shall be pursued by submission of respective application forms duly filled and authorized by the head of the Institution as per University norms. The applications must reach the University within the stipulated time frame as set by University.

**TRANSITORY PROVISION**

The revision of syllabus shall be done once in three years for better enhancement and updations.

**SUBJECT AND PAPER RELATED WEBSITE**

The websites are mentioned below the reference books column for every subject.

**Scheme of Examinations**
**B.Sc. (Fire and Safety Management)**

**FIRST YEAR**
**SEMESTER -I**

| Title of the Paper | Exam Duration | Hour | Credit | Internal | External | Total |
|---|---|---|---|---|---|---|
| **Part I** Tamil/ Alternate Subject | 3 | 6 | 4 | 25 | 75 | 100 |
| **Part II** English | 3 | 6 | 4 | 25 | 75 | 100 |
| **Part III Core Subjects** | | | | | | |
| Fire Prevention & Protection | 3 | 5 | 4 | 25 | 75 | 100 |
| Electrical Safety | 3 | 5 | 4 | 25 | 75 | 100 |
| **Part IIISubject Elective** | | | | | | |
| Chemical Safety | 3 | 3 | 3 | 25 | 75 | 100 |
| **Part IVSkill Based Subject** | | | | | | |
| Fire Fighting & Rescue Operation Mock Drill – **Practical** | 3 | 3 | 3 | 25 | 75 | 100 |
| **Part IVMandatory Subject** | | | | | | |
| Value Education | 3 | 2 | 2 | 25 | 75 | 100 |
| **Total** | **21** | **30** | **24** | | | **700** |

**SEMESTER- II**

| Title of the Paper | Exam Duration | Hour | Credit | Internal | External | Total |
|---|---|---|---|---|---|---|
| **Part I** Tamil/ alternate Subject | 3 | 6 | 4 | 25 | 75 | 100 |
| **Part II** English | 3 | 6 | 4 | 25 | 75 | 100 |
| **Part III Core Subjects** | | | | | | |
| Principles of Safety Management | 3 | 5 | 4 | 25 | 75 | 100 |
| Industrial Hygiene | 3 | 5 | 4 | 25 | 75 | 100 |
| **Part III Subject Elective** | | | | | | |
| Environmental Safety | 3 | 3 | 3 | 25 | 75 | 100 |
| **Part IV Skill Based Subject** | | | | | | |
| Elementary First Aid - **Practical** | 3 | 3 | 3 | 25 | 75 | 100 |
| **Part IV Mandatory Subject** | | | | | | |
| Environmental Studies | 3 | 2 | 2 | 25 | 75 | 100 |
| **Total** | **21** | **30** | **24** | | | **700** |

## SECOND YEAR

## SEMESTER III

| Title of the Paper | Exam Duration | Hour | Credit | Internal | External | Total |
|---|---|---|---|---|---|---|
| **Part I** Tamil/ Alternate Subject | 3 | 6 | 4 | 25 | 75 | 100 |
| **Part II** English | 3 | 6 | 4 | 25 | 75 | 100 |
| **Part III Core Subjects** | | | | | | |
| Constructional Safety | 3 | 4 | 4 | 25 | 75 | 100 |
| Environmental , Health & Safety (EHS) Laws and Acts | 3 | 6 | 4 | 25 | 75 | 100 |
| Hazard Identification & Risk Assessment | 3 | 4 | 4 | 25 | 75 | 100 |
| **Part III Subject Elective** | | | | | | |
| Fire Design Engineering | 3 | 2 | 3 | 25 | 75 | 100 |
| **Part IV Skill Based Subject** | | | | | | |
| Scaffolding & Work at Height – **Practical** | 3 | 2 | 3 | 25 | 75 | 100 |
| **Total** | **21** | **30** | **26** | | | **700** |

**SEMESTER IV**

| Title of the Paper | Exam Duration | Hour | Credit | Internal | External | Total |
|---|---|---|---|---|---|---|
| **Part I** Tamil/ alternate Subject | 3 | 6 | 4 | 25 | 75 | 100 |
| **Part II** English | 3 | 6 | 4 | 25 | 75 | 100 |
| **Part III Core Subjects** | | | | | | |
| Safety in Oil & Gas Sector | 3 | 4 | 4 | 25 | 75 | 100 |
| Food Safety ( HACCP) | 3 | 6 | 4 | 25 | 75 | 100 |
| Industrial Safety Management | 3 | 4 | 4 | 25 | 75 | 100 |
| **Part III Subject Elective** | | | | | | |
| Personal Protective Equipments(PPE) | 3 | 2 | 3 | 25 | 75 | 100 |
| **Part IV Skill Based Subject** | | | | | | |
| Extension Activities | 3 | 2 | 1 | 25 | 75 | 100 |
| **Total** | **21** | **30** | **24** | | | **700** |

## THIRD YEAR

## SEMESTER V

| Title of the Paper | Exam Duration | Hour | Credit | Internal | External | Total |
|---|---|---|---|---|---|---|
| **Part III Core Subjects** | | | | | | |
| Safety in Logistics & Warehouse Safety | 3 | 6 | 4 | 25 | 75 | 100 |
| Safety in Textile Industries | 3 | 6 | 4 | 25 | 75 | 100 |
| Hazardous Waste Management | 3 | 6 | 4 | 25 | 75 | 100 |
| **Part III Subject Elective** | | | | | | |
| Safety in Mining Industries | 3 | 6 | 3 | 25 | 75 | 100 |
| **Part IV Skill Based Subject** | | | | | | |
| Ergonomics& Physical Safety Practical | 3 | 4 | 3 | 25 | 75 | 100 |
| **Part IV Non Major Elective** | | | | | | |
| Emergency Preparedness and Response | 3 | 2 | 2 | 25 | 75 | 100 |
| **Total** | **18** | **30** | **20** | | | **600** |

## SEMESTER VI

| Title of the Paper | Exam Duration | Hour | Credit | Internal | External | Total |
|---|---|---|---|---|---|---|
| Lifting Equipments & Transport Safety | 3 | 6 | 4 | 25 | 75 | 100 |
| Safety Inspection & Audit | 3 | 6 | 4 | 25 | 75 | 100 |
| Safety in Material Handling and Equipments Safety | 3 | 6 | 4 | 25 | 75 | 100 |
| Internship / Industrial Exposure Training in any product or Service Industry, Training Report. Project work & Viva on IT/IET. | 3 | 10 | 5 | 40 | 60 | 100 |
| Case studies project on any National and International disasters | 3 | 3 | 3 | 25 | 75 | 100 |
| **Part IV Non Major Elective** | | | | | | |
| Computer Aided Hazard Analysis | 3 | 2 | 2 | 25 | 75 | 100 |
| **Total** | **15** | **30** | **22** | | | **600** |

## SEMESTER I
## FIRE PREVENTION & PROTECTION

**UNIT I -Introduction to Industrial Fire Protection**

Fire Prevention Vs Fire Protection – Importance of Fire Safety – Major Fire Accidents in History – Fire Accidents in India – Reasons for Fire – Combustion – Heat Vs Temperature – Heat Transfer – Sources of Heat – Physics of Combustion – Fire Hazards of Materials – Hazardous Materials.

**UNIT II -Alarm & Detection Systems**

NFPA 72 Classifications for Fire Alarm Systems – Power Supplies for Alarm Systems – Initiating Devices – Basic Considerations for Installation –Selection of Initiating Devices – Heat Sensing Fire Detectors – Location of Heat Sensing Fire Detectors: Spot Vs Line Devices – Smoke Sensing Fire Detectors – Radiant Energy Sensing Fire Detectors – Location & Spacing of Radiant Energy Sensing Fire

Detectors – Sprinkler Water Flow Alarm Initiating Devices – Signal Annunciation – Notification Devices – Audible & Visible Criteria of Notification Devices – Reporting Systems – Public Fire Alarm Systems – Central Station Fire Alarm Systems – Proprietary Supervising Station Fire Alarm Systems – Remote Supervising Station Fire Alarm Systems.

**UNIT III -Fire Extinguishment**

Classifications of Fires – Extinguishing Agents – Water, Water Use on Special Hazards, Carbon Di Oxide, Halogenated Agents, Dry Chemicals, Foam Extinguishing Agents, Combustible Metal Extinguishing Agents – Portable Fire Extinguishers – Fire Extinguisher Rating Systems – Fire Extinguisher Distribution & Mounting – Maintenance, Inspection & Testing of Fire Extinguishers – Water Based Sprinkler Systems – Wet Pipe Systems – Water Supply & Distribution – Piping – Outside Stem & Yoke Valves – Water Flow Alarms – Dry Pipe Systems – Cross Mains & Branch Lines – Sprinkler Heads – Fire Department Connections – Sprinkler System Inspections – Fire Hydrants – Standpipe & Hose Systems.

**UNIT IV-Common & Special Hazards**

Electricity as an Ignition Source – Hazardous Locations & National Electric Code – Safe Design of Electrical Equipment – National Testing Laboratory – Flammable Liquids & Combustible Liquids – Upper & Lower Explosive Limits – Flammable & Combustible Liquid Storage – Containers & Portable Tanks – Transfer of Flammable & Combustible Liquids – Storage Cabinets – Storage Tanks – Above Ground Tanks – Under Ground Tanks – Tanker Loading & Unloading – Hydrogen – Acetylene – Oxygen – LPG.

**UNIT V -Hazardous Processes**

Handling & Storage of Flammable & Combustible Liquids – Electrostatic Spray Operations – Spray Booths – Ventilation – Liquid Piping Systems – Hot Work.

**Reference books**:


- "Fundamentals of Fire Protection for the Safety Professional", Lon H. Ferguson,
- Christopher A. Janicak, Government Institutes, Scarecrow Press.
- "Industrial Fire Protection Engineering", Robert G. Zalosh, Wiley Publications.
- Fire Protection Hand BookPublication: National Fire Protection AssociationUSA,
- Author: Quincy – Massachusetts 20.Fire and explosion Hazards Handbook of Industrial Chemicals Publication: Jaico Publishing House, Author: Tatyana Devletshina& Nicholas P. Cheremisinoff, Ph. D.Electrical Safety,
- Fire Safety Engineering and Safety Management -Author: Rao. S.Industrial Fire Protection Hand Book, Publication: CRC Press, Boca Raton, FL. Author: Schroll, R. C, 2002.
- Guide book on fire and safety, Publication: NSC.

## ELECTRICAL SAFETY

**UNIT I- Basics of Electricity & Hazards of Electricity**

Introduction – Current – Voltage – Power – Resistance – Capacitor – Inductor – Ohm's Law – Types of Electrical Faults – Overloads – Short Circuits – Hazard Analysis – Shock – Arc – Blast – Body Parts & Effects of Shock: Skin, Nervous System, Muscular System, Heart, Pulmonary System – Indian Electricity Rules – Statutory Requirements from Electrical Inspectorate – International Standards on Electrical Safety – CPR.

