**SARDAR PATEL UNIVERSITY**
**VALLABH VIDYANAGAR**

**SYLLABUS EFFECTIVE FROM: 2018-19**
M.Sc. INDUSTRIAL HYGIENE AND SAFETY
**Semester –III**

**PS03CIHS21: Medical Surveillance and Biological Monitoring**

**1.0 Medical Surveillance**

1 Occupational Health Services- Role of medical and non- medical team, required facilities and equipment

1.1 Occupational Health Management, Occupational & Environment Medicine (OEM)

1.1.1 Scope of OEM, Prevention in OEM, Discipline of environmental and occupational Medicine.

1.2 Medical Surveillance Programme

1.2.1 Industrial/ occupational site medical Programme

1.2.2 Medical history and Pre/periodical-employment screening

1.2.3 First medical examination

1.2.3 Termination examination

1.2.3.1 Return to work assessment

1.2.4 Emergency and non- emergency treatment: First Aid First aid for burns, fractures, suffocation, toxic ingestion, bleeding, wounds and bandaging. Artificial respiratory techniques, First aid and antidotes for poisoning

1.2.5 Medical Records and program review.

1.2.6 Ambulance van

1.2.7 Medical surveillance programme for chemicals mentioned in schedule II and III as per Factory Act 1948

1.3 Integration of Industrial Hygiene and Medical Surveillance data.

**2.0 Introduction of Biological Monitoring**

2.1 General Principles

2.2 Application of Biological Monitoring in various occupations

2.2.1Advantages of Biological Monitoring

2.2.3 Limitation of Biological Monitoring

**3.0 Sampling, Laboratory Methods and Result**

3.1 Sampling Strategies

3.2 Collections of Samples: Urine, Blood faeces, adipose tissue, hair, nail, saliva, breast milk, sputum or amniotic fluid

3.2.1 Sources of possible error

3.2.2 Interpretation of Result

3.3 Confidentiality, Ethical Consideration, data interpretation Biological monitoring for specific substances/Chemicals

3.3.1 As per Factory Act: Schedule II and III

3.3.2 Metals: Pb, Cd, As, Mn, Hg, Cr, Be, Ni Cu and required metal causes occupational health related problem in India

3.3.3 Solvents: Benzene, Carbon disulfide, Vinyl Chloride Formaldehyde and required solvents causes occupational health related problem in India

3.3.4 Pesticides (Any Two) causes occupational health related problem in India

3.3.5 Dust (Any Four) causes occupational health related problem in India

3.3.6 Gases Chlorene, Ammonia, Carbon monoxide, SOX, NOX causes occupational health related problem in India

**4.0 Biological Marker**

4.1 Rationale for the development and use of biomarkers

4.2 Definition and classification

4.3 Biomarker of susceptibility

4.4 Characterization of biomarkers

4.5 Validation of biomarkers

4.6 Biologic samples: Non-invasive, Minimal invasive and invasive sampling

4.7 Biotransformation: Metabolism of xenobiotic compounds

**Suggested Books**


1. Matheson, Effects of Exposure to toxic gases – First Aid and Medical Treatment – Second Edition
2. Biological Monitoring, Edited by Shane S.Que Hee
3. Preventing Illness and Injury in the Workplace
4. Surface and Dermal Monitoring for Toxic Exposures by Shirley A.Ness
5. The Blood Borne Pathogen Standards by John T O'Nel
6. Get the Health Care you Deserve: A Manual for Managers by Solomayer and Boardman
7. Guidelines for Developing Community Emergency Exposure Levels for Hazardous Substances by Committee on Toxicology National Research Council

8. Effects of Exposure to Toxic Gases: First Aid & Medical Treatment Edition 3 by Matheson Gas Products
9. The Dose Makes the Poison Edition 2 by Allice Ottoboni
10. Infectious Waste Management by Frank L Cross, Howard E Hesketh, P Kay Rykowski (2 copies)
11. Pesticide Users' Health and Safety Handbook by Andrew Watterson
12. Reproductive Health Hazards in the Workplace by Office of Technology Assessment Task Force
13. Medical Toxicology, Diagnosis and Treatment of Human Poisoning by Ellenhorn and Barceloux