**UNIT II- Electrical Hazard Analysis**

Primary& Secondary Hazards – Shocks – Burns – Scalds – Falls – Safety in the Use of Electricity – Energy Leakage – Clearances & Insulation – Classes of Insulation – Voltage Classifications – Excess Energy – Current Surges – Over Current & Short Circuit Current –Heating Effects of Current – Electromagnetic Forces – Corona Effect – Static Electricity – Sources – Electrical Causes of Fire & Explosion – Ionization – Spark & Arc – National Electrical Safety Code – Lightning Hazards – Lightning Arrestor – Earthing – Earth Resistance – Earth Pit Maintenance

**UNIT III- Minimizing Electrical Hazards**

Fuses –Circuit Breakers & Overload Relays – Protection Against Over Voltage & Under Voltage – Safe Limits of Amperage –Safe Distance from Lines – Capacity & Protection of Conductor – Joints & Connections – Overload 7 Short Circuit Protection – No Load Protection – Earth Fault Protection – Earthing Standards – FRLS Insulation – Insulation & Continuity Test – System Grounding – Equipment Grounding – Miniature Circuit Breaker – Earth Leakage Circuit Breaker – Ground Fault Circuit Interrupter – Electrical Guarding – Personal Protective Equipment's.

**UNIT IV-Selection, Installation, Operation & Maintenance of Electrical Equipment's**

Role of Environment in Selection – Safety Aspects in Application – Protection & Interlock – Self Diagnostic Features &Fail-Safe Concepts – Lock Out Tag Out – Permit to Work System – Discharge Rod &Earthing Devices – Safety in the Use of Portable Tools – Cabling & Cable Joints – Preventive Maintenance – Indian Electricity Rule.

**UNIT V- Hazardous Zones**

Classification of Hazardous Zones – Intrinsically Safe & Explosion Proof Electrical Apparatus – Selection of Equipment's for Different Zones – Temperature Classification – Grouping of Gases – Use of Barriers & Isolators – Equipment Certifying Agencies – Classification of Equipment/Enclosure for Hazardous Locations

**Reference Books:**


- "Electrical Safety, Fire Safety Engineering & Safety Management", S. Rao, R.K. Jain, H.L. Saluja, Khanna Publishers, Second Reprint 2018.

- "Electrical Safety: A Guide to the Causes and Prevention of Electrical Hazards" J. Maxwell Adams, The Institution of Electrical Engineers.
- "Electrical Safety Handbook 3rd Edition", John Cadick, Mary Capelli-Schellpfeffer
- "Principles of Electrical Safety" Peter E. Sutherland, John Wiley & Sons
- "Electrical Safety Engineering" by W Fordham Cooper

## CHEMICAL SAFETY

**Unit I – Evaluating Hazards & Assessing Risks of Chemicals**

Introduction – Types of Chemicals – Routes of Entry – Sources of Information – Toxicity – Flammable, Reactive & Explosive Hazards – Physical Hazards – Nano materials – Biohazards – Radioactive Hazards – Labelling of Chemicals – Safety Data Sheet – Globally Harmonized System – Exposure Limits – WHMIS Symbols – CLP Hazard Pictogram – Toxicological Properties: LC50 & LD50 – Flammable Limits – Atmospheric Monitoring – Health Surveillance.

**Unit II – Classification &Management of Hazardous Chemicals**

Classification of Hazardous Chemicals – Green Chemistry – Acquisition of Chemicals – Inventory & Tracking of Chemicals – Transportation of Hazardous Chemicals – Emergency Information Panel – HAZCHEM Code – Personal Protective Equipment for Chemicals – Chemical Exposure Risk Assessment –Hierarchy of Risk Controls.

**Unit III – Storage & Handling of Hazardous Chemicals**

Storage & Handling of Chemicals – Requirements for Storage of Various Chemicals – Labelling & Relabeling Requirements – Explosive Substances – Oxidizing Substances – Flammable Substances – Toxic Substances – Corrosive Substances – Water Reactive Substances – Cryogens – Compressed Gases – Classification of Hazardous Substances – General Guidelines for Safe Storage & Handling – Chemical Storage Tanks – Design Considerations.

**Unit IV – Chemical Process Safety**

Process Hazard Analysis – Operating Procedures & Practices – Employee Training – Contractors – Pre startup Safety – Mechanical Integrity – No routine Work Authorizations – Managing Change – Investigation of Incidents – Emergency Preparedness – Compliance Audits – Safe Practices for Oil Storage & Handling – Recommended Practices for Handling & Storage of LPG.

**Unit V – Safety in Laboratories**

General Lab Rules – Supervisors Responsibilities – Personal Safety – Chemical Hazards – Biological Hazards – Safety Associated with Lab Instruments – Waste Disposal – Chemical/Biological Spills – Autoclaving – Lab Safety Rules – Housekeeping – Waste Minimization – Labeling – Packaging – Segregation –Treating Waste at the Source – Waste Categories (DG Classification).

**Reference books:**


- Chemical Plant & Its Operation (Including Safety & Health Aspects)", Second Edition, T. M. Cook & D. J. Cullen, Pergamon Press.
- "Industrial Hygiene & Chemical Safety", M. H. Fulekar, I.K. International Publishing House Pvt. Ltd, New Delhi.
- "Chemical Safety Manual", Indian Institute of Technology Bombay.
- "Chemical Safety Handbook", University of Guelph, 2008 Edition.
- "Chemical Safety Manual", The University of British Columbia, 2017.
- "Chemical Safety Manual", California Institute of Technology.


## FIRE FIGHTING & RESCUE OPERATIONS MOCK DRILL (PRACTICAL)

Gathering the safety professionals & work force as on emergency response by using the emergency siren / alarm.

- Mock drill for firefighting& rescue operations by the way of live demo on put off / quench the all classifications of fire
- Rescue operations from fire affected areas through different types of manual lifting, vertical & horizontal rope climbing.
- Head counting of fire fighters before & after fighting as well as giving instructions before fire fighting & getting reports after fire fighting.
- Fire fighting team & overall response (fire fighting team, rescue team, first aid team, salvage team & cordon team)
- Inspections for periodical refilling, maintenance & hp test for fire extinguishers.
- First aid training for fire affected work force.
- How to summon a fire brigade & how to select reports of fire affected area.
- Investigation reports of fire accident.

**STUDY:**

- Identification & classes of fire
- Identification of appropriate fire extinguishers.
- Identifying the other fire fighting & detecting equipments
- Learning the method of fire fighting (cooling, blanketing, smothering, starvation, inhibitation (or) cut the chain reaction)
- First aid procedures & treatments for fire burn.

**REQUIREMENTS:**

- All types of fire extinguishers
- Emergency services (first aid kit, strecthers & ambulance, list of emergency phone numbers, drinking water & artificial respirators, mega phones & tele communications equipments.
- Doctor on call (or) pre intimation to the nearest hospital.
- Sufficient water sources

- All other required safety equipments for fire demo
- Provision of windsock

**References:**

- Guide book on fire safety – national safety council – 2014
- Guide book – designing for fire safety – national safety council – 2015
- Practical guide on she – volume 4 – national safety council – 2010

## VALUE EDUCATION

Common syllabus is prescribed by the University.

## SEMESTER II
## PRINCIPLES OF SAFETY MANAGEMENT

**UNIT I - Concepts & Techniques**

History of Safety Movement – Evolution of Modern Safety Concept – General Concepts of Management – Planning for Safety for Optimization of Productivity – Productivity, Quality & Safety – Supervisors & Managers Roles in Safety – Safety Budgeting – Safety Policy – Incident Recall Technique – Disaster Control – Job Safety Analysis – Safety Survey – Safety Inspection – Safety Sampling – Evaluation of Performance on Safety.

**UNIT II - Safety Audit :** Components of Safety Audit – Types of Audit – Audit Methodology – Non-Conformity Reporting – Audit Checklist & Report – Review of Inspection – Remarks by Government Agencies, Consultants & Experts – Perusal of Accident & Safety Records & Formats – Implementation of Audit Indication – Liaison with Departments – Identification of Unsafe Acts & Unsafe Conditions.

**UNIT III - Accident Investigation & Reporting :**Concept of Accident – Reportable &Non-Reportable Accidents – Reporting to Statutory Authorities – Principles of Accident Prevention – Accident Investigation & Analysis – Records for Accidents – Departmental Accident Reports – Documentation of Accidents – Domino Sequence – Role of Safety Committee – Cost of Accident.

**UNIT IV - Safety Performance & Monitoring**

ANSI (Z16.1) Recommended Practices for Compiling & Measuring Work Injury Experience – Permeant Total Disabilities – Permanent Partial Disabilities – Temporary Total Disabilities – Calculation of Accident Indices – Frequency Rate – Severity Rate – Frequency Severity Incidence – Incident Rate – Safe "T" Score.

**UNIT V - Safety Education & Training**

Importance of Training – Identification of Training Needs – Training Methods – Programme, Seminars, Conferences, Competitions – Method of Promoting Safety – Motivation – Communication – Role od Government Agencies & Private Consulting Agencies in Safety Training – Creating Awareness, Awards, Celebrations – safety Posters, Safety Displays, Safety Pledge – Safety Incentive Scheme – Safety Campaign.

**Reference Books:**


- Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980.
- Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay,1997.
- Lees, F.P., "Loss Prevention in Process Industries" Butterworth publications, London, 2nd edition, 1990.
- John Ridley, "Safety at Work", Butterworth and Co., London, 1983.
- Dan Petersen, "Techniques of Safety Management", McGraw-Hill Company, Tokyo, 1981.
- Relevant India Acts and Rules, Government of India.
- Relevant Indian Standards and Specifications, BIS, New Delhi.
- Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973.
- "Safety and Good House Keeping", N.P.C., New Delhi, 1985.
- "Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 1982.


## INDUSTRIAL HYGIENE

**UNIT I - Introduction to Industrial Hygiene, Human Physiology & Industrial Diseases**

Introduction to IH – The Study of Human Systems – Basic Unit of Life: Cells – Structure of the Body: Skeleton – The Moving Force: Muscles – The Control System: Nervous System – Fuel Processing: The Digestive System – Distribution System: Circulatory System – Fuel Supply System: Respiratory System – Filtering System: Renal System – Defense System: Skin & Sense Organs.

**UNIT II - Recognition, Evaluation & Control of Hazards**

Noise – Vibration, Ionizing &Non-Ionizing Radiation – Thermal – Mechanical – Pressure – Illumination – Traumatic – Phycological – Legionella & Humidifier Fever – Bloodborne Diseases: Hepatitis B & C, HIV – Zoonoses: Anthrax, Leptospirosis, Salmonellosis- Substitution – Isolation of Source – Ventilation: Local Exhaust Ventilation, Dilution Ventilation of Industrial Workplaces, General Ventilation of Non-Industrial Workplaces – Administrative Controls – Personal Protective Equipment – Determining the Control Measure to Use.

**UNIT III - Fundamentals of Toxicology**

Introduction – Physical Form – Dose – Routes pf Entry/Absorption – Classification of Toxic Materials in Air: Irritants, Asphyxiants, Anesthetics, Hepatotoxic Agents, Nephrotoxic Agents, Blood Damaging Agents, Lung Damaging Agents – Metabolism – Excretion – Response to Toxins – Stages of Toxicological Evaluation – Exposure Limits – ACGIH Threshold Limit Values – HAZCHEM .

**UNIT IV - Industrial Ergonomics**

Introduction – Man/Machine System – Workplace Risk Assessment – Factors Affecting Performance of Physical Tasks – Manual Handling – Repetitive Tasks – Display Screen Equipment –Carpal Tunnel Syndrome – Bible Bumps – White Finger – Trigger Finger – Tendinitis – Tennis Elbow – MSD – WRULD – Minimum Requirements for Workstations – Design of the Job – Design of the Workplace – Administrative Controls.

**UNIT V - Air Sampling, Biological Monitoring & Health Surveillance**

Introduction – Sampling Particulates – Sampling Gases & Vapors – Sampling & Analytical Methods – Indoor Air Quality – HVAC – Microorganism & AAQ
Urine – Blood – Skin – Breath – Vision – X Rays – Neurological Tests – Audiometry – Lung Function Tests: Lung Volume, Airways Resistance – Biological Exposure Indices (BEI).

**References:**


- "Industrial Hygiene Engineering – Recognition, Measurement, Evaluation & Control", Second Edition, John T. Talty of NIOSH, Published by NOYES Data Corporation USA
- "Basics of Industrial Hygiene" by Debra Nims, John Wiley & Sons INS
- "Fundamental of Industrial Hygiene" 5th Edition, Barbara A. Plog, Patricia J. Quinlan, Published by Library of Congress Cataloging in Publication Data
- "Student Manual – Basic Principles in Occupational Hygiene" October 2010, by Adrian Hirst of Hirst Consulting Limited UK on behalf of Glaxo Smith Kline
- Hawlinks R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
- Heywood, V.H & Watson, R.T.1995, global biodiversity Assessment, Cambridge Univ.Press, 114op


## ENVIRONMENTAL SAFETY

**UNIT I - The Multidisciplinary Nature of Environmental Studies**

Definition, Scope and importance- Need for public awareness.

**UNIT II - Natural Resources**

Renewable and non-renewable resources

Forest Resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effect on forests and tribal people

Water Resources: Use and over-Utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

Mineral resources: Use and exploitation, experimental effects of extracting and using mineral resources, case studies.

Food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy resources, Case studies.

Land resources: Land as a resource, land degradation, main induced landsides, soil-erosion and desertification

Role of individual in conservation of natural resources

Equitable use of resources for sustainable lifestyle

**UNIT III - ECO SYSTEMS, BIODIVERSITY AND ITS CONSERVATION**

ECO SYSTEMS:

Concept of an Ecosystem- Structure and function of an Ecosystem- Energy Flow in the Ecosystem- Food Chains, Food Webs and Ecological Pyramids.

BIODIVERSITY AND ITS CONSERVATION: Introduction - Definition: Genetic, Species and Ecosystem Diversity- Bio-Geographical Classification of India- Value of Biodiversity: Consumptive Use, Productive Use, Social Ethical, Aesthetic and Option Values.- Biodiversity at Global, National and Local Levels- India as a Mega-Diversity Nation- Hot Spots of Biodiversity- Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts- Endangered and Endemic Species of India- Conservation of Biodiversity in-Situ and Ex-Situ Conservation of Biodiversity.

**UNIT IV- Environmental Pollution**

Causes, Effects and Control measures of:-Air Pollution- Water pollution- Soil pollution- Marine pollution- Noise pollution- Thermal pollution- Nuclear/hazards.

**UNIT V- Field Work**

Visit to a local area to document environmental assets–river/ forest/ grassland/ hill/ mountain- Visit to a local polluted site- Urban/Rural/Industrial/Agricultural- Study of common Plants, insects, birds- Study of simple ecosystem-pond, River, Hill slopes, etc.

**REFERENCE BOOKS:**


- Agarwal, K.C.2001 Environmental Biology, Nidi Publ.Ltd., Bikaner.
- BharuchaErach The Biodiversity of India, Mapin Publishing Pvt. Ltd, Ahamedabad-380013,India, Email: mapin@cent.net®.
- Burner R.C. 1989, Hazardous Waste Inclineration McGraw Hill Inc.480p.
- Clark R.S. Marine Pollution, Clanderson Press Oxford(TB).
- Cunnigham, W.P.Cooper, T.H.Gorhani, E& Hepworth, M.T 2001 Environmental Encylopedia, Jaico Publ. House, Mumbai, 1196p.
- De.A.K.Environmental Chemistry, Wiley Eastern Ltd.
- Down to Earth, Centre for Science and Environment®.
- Gleick H.P. 1993, Water in crisis, Pacific Instutue for studies in Dev, Environment & Security, Stockholm Env. Institute,Oxford Univ.Press,473p

## ELEMENTARY FIRST AID (PRACTICAL)

An introduction – first aid for electric shock, cuts and wounds – burns, suffocation, eye injury, poisoning, fracture, artifical respiration (airway, mouthway, circulation) treatment for burn injuries – types of burns – classification of burns injury – first aid for burn – first aid for chemical injuries.

**Study:**

1) First aid kit and containing of the medicines
2) Respiratory type ppe
3) Manual lifting and structuring
4) Cleanning and dressing procedures
5) Cpr (cardio pulmonary resusicitation) & other resusicitation

**Requirements:**

1) First aid kit with valid medicines
2) Trained and competent / approved first aider
3) Stretcher and ambulance service
4) Eye wash bottle and emergency shower
5) List of emergency numbers / to be displayed
6) Artifical respirator / scba (self contained breathing apparatus)
7) All other required safety & communication

**References:**


- Guide book on fire & safety – national safety council – 2014.
- Practical guide on safety health & environment– volume 1 – national safety council – 2013


## ENVIRONMENTAL STUDIES

*Common Syllabus is prescribed by the University.*

## SEMESTER III
## CONSTRUCTIONAL SAFETY

### UNIT I – SAFETY & HEALTH PROVISIONS FOR CONSTRUCTION WORKERS UNDER BOCW ( RE& CS) ACT 1996 WITH SITE CHECK LIST & CYCLE SAFETY AT CONSTRUCTION SITE.

Construction safety under bocw ( re & cs) act 1996 and central rule 1998 highlights - safety check list at site – safe, place of work – scaffolds – powered access equipment – ladders – roof work – excavations- hoists – cranes and lifting appliances – plant & machinery – traffic and vehicles – first aid and emergencies – general – fire – hazardous substances - noise – welfare – protective – equipments- - electricity – protecting the public.

Safety work cycles at construction sites – daily safety work cycle- morning safey meeting – safety meeting ( kyk- danger prediction activities ) – inspection prior to start of work – site manager patrol- guidance and supervision during work – safety process discussions- after –

work site clean up – end of work check – weekly safety work cycle – monthly safety work cycle – awarness through other safety promotional activities ( video & flip charts).

**UNIT -II SAFETY FOR EXCAVATION WORK, WORK AT FRAGILE ROOFS AND CHEMICAL INVOLVED WORK IN CONSTRUCTION**

Excavation work- introduction – planning - materials falling into excavations- people and vehicle falling into excavations- people being – struck by plant - undermining nearby structures- avoiding underground services- access- fumes- protecting the public – supervision inspecting excavations- fragile roof- prevent unauthorized access- working of fragile materials – working near fragile materials – chemical hazards – health effects – precautions- controlling exposures fire – personal protective equipments ( ppe) hygiene and first aid.

**UNIT - III THE SAFETY FOR FIRE HAZARD , ELEVATORS / LIFT AND CEMENT HAZARDS**

Common causes for fire at site- legal provisions- additional provisions for excavation or tunneling work -control measures – site house keeping – flammables- welding , cutting and other hot works- electrical equipments- fire emergency – emergency preparedness- if fire occurs- elevators / lifts safety- codes & standards provisions of Bombay Lift Act 1939 & safety features of Bombay lift act. Safety tips for approaching the elevator enter & leaving the elevator – ladder safety portable ladders – fixed ladders. Cages for fixed ladders – wells for fixed ladders – use of all ladders (including job made ladders) safety for climbing and standing on ladders.

**UNIT -IVNATIONAL BUILDING CODES, INDIAN STANDARD ON CONSTRUCTION OF EARTHQUAKE RESISTANCE STRUCTURE.**

NBC 2005 – its 11 parts of approach salient features of NBC 2005 – Indian standard for earthquake resistant structure – extracts – in introduction - design for earthquake structure BIS standard – is1893; 1984 certified for earthquake resistant structure – is1893 – part-i 2002 general provisions and building – is1893- part4 :2005 – industrial structures including stack like structure- is- 4026:1093 earthquake resistant design and construction of building – code of practice is- 13827: 1993 improving earthquake resistance of low strength masonry building guidelines. Is-13920: 1993 ductile detailing of reinforced concrete structures subjected to seismic forces – code of practice is-13935: 1993 repair and seismic strengthening of building – guidelines.

**UNIT- V SAFETY FOR SCAFFOLDING WORK IN CONSTRUCTION.**

Scaffolding erection works- use of scaffolding – alteration and dismantling of scaffoldings- scaffolding inspections – maintenance and storage of scaffolding – and other elevated work areas, ladders- and types of all scaffolds.

Safety ( standards & references – guidelines) for fall protections- guard rail- personal fall arrest systems – falling object protection – entry & exit – temporary stairways- ramps – slipping & tripping hazards – roof work- lighting – highwind collapse – work over water –

hot surfaces- unstable building and structure – fork lift supported temporary work platforms.

Portable ladders and step ladders ( conditions , position, clearance, use step ladders, extension ladder, job made ladders) scaffolds components ( general tubing & filling specifications, platform )- requirement of common to all scaffolds requirement of

Common to system and tube and coupler scaffolds- systems scaffolds – tube & coupler scaffolds – mobile & tower scaffolds- fabricated tumbler fram scaffolds- bracket scaffolds- underhund scaffolds.