**PS03CIHS22 : Hazardous Waste Management**

**1.0 Introduction to waste, definitions, types, characteristic, physical and chemical property.**

1.1 Sampling, method, preservation of liquid waste sample BOD, COD, ThoD, TOC, TOD and Bioassay test

1.2 Effluent treatment for domestic waste, ET for Industrial waste in a detail, functions of different pathways, limitation, problems and its solutions

Difference between industrial and municipal waste, environmental impact of industrial waste. Chlorine, ozone, UV treatment of waste.

1.3 Neutralization of waste

**2.0 Solid waste management**

2.1 Definitions, types, characteristic of solid waste, industries generating solid waste

2.2 Factors affecting generation of solid waste, flow chart for solid waste collection

2.3 Collection and their factors, transportations and storage of solid waste

2.4 Treatment and disposal- Incineration, composting, mechanical separator, magnetic separator, landfill, pyrolysis, sanitary landfills, trench method, area method, pit and quarry method, etc.

**3.0 Hazardous waste management**

3.1 Definitions, types, EPA, RCRA, CERCLA international act for hazardous waste, Environmental impact assessment

3.2 Cradle to grave approach, Priority in Hazardous Waste management, superfund amendment and reauthorization act 1986, Dose-response relationship, effect of hazardous waste on aquatic system and how do they enter the foods chain, route of entry, fate of toxicant in body.

**3.3 Volume reduction, strength reduction, equalization and proportioning of Wastewater**

Removal of suspended solids- sedimentation, flotation, and screening.

3.4 Removal organic solids by- Lagooning, activated sludge treatment, aeration, trickling filter, wet combustion, anaerobic digestion, well injection, foam phase separation, pure oxygen treatment, etc.

3.4 Removal inorganic dissolved solids by- evaporation, dialysis, ion exchange, and reverse osmosis, etc.

Treatment and disposal of sludge solids- Aerobic and anaerobic digestion, vacuum filtration, drying beds, drying and incineration, sanitary landfills, etc.

**4.0 Hazardous waste treatment technology-**

Physical treatment, chemical treatment, biological treatment.

**4.1 Major industrial waste:**

Dairy industry, Pharmaceuticals industry, Textile industry, Pesticide waste, Acid wastes in chemical industry, Metal plating industry, Petrochemical; Glass industry waste, Paint waste. Hazardous household waste, waste oils, PCB waste, mine waste

**4.**2 Biomedical waste and its management.

Biomedical Waste Management: Definition, Health and environment issues, Category of waste, segregation ,collection and transportation, Treatment systems

4.3 Hazardous wastes (management and handling) rules 1989

4.4 Bio-Medical Waste (Management and Handling) rules 1998

**Suggested Books**


1. Charles A Wentz Mc Graw Hill International Edn., Hazardous Waste Management
2. US EPA: Encyclopedia of Environment and Pollution Control
3. Hazardous Material Emergiencies : Response and Control Edition 2 by Johm R Cashman
4. Waste Minimization and Cost Reduction for Process Industries by Poul N Cheremisinoff
5. Environmental Health Hazards : Recognition and Avoidance by Donald E Waite
6. Hazardous Waste Handbook for Health and Safety by Martin, Liwppitt and Prothero
7. Managing Hazardous Substances Accident by Al J Smith
8. Hazardous Ocupational Environments by Paul N Cheremisinoff
9. Infectious Waste Management by Frank L Cross, Howard E Hesketh, P Kay Rykowski
10. Protecting Personnel at hazardous Waste sites Edition 2 by Martine and Ilevine

11. Hazardous Materials and Hazardous Waste Management by Gayle Woodsite
12. Solving the hazardous Waste Problem y EPA
13. Sara Title III Intent and Implementation of Hazardous Materials Regulations by Frank L Fire, Nancy K Grant, David H Hoover
14. The Complete Guide to the Hazardous Waste Regulations Edition 2 by Travis P Wagner
15. Joseph A Salvato Environment Engineering and Sanitation : $4^{th}$ Edition
16. Indian Legislation on related to Solid Waste, Hazardous Waste and Biomedical .
    MoEF Govt . Of India ( Use latest One)