**References:**


- Guide book on safety health & environment – national safety council – volume 2 – 2009
- Scaffolding hand book - saudi aramco – 2003
- Hand signaling on crane & rigging – (lifting safety) saudi basic industries corporation – 2008.


## ENVIRONMENTAL, HEALTH AND SAFETY (EHS) LAWS & ACTS

### UNIT I - Factories Act, 1948

Statutory Authorities – Inspecting Staff, Health, Safety, Provisions Relating to Hazardous Processes, Welfare, Working Hours, Employment of Young Persons – Special Provisions – Penalties and Procedures-Tamilnadu Factories Rules 1950 Under Safety and Health Chapters of Factories Act 1948.

### UNIT II - Environment Act, 1986

General Powers of The Central Government, Prevention, Control and Abatement of Environmental Pollution-Biomedical Waste (Management and Handling Rules, 1989-The Noise Pollution (Regulation and Control) Rules, 2000-The Batteries (Management and Handling Rules) 2001- No Objection Certificate from Statutory Authorities Like Pollution Control Board. Air Act 1981 And Water Act 1974: Central and State Boards for The Prevention and Control of Air Pollution-Powers and Functions of Boards – Prevention and Control of Air Pollution and Water Pollution – Fund – Accounts and Audit, Penalties and Procedures.

### UNIT III - Manufacture, Storage & Import of Hazardous Chemical Rules, 1989

Definitions – Duties of Authorities – Responsibilities of Occupier – Notification of Major Accidents – Information to be Furnished – Preparation of Offsite and Onsite Plans – List of Hazardous and Toxic Chemicals – Safety Reports – Safety Data Sheets.

### UNIT IV - Other Acts & Rules

Indian Boiler Act 1923, Static And Mobile Pressure Vessel Rules (SMPV), Motor Vehicle Rules, Mines Act 1952, Workman Compensation Act, Rules – Electricity Act And Rules – Hazardous Wastes (ManagementAnd Handling) Rules,

1989, With Amendments In 2000- The Building And Other Construction Workers Act 1996., Petroleum Rules, Gas Cylinder Rules-Explosives Act 1983-Pesticides Act.

**UNIT V - International Acts & Standards**

Occupational Safety and Health Act Of USA (The William-Steiger Act Of 1970) – Health And Safety Work Act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American National Standards Institute (ANSI).

**Reference books:**


- The Factories Act 1948, Madras Book Agency, Chennai, 2000
- The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
- Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt.Ltd., New Delhi.
- Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt.Ltd., New Delhi.
- The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
- The Mines Act 1952, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
- The manufacture, storage and import of hazardous chemical rules 1989, Madras Book Agency, Chennai. National seminar on hazardous waste management organized by National Safety council, Ministry of environment and forests, Government of India, United States – Asia environmental partnership, Tamil Nadu Pollution Control Board and Indian chemical manufacturers association, April 2001.


## HAZARD IDENTIFICATION AND RISK ASSESSMENT

**UNIT I - Basics of Hazard, Risk & Risk Ranking**

Introduction – Hazard & Risk – Risk Register, Risk Matrix & Risk Ranking – Consequence, PHA & ALARP – Fault Tolerance & Plant Ageing – Safety Instrumentation – Functional Safety.

**UNIT II - Evaluation of Hazard & Risk Analysis**

Plant Hazard Analysis Preliminaries – Evaluation of Plant Hazard Selection Techniques – Comparison of Various PHA Methods – Hazard Identification (HAZID) & Risk Estimation – Risk Assessment & Management.

**UNIT III - Qualitative & Quantitative Hazard Analysis**

Preliminary Hazard Analysis – Data Collection – What If Analysis – Checklist Analysis – Fault Tree Analysis – Layer of Protection Analysis – Human Reliability Analysis.

**UNIT IV - SIL, FMEA & HAZOP**

Risk Analysis and SIL – SIL Determination Techniques – SIL Calculation for Safety Instrument Loop – SIL Certifications & Standards – FMEA/FMECA Methodology – FMEA/FMECA Detection & Risk Priority Number – Controls

&Recommended Actions – Automated FMEA Concepts – HAZOP Methodology – Reporting & Follow Up – Computer HAZOP – Intelligent HAZOP.

**UNIT V - Safety Instrumentation Systems**

Design & Engineering – Erection, Commission & Validation: Safety Life Cycle – Operation & Maintenance – Third Party Certification of Instruments – Electrical Area Classification – Combustible/Flammable Gas Detection – Explosion Protection

**Reference books:**


- "Plant Hazard Analysis and Safety Instrumentation Systems", SwapanBasu, Academic Press – Elsevier, ISBN: 9780128037638.
- "Risk Management Plan (RMP) & Process Safety Management (PSM) Manual", Newington Energy, General Electric Contractual Services, Triton Environmental Inc


## FIRE DESIGN ENGINEERING

**UNITI- IDENTIFY, CLASSIFICATION OF BUILDING & HAZARDS**

Fundamentals of fire - Fire theory - Terminologies in fire safety - Fire fighting techniques - Class of fire - Heat transfer- Types of fires based on the size & Manner- Fire growth- Reason for fire - Fire load- identify ignition sources - classify the level of fire hazards- NBC classification based on occupancy.

**UNITII- Fire Protection and control**

Fire protection system - Active fire protection system - Passive fire protection system - Fire extinguisher - Types of fire extinguishers - Installation of fire extinguishers - Fire extinguisher service and maintenance - Modular fire extinguisher - Sand and water buckets technical details - Fire ball - Fire blanket.

**UNITIII - Fire Hydrant System**

Fire hydrant system - Installation of fire hydrant system - Fire water storage tank specifications - Fire hydrant point installation - Hydrant pipe size - Hose box - Hose reel drum - Hose rolling training - Branches and nozzles - Water monitoring - Collecting head/ suction hose - Hydrant fitting methods - Sprinkler system installation - Installation of wet / dry / foam / pre-action / deluge fire sprinkler system - Installation of fire pump room.

**UNIT IV- Flooding & Suppression System**

Installation of co2 flooding system - co2 suppression system - Installation of clean agent suppression system - Installation of foam flooding - Foam suppression system - Basic of fire tender/brigade/engine.

**UNIT V- Fire Alarm Technology**

Introduction to the fire alarm- Fire alarm system designing- Smoke & Heat detector- Flame detector- Communication techniques for fire technicians- Basic of

electrical and electronics in fire alarm- Design / layout / application of equipments- System operation & control- Installation of alarm system panel- Installation of smoke & heat detector - Installation of hooter - Installation of MCP - Installation of emergency lighting- Wiring methods for addressable fire alarm system - Wiring methods for conventional fire alarm system- Location setting in detector- Program / coding writing in fire panel- contract / bidding / filing / approval- Maintenance / testing / service / training.

**Reference Books:**


- Fire Protection Hand Book Publication: National Fire Protection Association USA, Author: Quincy – Massachusetts 20.
- Fire and explosion Hazards Handbook of Industrial Chemicals Publication: Jaico Publishing House, Author: Tatyana A. Devletshina& Nicholas P. Cheremisinoff, Ph. D.
- Electrical Safety, Fire Safety Engineering and Safety Management -Author: Rao. S.
- Industrial Fire Protection Hand Book, Publication: CRC Press, Boca Raton, FL. Author: Schroll, R. C, 2002. Guide book on fire and safety, Publication: NSC.


## SCAFFOLDING & WORK AT HEIGHT (PRACTICAL)

**Experiments :**

An introduction of 10 reasons for falling (trips ,slips and other falls) – fall protection programme (ladders, fixed ladders, scaffolds, falls from building, other structure and other roofs, installation of adequate guarding / fall protection provision, falls and / slips on the same level .

**Study :**

1. 100% tied off procedure
2. 3 point anchorage while ascending & decending.
3. Wearing the full body harness with double lanyard.
4. Using method of vertical / horizontal lifeline
5. Training on use of fall arrestor – rope grab and retractable
6. Using the safety net for man falling and material falling
7. Inspection of all fall protection equipments
8. Learning of technical data's about fall protectors.

**Requirements :**

**Fall protection devices / equipment**

1. Full body harness with double lanyard
2. Rope grab
3. Vertical / horizontal lifeline
4. Fall arrestor – retractable
5. Safety net and debris net
6. Mobile ladders
7. All other training and safety required equipments

**References:**


- Tata mc graw hill – industrial safety management – lm deshmukh – 2006
- Practical guide on safety health & environment– volume 1 – national safety council – 2013


## SEMESTER - IV
### SAFETY IN OIL & GAS SECTOR

**UNIT I-Introduction to oil and gas safety**

Introduction-need for safety and safety engineers- safety management principles – product hazard classifications and product safety organization tasks – common causes of work injuries and mechanical injuries- accident causation theories – occupational stress and human error occurrence reasons – consequences of human error and human error classifications – bath tub hazard curve.

**UNIT II-Methods for performing safety and reliability analysis in oil and gas industry**

Introduction- root cause analysis – hazards and operability analysis – technique of operations review – interface safety analysis-job safety analysis – preliminary hazard analysis – failure mode and effect analysis- fault tree analysis – markov method.

**UNIT III-Safetyin offshore oil and gad industry**

Introduction – offshore industrial sector risk picture – offshore worker situation awareness concept , studies, and their results – offshore industry accident reporting approach and offshore accident related causes – offshore industry accidents case studies (Mumbai high north platform , piper alpha accident – bohai 2 oil accident – Alexander l. kielland accident – ocean ranger accident – glomar java sea drillship accident- baker drilling barge accident – seacrest drillship accident ).

**UNIT IV-Factors contributing to accidents in the oil and gas industry**

Introduction- human factors that affect safety in general – organizational factors – group factors – individual factors – categorization of accident related human factors in the industrial sector – categories of human factors accident causation in the oil and gas industry – oil field fatality analysis – recommendation to reduce fatal oil and gas industry accidents.

**UNITV-Oil and gas industry accident data and accident data analysis**

Introduction- offshore oil and gas industry accident databases and accident data collection sources – (world wide offshore accident databank –well control incident database – collision database – hydrocarbon release database - Danish energy agency – performance measurement project – international association of oil and gas producers )- onshore and offshore oil and gas industry accident data and analysis- offshore oil and gas rigs accident analysis – failures and lessons learned from landmark offshore oil and gas accidents and

corrective measures (prevention – mitigation – emergency – safety management – preparedness and planning – aftermath / restoration – early warning – lesson learning ).

**Reference books:**


- B.S. Dhillon , Safety and Reliability in the oil and gas industry a practical approach , CRC Press, Taylor and Francis Group 2016.
- Alireza Bahadori , Personnel Protection and Safety equipment for oil and gas industries ,gulf professional publishing of Elsevier group 2015.
- Abdul khalique , Basic Offshore Safety , Routledge 2016.


# FOOD SAFETY (HACCP)

## UNIT- I – PERSONAL DISEASE, CONTROL AND STRESS MGMT FOR WORKERS

Health aspects – diabetic – asthma and cardiac patiets – body mass index – heat stress effects and control measures – infectious disease control for emergency workers – flooding an communicable disease – bird flu and prevention – dengue fever and prevention – early symptoms of cancer – emerging and re emerging infectious diseases – hiv / aids awareness and prevention – water and sanitation related disease – benefits of physical activities – occupational stress management – stress management at work place – healthy diet.

## UNIT- II – FOOD MICROBIOLOGY & FOOD QUALITY

Food microbiology : - an introduction – common food – borne microorganisms – (viruses, bacteria, fungi and parasites) – characteristics of micro organism – growth of bacteria – factors affecting growth of microbes – control of microbial growth in foods – beneficial role of microorganisms in food

Food quality : food contamination and spoilage an introduction – types of contaminants in food – natural toxins – toxic metals and chemicals – pesticide residues – presence of extraneous material – residue from processing and packagingmaterial – reasons for food is fit for consumption – classification of food on the basis of shelf life – conditions that could lead to food spoilage – sings of spoilage in fresh, dry and preserved foods.

Food preservation : basic principles of food preservation – methods of food preservation – food additives – food borne diseases – disease and their classifications – mode or transmission of disease – food – bornei – bacterial food poisoning (or) intoxications – bacterial food infections – listeriosis – viral infections – parasitic infections – food allergies – control of food – borne illnesses

## UNIT- III – HYGIENE FOOD HANDLING

An introduction of purchase and storage of food – important point to be observed while receiving and inspecting deliveries – food storage – general guidelines for food storage – the dry – food store – the refridgerated store – the freezer store – storage of specific foods – sanitary procedures while preparing, holding, serving and displaying food – procedures to minimize microbial load, preparation of specific foods – common faults in food preparation – basic rules to be observed during food service – special rules for dining room waiters and bus boys – special rules ruler for bartenders and bar waiters – protective display of food – protecting foods in cafeterias and fast food counters – street foods – single service items.

Special food operations : an introduction – mobile food units – temporary food – service establishments – vending machines – outdoor catering – transport catering – street foods – stret side food and diseases.

**UNIT- IV – PERSONAL HYGIENE, SANITATION OF PREMISES AND ENVIRONMENT**

An introduction of personal hygiene – necessity for personal hygiene – health of staff – personal appearance – sanitary practices – habits – protective clothing – importance of rest, exercise and recreation – an introduction location, layout and construction of permises – building interiors –ventilation – enconditioning – lighting – general guidelines for cleaning equipment – installation and arrangement of equipment – food preparation surfaces – materials used for making large and small equipments – equipments requiring special attention – cleaning and sanitising – necessity for an efficient cleaning program – types of soil, water, cleaning agents and equipments, types of cleaning equipments (manual & mechanical) three methods to wash, rinse and sanitise food contact surfaces – post cleaning storage – dishcloth – cleaning of premises and surroundings – pest control – importance of pest control – classifications of pests – pesticides – water supply – sources – contamination of water – hazards of water pollution – purification – criteria for judging water quality – water quality standards & sewage and contamination of water supply – storage and disposal of waste – solid wastes – liquid waste (or) sewage – gaseous wastes – environmental pollution – solid waste pollution – e-waste or electronic waste – pollution by radiation – noise pollution – measures of check pollution.

**UNIT- V – FOOD LAWS AND REGULATIONS**

An introduction of food laws and regulations – regulatory agencies – control of food quality – the food safety and standards act, 2006 – general provisions as to articles of food provisions relating to import – special responsibilities for food safety – enforcement of the act – the plastic manufacture, safe and usage rules, 1999 – the atomic energy (control of irradiation of food) rules 1996 – local health authority- quality and food standards – hazard analysis and critical control point (haccp) – steps in haccp – application stages of haccp – haccp benefits – sanitation risk management standards – iso 9000 quality management systems – iso 14000 environmental management systems – iso 22000 fod safety management systems – recent concerns – emerging diseases – genetically modified food – food labelling – new trends in food packaging and technology.

**REFERENCES:**


- Guide book on safety health & environment – national safety council – volume 3 – 2010
- Food hygiene & sanitation – sunitra roday – 2011

## INDUSTRIAL SAFETY MANAGEMENT

**Unit I–Industrial Safety: An Introduction**

Introduction – Terms & Definitions – Cost of Accidents – Safety Responsibility & Organization – Accident Reports, Records & Analysis – Workers & Machines – Human Factors, Selection & Training – Working Hours, Incentives & Outside Influences – Safety Inspections & Audits – Insurance & Compensation – Legal Aspects – Security – Planning for Major Emergencies.

**Unit II – Site Design, Inspection & Maintenance**

Site Layout & Planning – Design of Buildings & Plant – Building Design & Fire Protection – Causes of Building Failure & Collapse – Storage of Chemicals & Hazardous Materials –Hazard Analysis – Condition Monitoring – Non-Destructive Testing – Plant Inspection & Maintenance.

**Unit III – Work Environment**

Air & Breathing – Lighting & Vision – Noise & Hearing – Vibration – Heat – Ergonomics – Fatigue – Industrial Hygiene – Industrial Toxicology – Personal Protective Equipment's & Clothing – Safety Equipment's – Welfare Facilities.

**Unit IV – Common Industrial Hazards**

Poor Housekeeping – The Slipped Disc Syndrome – Manual Handling – Falls & Falling Objects – Machine Hazards – Static Electricity – Ropes, Lifting Tackles & Cranes – Powered Wheeled Transports – Confined Spaces – Chemical Hazards – Metal Casting – Welding & Thermal Cutting of Metals – Grinding – Hand Tools & Portable Power Tools – Press & Machine Tool Hazards – Woodworking Machinery – Radiation Hazards.

**Unit V – Lean Concepts**

Leadership - The WAR Room – The Art of KAIZEN (PDCA) – The KAIZEN Blitz – Elimination of Waste (MUDA) – 5S – POKA YOKE – The 5 GEMBA Principles – The 5 Why's Techniques – Quality Circles – ISHIKAWA Diagrams – A3 Problem Solving – Benchmarking.

**REFERENCE BOOKS:**


- "Industrial Hazard and Safety Handbook "Third (Revised) Impression, Ralph W King & John Magid, Butterworth & Co Publishers Ltd.
- "How to Implement Lean Manufacturing", Lonnie Wilson, Mc Graw Hill, ISBN: 9780071625081.
- "Lean Six Sigma – Quick Start Guide", 2nd Edition, Benjamin Sweeney, Clydebank Business, ISBN: 9781945051241.
- "Lean Safety: Transforming Your Safety Culture with Lean Safety Management", First Edition, Robert Pemberton, ISBN 9781386121336.

## PERSONAL PROTECTIVE EQUIPMENTS (PPE)

### Unit- I – HEAD PROTECTION, EYE PROTECTION & EAR PROTECTION

**Head protection :** an introduction to head protection – hazards – protective measures safety headgear – safety helmet – other protective head gear – head protectors (types, characteristics, protects against) – emergency measures.

**Eye protection:** an introduction – direct hazards (mechanical, chemical, thermal and radiation hazards) – eye protector (tyres, characteristics and protects against) – lenses for eye protectors should withstand – associated hazards – cleaning and disinfecting – precautions – fliter lenses : ir/uv radiation – recommended average levels of illumination for typical work areas – emergency eye protection : checklist – emergency measures.

**Ear protection :** an introduction to ear protection – the hearing mechanism – hearing loss – permissible exposure levels of continous noise – noise – workplace hazards – noise control – ear protection – hearing protection aids – earplugs – permissible exposure levels of impulsive for impact noise – canal caps – ear muffs.

### UNIT- II –HAND PROTECTION AND LEG PROTECTION

**Hand protection :** an introduction to hand protection – injuries – hazards – emergency measures – prevention of hand injuries – types of hand protection – selection – use and care – head protectors (types, characteristics and protects against)

**Leg protection :** an introduction to leg protection – hazards – direct hazard – indirect hazards – protective measures – leggings and leg guards – feet protection checklist (hazards and protection) – safety shoes – safety shoes should have – maintenance care.

### UNIT- III – SKIN PROTECTION

An introduction to skin protection – causes – physical hazards – chemical substances – plant products – living agents – preventive measures (wash frequently using proper cleansers – change clothes often – remove irritants – take showers – separate soiled - clothing – treat abrasions promptly) protective equipment (eye protection – gloves – footwear – body protection) – skin / body protection – protective creams – housekeeping – machine guards – ventilation – storage and transport – identification labels.

### UNIT- IV– RESPIRATORY PROTECTION

an introduction – the respiratory system – hazards – oxygen deficiency – harmful contaminants – smoke and fumes – spray and mists – gases and vapours – respirators – dusts – color code for canisters – protective equipment – air purifying respirators – fresh air breathing apparatus – self contained breathing apparatus – selection – use and fit.

### UNIT- V – STANDARDS FOR PPE (PERSONEL PROTECTIVE EQUIPMENT)

An introduction to personal protective equipment – applicable statutes / salient / features / provisions of the statutes – the factories act, 1948 and the model rules made thereunder – msihc rules (framed under the epact, 1986) – national standards – management responsibilities – international standards – health & safety at work act of 1974, UK.

## REFERENCES :


1. Personal protection at work place - loss prevention association of India
2. Safety health & working conditions - ILO training manual – Geneva – joint industrial safety council – Stockholm - 1994.


# SEMESTER V

## SAFETYIN LOGISTICS & WAREHOUSE SAFETY

### UNIT I - INTRODUCTION TO LOGISTICS & WAREHOUSE

Logistics- Logistics System-Logistics management –Maximum and Minimum inventory control systems-Storage and Distributions-Logistics system Designs- Warehouse-Introduction, Objectives, Meaning of a Warehouse, Need for warehousing management, Evolution of warehousing, Role of a warehouse manager, Functions of Warehouses, Types of Warehouses, Warehousing Cost, Warehousing Strategies, Significance of Warehousing in Logistics, Warehousing Management Systems (WMS).

### UNIT II - TRANSPORTATION OF HAZARDOUS GOODS & DRIVER SAFETY

Transport emergency card (TREM) – driver training-parking of tankers on the highways speed of the vehicle – warning symbols – design of the tanker lorries – earth chains-static electricity-responsibilities of driver – inspection and maintenance of vehicles-check list decanting procedures – communication- Driver safety programme – selection of drivers – driver training-tacho-graph-driving test driver's responsibility-accident reporting and investigation procedures-fleet accident frequency-safe driving incentives-slogans in driver cabin-motor vehicle transport workers act-road transport act and rules – driver relaxation and rest pauses – speed and fuel conservation – emergency planning.