**PS03CIHS23:Principles of Ergonomics**

**1.0 Introduction to occupational ergonomics, history, man machine interrelationship.**

1.1 Human work physiology

1.1.1 Structure of human skeleton

1.1.2 Capacity for physical work, energy cost of work, heart rate, matching people and their work, rating the perceived effort, work/ rest cycles

1.1.3 Physiology of body movement- bones joints and muscles.

1.1.4 Muscles strength, endurance and fatigue

1.1.5 Problems Associated With Load Carrying and solutions to this problems and guidelines to avoid this problem

**1.2 Engineering Anthropometry**- Definition

1.2 Variability in body shapes and sizes

1.2 Sources of anthropometeric variability

1.3 **Human Biomechanics**-

1.4 Muscles strength, lever system in the body

1.5 Assessment of muscles strength by EMG

1.6 Measuring techniques, and the strength test protocol.

2.0 **Manual material handling.**

2.1 The body as energy source.

2.2 Matching people with their tasks.

2.2 Training for safe lifting practices: rules for lifting**.**

2.3 Personal Selection For material handling.

2.4 Assessment methods.

2.5 Screening techniques.

2.6 Permissible loads for manual material handling.

2.7 Examples - Limits for lifting, lowering, pushing, pulling and carrying.

2.8 The elements of lifting task

**3.0 Man- machine communication: Words and symbols, Displays, Control**

3.1 Meaning, communication and message

3.2 Perceptual process in written communication

3.3 Typographical features of written communication

3.4 Alternative ways presenting information and instruction

3.5 Readability

3.6 Visuals displays, design**,** VDU design and use

3.7 Auditory displays- warnings displays, tracking displays

3.8 Types of control

3.9 Factors important in control design

3.10 **Seating and Posture**

Orthopedic aspects of sitting

Muscular aspects of sitting

Behavioral aspects of sitting

Seat design

4..0 Tool Design

4.1 Introduction and Anatomy of hand and anthropometry of hand

4.2 Types of Grip

4.3 Principles of hand tool

4.4 Vibration ,controlling hand arm vibration exposure

4.5 Attribute of common industrial hand tool- shovels, hammers, saws, pliers, screwdrivers, knives etc

4.6 Attributes of common industrial power tools- power drills, nut runners, etc

4.7 Safety while handling tools and Tool evaluation checklist

4.8 Workstation design, workplace design, office workstations

4.9 General principles, sitting vs. standing.Physical requirements of the workplace

4.10 Social requirements in the workplace also Workstation, workplace and office workstation checklist

4.11 **Ergonomic hazard evaluation method**

Anthropometry – Practical measurements of a few body dimensions, its treatment and application
Skin Fold Caliper for measurement of body dimension

Use of Dynamometer for measurement of force
Designing of IT work station, Administration department, tool designing, work area by using principles of Ergonomic

NIOSH lifting equation:Single task and Multiple Task

4.12 RULA's method and REBA

**Suggested Books**

1.0 Ergonomic design for people at Work, volume III, Eastman Kodak, Human factors section, Health Safety and Human Factors Laboratory

2.0 Ergonomic design for people at work Vol. I, Eastman Kodak, Human factors section, Health Safety and Human Factors Laboratory

3.0 Fitting the Task to the man by E Gradjean, 4th ed. 1988

4 Ergonomics by Murrell K.F.H., Champian and Hall, London.
5 Ergonomics at work by David J. Oborne, John Wiley and Sons
6 Ergonomics By Pennathur Krishnamoorthy.
7 Human factors in Engineering and Design by EJ Mc Cornick.
8 Research technique in Human Engineering by Chapanis, A., Baltimore, John Hopkins.
9 A pain in your workplace? : Ergonomic Problems and Solutions by Health & Safety Executive
10 NIOSH Elements of Ergonomics Programs : A Primer based on Workplace Evaluations of Musculoskeletal Disorders by CDC
11 Ergonomics in Backpain : A guide to Prevention and Rehabilitation by Khalil, Rosomoff
12 Ergonomics of Workstation Design by T O Kwalseth
13 Ergonomics at Work Edition 2 by David J Obrne
14 VDTs and Radiation Safety
15 Working with Displays VDTs and Vision
16 Revised NIOSH Lifting Equation by NIOSH
17 The Rapid Entire Body Assessment (REBA) method developed by Dr. Sue Hignett and Dr. Lynn McAtamney , ergonomists from University of Nottingham in England (Dr. McAtamney is now at Telstra, Australia) Cornell University Ergonomic
18 .Web*ergo.human.cornell.edu/ahReba.html*

**PS03CIHS24: Safety Engineering –II**

**1. Metallurgical Industry**

1.0 Manufacture of Basic Metals, Manufacture of Ferrous & Non – Ferrous Metals

1.1Hazards and controls in steel industry,Metallurgical processes

1.2Foundry operations of mixing of materials, mold and core making melting (furnaces), casting, knockout and dressing, forging etc. Working on hot rolling and cold rolling mills.

1.3 Hazards and safety measure of heat treatment operations.

1.4 Hazards and safety measures of other operations like blasting, welding and cutting, brazing, soldering, polishing, buffing, cleaning etc.

**1.4 Textile Industry**

1.5 Introduction to Textile Industry. Flow chart of textile processes including synthetic textile industry.

1.6 Machine guarding for blow room, spinning, weaving and processing machinery for cotton and synthetic fiber industry.

1.7 Fire, explosion and health hazards and their control measures.

**Construction Industry**

1.8 Basic parameters governing the safety in construction such as site planning and layout, safe access, safety works permit and checklist, good housekeeping.

1.9 Safety in the use of construction machinery and equipment.

1.10 Underground and above ground works. Hazards and controls. Statutory safety requirement.

1.11 Health and welfare of construction workers – Dust, noise, vibration, heat, humidity and other hazards. First aid, medical examination and health records.

**2 Information Technology**

2.1 Safety features of manufacture of electronic valves, tubes, other electromagnetic devices, semiconductors and superconductors.

2.2 Safety features of manufacture of computers, radio, television and communication equipment and apparatus.

2.3 Hazards involved in testing of IT equipments and their safety measures.

**Cement Industry**

2.4 Types of cement and manufacturing process

2.5 Hazards due to bulk storages of raw materials, conveyers and machineries, rotary kiln, mixers and driers, loading, unloading and packing etc.

2.6 Control measures for dust collection, noise, vibrations, heat exposure etc.

2.7 Cement pneumoconiosis.

**Fertilizer Industry**

2.8 Types of fertilizer and manufacturing processes

2.9 Flow chart and safety aspects of machinery in use.

2.10 Hazards due to bulk storages, processes, transfer and transportation of chemicals, dust, noise etc. and their control measures.

**3 Pesticide Industry**

3.1 Types of pesticides and their lethal dosages

3.2 Marking, labeling and safe disposal of containers

3.3 Manipulation processes, their hazards and controls.

3.4 Medical treatment in case of exposure. Antidotes.

**Petroleum (Refinery) & Petrochemical Industry**

3.5 Petroleum classification and hazards due to petroleum products.

3.6 Hazards of bulk storages

3.7 Storage of Naptha, propylene, ethylene, xylene, benzene, LPG, Petrol, diesel, kerosene etc and their control measures.