### UNITIII - WAREHOUSE SAFETY

Transport precautions-safety on manual mechanical handling equipment operations-safe driving-movement of cranes-conveyors etc., servicing and maintenance equipment-grease rack operation-wash rack operation-battery charging-gasoline handling-other safe practices-off the road motorized equipment-Forklift safety-employers management (employer/worker training) forklift inspection & maintenance-lifting – workers on foot – work environment) – employees / workers – load – centers – electric forks – checking controls – forklift safety – checking loads – stacking – moving loads – driving a forklift – forklift training.

### UNIT IV - FIRE PROTECTION

Design of building, plant, exits for fire safety-Fire-resistance of building material-Fire-doors and firewalls-Determination of fire load-Dow Fire and Explosion Index-Salient features of fire, explosion and toxicity index -Fire detection and alarm system-Various

types of fire detection and alarm system- Special safety measures for control of fire and explosion in handling- Fire-fighting systems: Different types of portable fire extinguishers-their installation-periodic inspection and operation-Replacement of Halon with safer substitutes-Fire hydrant system-Fire monitors-sprinkler system and deluge system-Carbon-dioxide flooding system-Foam Pourer system.

**UNIT V - SAFE HANDLING STORAGE & MATERIAL HANDLING**

Material handling- manualmaterialhandling (correct positioningoffeet-bentingknees- straightback- armsclosedtothebody- correct grip)-mechanized(kinetic) materialhandling EOT cranes/goliath crane/jibcrane safetyprecautions.

**REFERENCES**


- The Logistics Handbook A Practical Guide for the Supply Chain Management of Health Commodities
- Logistics and Supply Chain Management; Christopher, M (1992), Pitman Publishing, London.


## SAFETY IN TEXTILE INDUSTRIES

**UNIT I-INTRODUCTION** Introduction to process flow charts of i) short staple spinning, ii) long staple spinning, iii) viscose rayon and synthetic fibre, manufacturer, iv) spun and filament yarn to fabric manufacture, v) jute spinning and jute fabric manufacture-accident hazard, guarding of machinery and safety precautions in opening, carding, combing, drawing, flyer frames and ring frames, doubles, rotor spinning, winding, warping, softening/spinning specific to jute.

**UNIT II-TEXTILE HAZARDS**

Accident hazards i) sizing processes- cooking vessels, transports of size, hazards due to steam ii)loom shed – shuttle looms and shuttles looms iii) knitting machines iv) non-woven's.

**UNIT III - TEXTILE HAZARDS**

Scouring, bleaching, dyeing, punting, mechanical finishing operations and effluents in textile processes.

**UNIT IV-HEALTH AND WELFARE**

Health hazards in textile industry related to dust, fly and noise generated-control measures-relevant occupational diseases, personal protective equipment-health and welfare measures specific to textile industry, special precautions for specific hazardous work environments.

**UNIT V-SAFETY STATUS**

Relevant provision of factories act and rules and other statues applicable to textile industry – effluent treatment and waste disposal in textile industry

**REFERENCE BOOKS:**


- "Safety in textile industry" Thane Belapur Industries Association, Mumbai.1. 100 textile fires – analysis, findings and recommendations LPA
- Groover and henry ds, "hand book of textile testing and quality control"
- "Quality tolerances for water for textile industry", bis
- Shenai, v.a. "a technology of textile processing", vol.I, textile fibres
- Little, a.h.,"water supplies and the treatment and disposal of effluent"


## HAZARDOUS WASTE MANAGEMENT

**UNIT I -INTRODUCTION TO HAZARDOUS WASTE**

Introduction-Hazardous Waste Characteristics-Transport Of Hazardous Waste-Transport Vehicles -The Manifest System-Treatment, Storage And Disposal-Treatment-Surface Storage And Land Disposal-Secure Landfills-Remedial Action-Ghs-Un Classifications Of Chemicals-SDS-TREM Card.

**UNIT II - HAZARDOUS WASTE MANAGEMENT FUNDAMENTAL AND RELEVANT REGULATION**

Characterization Of Waste-Compatibility And Flammability Of Chemicals-Fate And Transport Of Chemical-Health Effect-Municipal Solid Waste (Management And Handling) Rules-Hazardous Waste (Management And Handling)-Biomedical Waste Handling Rules-Fly Ash Rules-Recycle Plastics Usage Rules-Batteries (Management And Handling) Rules-MSIHC Rules 1989.

**UNIT III - SOLID WASTE MANAGEMENT AND RADIOACTIVE WASTE MANAGEMENT**

Sources-Composition-Generation Rules-Collection Of Waste-Separation, Transfer And Transport Of Waste-Treatment And Disposal Options-Sources Of Radioactive-Measure And Health Effects-Nuclear Power Plants And Fuel Production-Waste Generation From Nuclear Power Plants-Disposal Options.

**UNIT IV - ENVIRONMENTAL RISK ASSESSMENT AND LANDFILL DESIGN**

Defining Risk And Environmental Risk-Methods Of Risk Assessment-Case Studies-Land Fill Design For Solid And Hazardous Wastes-Leachate Collection And Removal-Landfill Covers-Incineration-Auto Clave-Micro Clave-Disinfection.

**UNIT V -PHYSICOCHEMICAL AND BIOLOGICAL TREATMENT OF SOLID AND HAZARDOUS WASTE**

Chemical Treatment Processes For MSW (Combustion, Stabilization And Solidification Of Hazardous Waste)-Physicochemical Processes For Hazardous Waste (Soil Vapor Extraction-Air Stripping-Chemical Oxidation)-Ground Water Contamination &Remediation-Composting-Bioreactor-

Anaerobic Decomposition Of Solid Waste-Principles Of Biodegradation Of Toxic Waste-Inhibition-Co-Metabolism-Oxidative And Reductive Process-Slurry Phase Bioreactor-In-Situ Remediation.

**REFERENCE BOOKS:**


1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.

2. Richard J.Watts, Hazardous Wastes-Sources, Pathways, Receptors John Wiley and Sons, New York, 1997.

3. LaGrega, M.D. Buckingham, P.L and Evans, J.C. Hazardous Waste Management, McGraw Hill International Edition, New York, 1994.


## SAFETY IN MINING INDUSTRIES

**UNIT I-Opencast Mines**

Causes And Prevention Of Accident From: Heavy Machinery, Belt And Bucket Conveyors, Drilling, Hand Tools-Pneumatic Systems, Pumping, Water, Dust, Electrical Systems, Fire Prevention. Garage Safety –Accident Reporting System-Working Condition-Safe Transportation – Handling of Explosives.

**UNIT II-Underground Mines**

Fall of Roof and Sides-Effect of Gases-Fire and Explosions-Water Flooding-Warning Sensors-Gas Detectors-Occupational Hazards-Working Conditions-Winding and Transportation.

**UNIT-III-Tunneling**

Hazards from- Ground Collapse, Inundation and Collapse of Tunnel Face, fallsfrom Platforms andDangerfrom Falling Bodies. Atmospheric Pollution (Gases and Dusts) – Trapping –Transport-Noise Electrical Hazards-Noise and Vibration From: Pneumatic Tools and Other Machines – Ventilation and Lighting – Personal Protective Equipment.

**UNIT IV-Risk Assessment**

Basic Concepts of Risk-Reliability and Hazard Potential-Elements of Risk Assessment – Statistical Methods – Control Charts-Appraisal of Advanced Techniques-Fault Tree Analysis-Failure Mode andEffect Analysis – Quantitative Structure-Activity Relationship Analysis-Fuzzy Model for Risk Assessment.

**UNITV-Accident Analysis and Management**

Accidents Classification And Analysis-Fatal, Serious, Minor And Reportable Accidents – Safety Audits Recent Development Of Safety Engineering Approaches For Mines-Frequency Rates-Accident Occurrence Investigation-Measures For Improving Safety In Mines-Cost Of Accident-Emergency Preparedness –Disaster Management

**REFERENCES:**

- "Mine health and safety management", michaelkarmis ed., sme, littleton, co.2001.
- Kejiriwal, b.k. safety in mines, Gyanprakashan, Dhanbad, 2001.
- DGMS circulars-ministry of labour, government of india press, or lovely prakashan-dhanbad, 2002.


## ERGONOMICS & PHYSICAL SAFETY PRACTICAL

### UNIT I :ANATOMY

Introduction To Ergonomics: The Focus Of Ergonomics**,** Ergonomics And Its Areas Of Application In The Work System, A Brief History Of Ergonomics, Attempts To Humanize Work, Modern Ergonomics, Future Directions For Ergonomics Anatomy, Posture And Body Mechanics: Some Basic Body Mechanics, Anatomy Of The Spine And Musculoskeletal Disorders In The Workplace, Behavioral Aspects Of Posture, Effectiveness And Cost Effectiveness, Research Directions.

### UNIT II :HUMAN BEHAVIOR

Individual Differences, Factors Contributing To Personality, Fitting The Man To The Job, Influence Of Difference On Safety, Method Of Measuring Characteristics, Accident Proneness. Motivation, Complexity Of Motivation, Job Satisfaction, Management Theories Of Motivation, Job Enrichment Theory, Frustration And Conflicts, Reaction To Frustration, Emotion And Frustration, Attitudes-Determination Of Attitudes, Changing Attitudes Learning, Principles Of Learning, Forgetting, Motivational Requirements

### UNIT III :ANTHROPOMETRY AND WORK DESIGN FOR STANDING AND SEATED WORKS

Designing For A Population Of Users, Percentile, Sources Of Human Variability, Anthropometry And Its Uses In Ergonomics, Principals Of Applied Anthropometry In Ergonomics, Application Of Anthropometry In Design, Design For Everyone, Anthropometry And Personal Space, Effectiveness And Cost EffectivenessFundamental Aspects Of Standing And Sitting, An Ergonomics Approach To Work Station Design, Design For Standing Workers, Design For Seated Workers, Work Surface Design, Visual Display Units, Guidelines For Design Of Static Work**,** Effectiveness And Cost Effectiveness, Research Directions

### UNIT IV :MAN - MACHINE SYSTEM AND REPETITIVE WORKS ANDMANUAL HANDLING TASK

Applications Of Human Factors Engineering, Man As A Sensor, Man As Information Processor, Man As Controller – Man Vs Machine.