3.7.1 Testing of storage vessels and their safety fittings.

3.7.2 safety in Pipeline transport

3.8 Stages of manufacturing processes.

3.8.1 Hazards and controls during manufacturing process. Testing of pressure vessels.

3.8.2 DCS control rooms and instrumentation for safety.

3.8.3 Fire and gas detectors and fire fighting system. PIPA Software.

3.9 Filling of Road and Rail Tankers

3.9.1 Safety measures associated with filing of tankers.

3.9.2 Safety of workers employed for this purpose.

3.10 OISD norms for petroleum industries

**4 Miscellaneous Industries**

4.1 Pottery and Ceramic Industry:

4.2 Raw materials and process flow chart

4.2.1 Hazard of raw material mixing and manufacturing processes.

4.2.2 Machine guarding

4.2.3 Control measures for dust, heat, noise, vibration and other hazards. Temperature control near kilns and glaze driers. Local exhaust ventilation.

4.2.4 Medical examinations of workers

4.2.5 Washing facilities

4.2.6 Statutory provisions

**4.3 Glass and quartz industry**

4.3.1 Products of Glass Industries

4.3.2 Raw materials and process flow chart.

4.3.3 Hazards of Raw Material mixing and manufacturing processes.

4.3.4 Hazards of quartz grinding and handling.

4.3.5 Machine guarding.

4.3.6 Control measures for dust, heat, noise, vibration, glass breaking and flying fuel and exhaust gases. Other hazards. Temperature control near furnaces and heaters. Local exhaust ventilation. LEV for Quartz, Akik and Diamond grinding and polishing.

4.3.7 Washing facilities

4.3.8 Statutory provisions.

**4.4 Paper Industry**

4.4.1 Products of paper industries. Pulp, paper and containers.

4.4.2 Raw materials and process flow chart.

4.4.3 Hazard of raw material mixing and manufacturing processes.

4.4.4 Machine guarding. Nip Guards near moving rollers. Trips and interlocks. Guards near straw cutters and paper cutting blades. Fencing or conveyer feeding to Pulper for preventing fall accidents.

4.4.5 Control measures for grass, dust, waste paper, digesters, bleaching agent like $Cl_2$ or $H_2O_2$, steam exposure, noise, vibration and other hazards.

4.4.6 Washing facilities.

4.4.7 Statutory Provisions

**4.5 Sugar Industry**

4.5.1 Process flow chart from sugar canes entry to the sugar godown and molasses tanks.

4.5.2 Hazards of machinery for sugar cane unloading, crushing, juice making boiling, evaporating, centrifugating, sugar grading and packing.

4.5.3 Machine guarding for V-belt drivers, gear wheels, fly wheels, rollers etc.

4.5.4 Control of dusting from baggase, coal, $SO_2$, noise and vibration.

4.5.5 Control of hazards from Juice Heaters, Evaporation and Boiling Pans, Syrup and Molasses Tanks

**Suggested Books**


1. Conference on Advanced Composites
2. CDC - National program for occupational safety and health in construction
3. Construction Industry

4. Construction lost-time injuries
5. Crane or Derrick Suspended Personnel Platformss
6. NIOSH Alert - Preventing Injuries and Deaths from Falls during Construction and Maintenance of Telecommunication Towers
7. NIOSH Construction
8. NIOSH Health and safety guide for concrete products industry
9. NIOSH health and safety guide for construction and related machinery manufacturers
10. NIOSH Health and Safety Guide for Highway and street construction
11. Off-shore construction
12. Excavating and Trenching operations
13. NIOSH safety and health in Soldering and brazing
14. NIOSH alert - preventing entrapment and suffocation caused by the unstable surfaces of stored grain and other materials
15. NIOSH Research Report standardization of friction testing of industrial working surfaces
16. NIOSH health and safety guide for bulk petroleum plants
17. Spray Painting good practices for employees : Your health and saafety are in your hands
18. NIOSH Health and safety guide for paperboard - container industry
19. Refinery Process by Maharshi Mehta
20. NIOSH Research Report Engineering control Technology assessment for the plastics and resins industry
21. NIOSH health and safety guide for plumbing, heating, and air conditioning contractors
22. NIOSH Employee health and safety in lithographic printing Industry
23. NIOSH health and safety guide for the printing industry
24. NIOSH good work practices for tannery workers

**PS03CIHS25: Legislation on Safety & Health**

**1.0 Legislative Process**

Meaning of legislation, legislative process and other legal terminology such as statement of objects and reasons, bill, act, rules, amendment, section rule, schedule and form, preamble, penal section, prosecution, judicial process, judgment, citation etc.

2.0 ILO convention and recommendations

2.1 Role of ILO for Safety, Health & Environment

**2.2 ILO Conventions and Recommendations in the furtherance of safety, health and environment. Some examples.**

| **Year** | **Convention** | **Recommendation** |
|---|---|---|
| 1981 | 155-OHS | 164-OHS |
| 1985 | 161-OHS | 171-OHS |
| 1988 | 167-Safety and health in construction | 175-safety and health in construction |
| 1990 | 170 – safety in the use of chemicals at work | 177 – Chemicals |
| 1993 | 174 – Prevention of major industrial accidents | 181 – Prevention of major industrial accidents |
| She as human right issue. Trade policy-affecting OHS. | | |

2.3 The factories act, 1948 and the Gujarat factories rules 1963:

2.4 History of the safety movement in the world and India, including the factories acts and their amendments.

2.5 Provisions of the factories act 1948 and Gujarat Factories Rules made their under with special reference to definitions u/s 2, chapter 3, 4-, 4-A, 5,6,9 & 10 and schedules and forms pertaining to dangerous operations and hazardous processes.

**3.0 Other legislations:**

Sections pertaining to safety, health and environment from the following statutes (latest with last amendment)

3.1 The Gujarat Lifts and Escalators Act 2000 and Rules 2001.

3.2 Boilers Act 1923, Gujarat Boilers Rules 1966 and Indian Boiler Regulations 1950 (IBR).

3.3 Electricity Act 2000 and Rules 2000.

3.4 Petroleum Act 1934 and rules 1976.

3.5 Explosives act 1884 and rules 1983

3.6 Static and mobile (Unfired) Pressure Vessels Rules 1981.

3.7 Gas Cylinders Rules 1981.

3.8 Insecticides act 1968 and Rules 1971.

3.9 Rules for transportation of hazardous goods from the motor vehicles rules 2000.

3.10 The dock workers (Safety, health & welfare) Act 1986, Rules and Regulations 1990.

3.11 The dock workers (Safety, health & welfare) Act 1986, Rules and Regulations 1990.

3.12 The buildings and other construction workers (Regulation of employment and conditions of service) Act 1996 and the Central Rules 1998.The buildings and other construction workers (Regulation of employment and conditions of service) Act 1996 and the Central Rules 1998.

**4.0 Legislation on environmental protection:**

4.0 Water (Prevention and control of pollution) Act 1974 and Rules 1975.

4.1 Air (prevention and control of pollution) act 1981 and rules 1982.

4.2 Environment (protective) Act 1986 and rules 1986.

4.3 Manufacture, Storage and import of hazardous chemicals rules 1989.

4.4 Rules for the manufacture, use, import, export and storage of hazardous microorganisms, genetically engineered organisms or cells.

4.5 Chemical Accident (Emergency Planning, Preparedness and Response) Rules 1996.

4.6 Recycled plastics manufacture and usage rules 1999.

4.7 Ozone Depleting Substances Rules 2000.

4.8 Batteries (Management & Handling) Rules 2001.

**PS03EIHS21 : Advanced Safety Management and Engineering Techniques**

**TOPICS & SUB TOPICS**

**1.0 Plant siting**

1.1Sitting criteria for hazardous industries, Meterological factors

Environmental guidelines ,Reports to authorities

1.2 Environmental impacts Assessment (EIA) ,Environmental statement

Definition, inventory, preparation and submission of report to competent authorities.

Separation distances and its relevance. Statutory requirements. National and international standards.