Ergonomics Interventions In Repetitive Works, Handle Design, Key Board Design-Measures For Preventing In Work Related Musculoskeletal Disorders (Wmsds), Reduction And Controlling, Training Anatomy And Biomechanics Of Manual Handling, Prevention Of Manual Handling Injuries In The Work Place, Design Of Manual Handling Tasks, Carrying, Postural Stability.

### UNIT V:

**HUMAN SKILL AND PERFORMANCE AND DISPLAY,CONTROLS AND VIRTUAL ENVIRONMENTS**

A General Information-Processing Model ofthe Users, Cognitive System, Problem Solving, EffectivenessPrinciples For The Design Of Visual Displays- Auditory Displays- Design Of Controls- Combining Displays And Controls- Virtual (Synthetic) Environments, Research Issues.

**REFERENCES BOOK**


- Introduction To Ergonomics, R.S. Bridger, Taylor And Francis
- Ergonomic Design For Organizational Effectiveness, Michael O'neill
- Human Factors In Engineering And Design, Mark S.Sanders,The Ergonomics Manual, Dan Mc Leod, Philip Jacobs And Nancy Larson


**EMERGENCY PREPAREDNESS & RESPONSE**

**EXPERIMENTS**

1. The awareness & preparedness for emergencies at local level (apell) process and partners
2. Starting the awareness & preparedness for emergencies at local level (apell) process
3. Building community awareness
4. Achieving preparedness for emergencies

**STUDY**

1. Responsibility and roles of the awareness& preparedness for emergencies at local level (apell) partners.
2. The work process of the awareness & preparedness for emergencies at local level (apell)
3. The organization setup of the awareness & preparedness for emergencies at local level (apell).
4. Forming the co-ordinating group.
5. Knowledge of hazardous installations and local community.
6. Knowledge of informative communications
7. Addressing the issues in emergency preparedness planning.
8. The approaching process for emergency planning & preparedness (10-steps)
9. Making time table for implementing the awareness & preparedness for emergencies at local level (apell) process.

## REQUIREMENTS

1. The awareness & preparedness for emergencies at local level (apell) partners or members
2. Emergency vehicles
3. Communicative equipments
4. Emergency tools kit
5. First aid kit
6. Doctor on call
7. Fire extinguishers
8. Personal protective equipments (as per hazards involved)
9. All emergency phone numbers on display.
10. All other required sources

## REFERENCES:


1. Guidelines for the preparation cyclone – emergency management manual – national safety council – 2003
2. The awareness & preparedness for emergencies at local level (apell) – industry and environment office – united nation environmental programme - 2001


## SEMESTER VI

### LIFTING EQUIPMENTS & TRANSPORT SAFETY

### UNIT- I – SPECIFIC HAZARD CONTROL MEASURE – FORK LIFT HAZARD CONTROL

An introduction of fork lift hazard control – employers management (employer / worker training) fork lift inspection & maintenance – lifting – workers on foot – work environment) – employees / workers – load – centres – electric forks – checking controls – forklift safety – checking loads – stacking – moving loads – driving a forklift – forklift training.

### UNIT- II – SAFEHANDLING & STORAGE – MATERIAL HANDLING

Material handling (basic facts, factors influencing selection of handling materials, mechanical aids / equipments, unsafe work habits) – manual material handling (correct positioning of feet – benting knees – straight back – arms closed to the body – correct grip) – mechanised (kinetic) material handling ceot cranes / goliath crane / jib crane safety precautions – satutory examinations & inspection, chain pulley block safety precautions forklift truck safety precautions – slings and slingging practices – wire rope sling – safe working load – defects in slings – chain sling) chain defects (stretch & deformation – wear – nicks and grazes – twisting – cracks – defects in hook, load limits – factors of safety – angle between two legs of a sling – use – care and maintenance of chains and wire rope slings – procuring new lifting tackles (slings) and maintaining them in a shop – single and multi legged slings) handling and storage of compressed gas cylinders – introduction –

storage – safety precaution in storing gas cylinders – storage of corrosive substances introduction – storage – safety precautions storage of hydrocarbons – anintroduction – class (a) – safety precautions class b&c – safety precautions – disposal of empty containers – storage of waste drums and containers – storage – handling of drums – decontamination – decontamination plan – prevention of contamination – types of contaminates – decontamination methods

(physical removal – loose contaminates, adharing contaminates – volatile liquids) other decontaminates methods.

**UNIT- III – HAND SIGNALING ON CRANE & RIGGING**

An introduction of signaling and rigging

**Module 01 :** oet cranes – types of cranes – major components – description and functions – inspection & maintenance – qualification & conduct of operators – standard communication hand signals – operational inspection and documentation – safe working load.

**Module 02 :** introduction of lifting tackles - lifting tackles and their function – slings – wedge / sockets and hooks – swivel & chains – shackles / eye bolds / eye nuts – inspection, selection of lifting tackles and procedures – common types of hitch and how to use them determining of baskets and choker value - sling angle safe working load – recommended safe lifting angle – choker stress formula – plan for a safe lift.

**Module 03 :** appointed / nominated in-charge in lifting operations – lifting techniques – safety rules – safety observations – important points to remember in lifting.

**UNIT- IV – TRANSPORTATION SAFETY – ROAD SAFETY**

Road safety – drive to stay alive – defensive driving – knowledge – foresight – good judgement – standard accident prevention formula – recognized hazards – six conditions (light – blinded by oncoming vehicle – adverse road conditions – adverse weather conditions – traffic – vehicle – driver – anger – tired – depressed – hurry – alcohol – drugs – physical impairments – distraction – how to prevent an accident – six positions of two vehicles collisions – vehicle ahead – reacting distance – breaking distance – vehicle behind – blind spot – head on collision – rule no. 1 – read the road ahead – rule no. 2 – ride to the left – rule no. 3 – reduce the speed – rule no. 4 – ride on the left of the road – split – second decisions – covering the break – stop sign – traffic lights – over taking – being overtaken – fixed object collision – off the road or mystry crash – driving errors – collision – traffic violation vehicle abuse – schedule delays – discourtesy – goal – defensive driving code qualities of a defensive driver – two wheelers – low visibility – high incidents of head injuries – skidding – pillion rider – always expect the unexpected and be adefensive driver the bicycle – pedestrian safety –

**Road safety management plan for transporters :**leadership &commitment of top management expressed through basic road safety policy covering – organization– planning & implementation – monitoring the implementation and evaluation – road accident death – defensive driving and road safety – basics elements of defensive driving techniques – adjust your driving – stopping your vehicle – the two second rule - avoiding collisions with other vehicles.

## UNIT- V – MOTOR VEHICLE MAINTENANCE & SAFETY

Statutory requirements – periodicity of the maintenance – maintenance tips – safe driving tips to motorists – environment consciousness in road transport sector – fuel saving tips for vehicle owners (tips for two/three wheeler, probable causes of high fuel consumption and remedies – recommended maintenance schedule for optimum fuel consumption) – tips for motorists – factors affecting petrol consumption (driving skills, car loading conditions, vehicle condition). Safety tips for two – wheelers (motorcycle & scooter) riders – (introduction, checks before riding tips for safe riding) – safety tips on vehicular use of cng – safe transportation of hazardous material by road – statutory provisions – salient provisions (qualification and training of drivers of hazmat vehicles, emergency information panel (eip) – hazard class lables – transport emergency card (trem card) responsibilities – notification and identification of accidents – licenses – inspection & maintenance of vehicles – restrictions – documents to be carried in the vehicle & others).

**Transportation of hazardous goods by road :-** main provisions in central motor vehicles rules, 1989 relating to transportation of hazardous goods –

Rule : 9: educational qualifications for drivers of goods carriage carrying dangerous or hazardous goods.

Rule : 129: transportation of goods of dangerous of hazardous nature to human life.

Rule 129a : spark arrestor –

Rule 130 : manner of display of class labels –

Rule 131 : responsibility of the consignor for safe transport of dangerous or hazardous goods.

Rule 132 : responsibility of the transporter or owner of goods carriage

Rule 133: responsibility of the driver

Rule 134 : emergency information panel

Rule 135: driver to be instructed

Rule 136 : driver to report in the police station about accident.

Rule 137 : class labels – places for fixing emergency information panels on vehicles & dimensions – emergency information panel – unhazard class symbols on transportation of hazardous goods – un number, hazard class and haz chem code for selected chemicals – guidance notes on hazchem code – unclassification and definitions of classes of dangerous goods (class – 1 – explosives, class – 2 – gases, class – 3 – flammable liquids – class - 4 – flammable solids – class – 5 – oxidising substances – class – 6 – toxic and infectious substances – class – 7 – radioactive material – class – 8 – corrosive substances,

Class – 9 – miscellaneous dangerous substances and particles) – transportation of hazardous wastes – guidelines – procedure for safe loading & unloading of road tankers carrying petroleum liquid (vehicles carrying hazardous goods – check list)

**References:**


- Practical guide book on safety health & environment – national safety council – volume 1 – 2013
- Industrial safety management – lm. Deshmukh – Tata Mc Graw Hill – 2006
- Safety health & working conditions - ilo training manual – Geneva – Joint Industrial Safety Council – Stockholm - 1994.


## SAFETY INSPECTION & AUDIT

### UNIT I - Safety Inspection

Importance of Workplace Inspection – Purpose of Workplace Inspection – Planning of Workplace Inspection – Hazards in Workplace – Information's Required in Workplace Inspection Report – Inspection Team – Duration of Inspection – Frequency of Inspection – Follow up & Monitoring – Summary.

### UNIT II - Safety Audit

Introduction – Types of Audits – Audit Objectives – Methodology to Conduct Safety Audit – Pre Audit Activities – Background Information to be gathered – Data to be gathered – On Site Activities – Understanding Management Systems – Assessing Strengths & Weaknesses – Collecting Audit Evidence – Interviewing – Observation – Evaluating Audit Evidence – Reporting Audit Findings – Post Audit Activities.

### UNIT III - ISO 14001

EMS, ISO 14001, Specifications, Objectives, Environmental Policy, Guidelines and Principles (ISO 14004), Clauses 4.1 To 4.5. Documentation Requirements, 3 Levels of Documentation for An ISO 14000 Based EMS, Steps in ISO 14001. Implementation Plan, Registration, Importance of ISO 14000 To the Management. Auditing ISO14000General Principles of Environmental Audit, Auditor, Steps in Audit, Audit Plan.ISO 14040(LCA), General Principles Of LCA, Stages Of LCA, Report and Review. ISO 14020

(Eco Labeling) – History, 14021, 14024, Type I Labels, Type II Labels, ISO 14024, Principles, Rules for Eco Labeling Before Company Attempts for It. Advantages. EIA in EMS, Types Of EIA, EIA Methodology EIS, Scope, Benefits- Audit-Methodology, Auditors Audit Results Management Review-Continual Improvement.

**UNIT IV - IS 14489:1998 Code of Practice on Occupational Safety & Health Audit**

Scope – Definition – Audit Goals, Objectives & Responsibilities – Initiating the OS&H Audit: Preparing the Audit, Executing the Audit, Collecting Evidences, Audit Recommendations, Closing Meeting, Audit Documents & Report, Report Distribution, Record Retention – Audit Completion – Implementation of Audit Report – Annex A: Elements of OS&H System – Annex B: Types of Records to be Examined During the Safety Audit – Annex C: Safety Audit Questionnaire.

**UNIT V - OHSAS 18001 & ISO 45001**

Introduction – Development Of OHSAS Standard – Structure And Features Of OSHAS 18001 – Benefits Of Certification-Certification Procedure – OH And S Management System Element, Specification And Scope - Correspondence Between OHSAS 18001, ISO 14001:1996 And ISO 9001:1994 – Guidelines (18002:2000) For Implementing OHSAS 18001 – Developing OH And S Policy– Guidelines – Developments - Procedure - Content Of OH And S Policy – General Principle, Strategy And Planning, Specific Goals, Compliance- Methodology. Planning – Guidelines, Methodology Steps Developing Action Plan – Analysis and Identify the Priorities, Objective and Targets, Short Term Action Plan, Benefits and Cost of Each Option, Development of Action Plan- High Level Structure (HLS) – Annex SL – Key Changes in ISO 45001 – Comparison of ISO 45001 & OHSAS 18001.

**REFERENCE:**


- ISO 9000 to OHSAS 18001, Dr. K.C. Arora, S.K. Kataria and Sons, Delhi.\
- The management systems, Quality, Environment, Health & Safety ISO9001: 2000, ISO14001, ISO 45001.
- Safety Auditing, Donald W.kase, John Wiley and Sons Ltd,
- Health and Safety, Environment and Quality Audits: A Risk-based Approach,Health and Safety, Environment and Quality Audits: A Risk-based Approach, Routledge; 3 edition (10 April 2018).
- Industrial Hygiene & Safety auditing:A manual for practice,secondedition,CraigHollenbeck,AIHA


## SAFETY IN MATERIAL HANDLING AND EQUIPMENT SAFETY

**Unit -I-Manual material handling**

Preventing common injuries- lifting by hand- team lifting and carrying- handling specific shape machines and other heavy objects –accessories for manual handling, hand tools, jacks, hand trucks, dollies and wheel barrows –storage of specific materials - problems with hazardous materials, liquids, solids –storage and handling of cryogenic liquids -shipping and receiving, stock picking, dock boards, machine and tools, steel

strapping and sacking, glass and nails, pitch and glue, boxes and cartons and car loading – personal protection –ergonomic and safety considerations.

**Unit-II-Cranes**

Types of cranes-reasons for crane accidents:powerline contact, overloading, failure to use outriggers-load control-wire rope requirements-annual inspections-preventive maintenance-lifting tools & tackles-structural failure, two blocking, pinch point, moving parts, unsafe hooks, obstruction of vision, sheave caused cable damage, cable kinking, side pull, boom buckling,access,control confusion, turntable failure, removal of counter weight systems-pre lifting plan-job hazard analysis-hand signals-signaling devices-lifting capabilities-third party inspection-safe load indicator.

**Unit III: Derricks, Conveyors, Hoists & Vehicles.**

Derricks: Types of derricks-load ratings-inspections-testing-maintenance-handling the load-guard-operating near power lines-floating cranes. Conveyors: Gravity or inertia conveyors-guidelines for using motorized or powered conveyors safety-conveyor regulations- conveyor safety. Hoists: Inspections-load testing-controls for hoist-moving a load- hoist limit switch-base mounted drum hoist-materials hoist-overhead hoist. Vehicles: Highway trucks-off road vehicles-railroad cars.

**Unit-IV: Rigging**

Rigging& rigger-types of slings-size-weight& centre of gravity of the load-number of legs and angle-removal from service- selection of wire rope sling-strength,fatigue,abrasive wear, abuse-rated capacity of the sling-safe use & maintenance-chain slings-wire rope slings-rope lay-wire rope life-field lubrication-storage-U bolts-metal mesh slings-fiber rope & synthetic web slings-hooks and shackles.

**UNIT- V: Industrial trucks**

Powered industrial trucks, requirements, operating principles, operators selection and training and performance test, inspection and maintenance, electric trucks, gasoline operated trucks, LPG trucks –power elevators, types of drives, hoist way and machine room emergency procedure, requirements for the handicapped, types-Escalator, safety devices and brakes, moving walks –man lifts, construction, brakes, inspection -ergonomic and safety consideration.

## REFERENCE:


- Apple .M. James, Plant layout and material handling, 3rdedition, John Wiley and sons, 1991.
- Fred E. Meyers and Matthew P. Stephens, “Manufacturing Facilities Design and Material Handling”, Prentice Hal, 3rdedition, 2004.
- Encyclopedia of occupational safety and health, ILO Publication, 1985.
- Accident prevention manual for industrial operations, N.S.C., Chicago, 1982.
- Alexandrov. M.P., Material handling equipment, Mir Publishers, Moscow, 1981.
- Spivakosky, Conveyors and related Equipment, Vol.I and II Peace Pub. Moscow,

**FIRE AND SAFETY INTERNSHIP TRAINING REPORT AND VIVA – VOCE**

Objectives: To facilitate the students to understand the basic concept and principles of functional areas of**FIRE AND SAFETY** and make use of the tools, techniques and processes.

Outcome: On completion of the training, the students will be able to recollect basic concepts of **FIRE AND SAFETY** management and present report of basic practices in industries.

**Rules covering internship trainings**

1. Each student should undergo three months internship in an organizational Government undertaking during June to August and attendance certificate from the organization is to be submitted to the HOD.
2. He/ she shall undergo the above training in the organization approved by the department.
3. He/ she has to submit two copies at the report in not less than 50 type written pages within a month of the completion of period in the5th semester.
4. In case of failure to submit the report within the above stipulated the date of submission shall be extended by another 15 days. If the student fails the report even within the period of extension, he/she has to undergo the training after the subsequent vacation ( end of semester VI June to August) as arrear paper and submit the report within 15 days of completion of the period.
5. The training programme shall be evaluated for a total of 100 marks, out of which the training programme is to be evaluated by the training supervisor for 40 marks in the organization and to be
   evaluated by the guide for 40 marks and the student has to appear viva-voce conducted by the faculty for 20 marks. The members of the viva-voce committee are HOD, guide and an external examiner. The maximum marks for pass in the paper is 50%
6. If any candidate fails to secure a pass in the training programme he/she has to undergo the training programme once again after completion of the course.
7. The training report should contain the following items:
   A. Introduction
   B. Objectives of the training
   C. Organizational structure of the concern
   D. Observations about the working of the concern
   E. Identifications of the problems, if any
   F. Suggestions to solve the problem
   G. Limitation of the training
   H. Conclusion.

## COMPUTER AIDED HAZARD ANALYSIS

**OBJECTIVES**: To provide knowledge on risk, hazard and their assessment techniques in Industry• To understand the principles of operation of various equipment for safety application• To know the consequences of fire, explosion and toxic release• To know the various software available for risk quantification• To conduct a risk assessment technique in Industries.•

### UNIT I HAZARD, RISK ISSUES AND HAZARD ASSESSMENT

Introduction, hazard, hazard monitoring-risk issue, group or societal risk, individual risk, voluntary and involuntary risk, social benefits Vs technological risk, approaches for establishing risk acceptance levels, Risk estimation. Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis(PHA), human error analysis, hazard operability studies(HAZOP),safety warning systems.

### UNIT II COMPUTER AIDED INSTRUMENTS

Applications of Advanced Equipments and Instruments, Thermo Calorimetry, Differential Scanning Calorimeter(DSC), Thermo Gravimetric Analyser(TGA), Accelerated Rate Calorimeter(ARC), Reactive Calorimeter(RC), Reaction System Screening Tool(RSST) - Principles of operations, Controlling parameters, Applications, advantages. Explosive Testing, Deflagration Test, Detonation Test, Ignition Test, Minimum ignition energy Test, Sensitiveness Test, Impact Sensitiveness Test(BAM) and Friction Sensitiveness Test (BAM), Shock Sensitiveness Test, Card Gap Test. U

### UNIT III

RISK ANALYSIS QUANTIFICATION AND SOFTWARES Fault Tree Analysis and Event Tree Analysis, Logic symbols, methodology, minimal cut set ranking - fire explosion and toxicity index(FETI), various indices - Hazard analysis(HAZAN)- Failure Mode and Effect Analysis(FMEA)- Basic concepts of Reliability- Software on Risk analysis, CISCON, FETI, HAMGARS modules on Heat radiation, Pool fire, Jet, Explosion. Reliability softwares on FMEA for mechanical and electrical systems.

### UNIT IV

CONSEQUENCES ANALYSIS 12 Logics of consequences analysis- Estimation- Hazard identification based on the properties of chemicals- Chemical inventory analysis- identification of hazardous processes- Estimation of source term, Gas or vapour release, liquid release, two phase release- Heat radiation effects, BLEVE, Pool fires and Jet fire- Gas/vapour dispersion- Explosion, UVCE and Flash fire, Explosion effects and confined explosion- Toxic effects- Plotting the damage distances on plot plant/layout.

**UNIT V**

CREDIBILITY OF RISK ASSESSMENT TECHNIQUES 12 Past accident analysis as information sources for Hazard analysis and consequences analysis of chemical accident, Mexico disaster, Flixborough, Bhopal, Seveso, Pasadena, Feyzin disaster(1966), Port Hudson disaster- convey report, hazard assessment of non-nuclear installation- Rijnmond report, risk analysis of size potentially Hazardous Industrial objects- Rasmussen masses report, Reactor safety study of Nuclear power plant TOTAL: 60 PERIODS 16

**REFERENCES:**

1. Brown, D.B. System analysis and Design for safety, Prentice Hall, 1976.

2. Course Material Intensive Training Programme on Consequence Analysis, by Process Safety Centre, Indian Institute of Chemical Technology, Tarnaka and CLRI, Chennai.

3. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process safety, AICHE 1992

4. Hazop and Hazom, by Trevor A Klett, Institute of Chemical Engineering.

5. ILO- Major Hazard control- A practical Manual, ILO, Geneva, 1988.

6. Loss Prevention in Process Industries-Frank P. Less Butterworth-Hein UK 1990 (Vol.I, II and III) 7. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Common wealth Science Council, UK 8.Quantitative Risk assessment in Chemical Industries, Institute of Chemical Industries, Centre for Chemical process safety.

***