**1.1 Bulk storages**

**1.2** General Considerations

**1.2.1** NFPA & OISD Standards

**1.2.2** Design of storage layout. Dyking requirements. Incompatibility Criteria.

**1.3** Types and Safe Layout of Storages.

**1.3.1** Tank layout of LPG, Chlorine, Ammonia, EQ and Oleum.

**1.3.2** Isolated storages

**1.3.3** Mounded storages

**1.3.4** Cryogenic storages

**Plant inspection**

**1.4** Non destructive tests: its significance and limitations.

**1.4.1** Radiography, Ultrasonic, Magnetic Particle Methods, Eddy Current Method, Dye Penetration test.

**1.4.2** Strain measurement

**2 Safety in transportation**

**2.1** Transportation risk estimation

**2.2** Safety criteria for transportation

**2.2.1** Threshold qualities

**2.2.2** Statutory provisions

**2.3** Pipeline transport

**2.3.1** Road transport, Rail transport ,Sea transport, Air transport

**2.4** Hazard Communication

**2.4.1** UN No., HAZ CHEM No.

**2.4.2** Safety and risk phrases

**2.4.3** TREM CARD

**2.4.4** Day night release and consequences

**2.5** Emergency planning for the transportation of hazardous chemical

**2.6 Safety through design**

**2.7** The component involved in design process.

**2.8** Preliminary hazard analysis (PHA) and HAZOP exercise

**2.9** Different tires of protection and redundancy

**2.10** General considerations of design for emergency shutdown and start up

**2.11** Operating considerations

**2.12 Pressure system design**

**2.13** Pressure system components

**2.14** Fundamentals of pressure vessel design,Codes, standards and specifications

**2.15** Over pressure protection, Pressure relief and blow down

**2.16** Basic requirements of protection and their practical application for Flare Systems.

**3 Control system design**

**3.1** Process and control system characteristics

**3.2** Instrument system for safety and safety features of instruments.

**3.3** Safety integrity levels.

**3.4** Testing and certification of vessels and equipments and their records.

**3.5 Principles of reliability engineering**

**3.6** Principles of Reliability engineering

**3.7** Application of reliability for plant design

**3.8** Engineering concepts of critical equipments and devices

**3.9 Risk management**

**3.10** Definition of risk and allied terminology Acceptable risk. Individual and group risk. Social risk. ALARP (as low as reasonably practicable) concept.

**3.11** Computation of risk, Risk assessment techniques – detailed and quick

**3.12** Risk assessment report – its preparation and utility

**3.13** Engineering feasibility.

**3.14 Emission and dispersion**

**3.15** Liquid discharge, gas discharge, vapour – liquid discharge, fugitive emissions and measurement.

**3.16** Ambient air monitoring, Stack monitoring

**3.17** Risk contours, population density, probit equation for probability assessment, consequence analysis and inference of scenarios. Software modeling.

**3.18** Safety audit and safety report. Their preparation, assessment and utility for emergency planning.

**3.19** On site emergency plan.Off site emergency plan.

**4 Biological hazards**

**4.1** Biological agents and sources

**4.2** Hazards and controls. Biohazard symbol. Safety aspects of genetic engg.

**4.3** Sick building syndrome.

**4.4** Statutory provisions

**4.5 Advanced fire protection systems**

**4.6** Halon alternatives. Comparision on the basis of advantages and disadvantages.

**4.7** At once Fire / Gas Detection System

**4.8** Linear heat detection system and its suitability.

**4.9** Tank farm fire fighting system.

**4.10** Design of a Fire Training Ground.

**Suggested Books**


1. Accident prevention manual for industrial operations, national safety council 425, north Michigan Ave, Chicago, Illinois, USA.
2. Encyclopaedia of occupational health and safety, fourth edition, ILO, Geneva.
3. Safety and Health for Engineers, By Roger L Brauer, Van Nostrain Reinhold, new York.
4. Loss Prevention in the process industries, Frank P Lees, Butterworth Heinemann.
5. Occupational safety management and engineering by Willi Hammer
6. Handbook of industrial safety by K.U.Mistry, Siddarth Prakashan, 108, Western Plaza, Near Bhulka havan School, Adajan Road, Surat – 395 009. (Gujarat).
7. Major Hazard Control – A Practical Manual, ILO, Geneva.
8. Chemical Process Safety Fundamentals with Applications by Daniel A Crowl and Joseph F Louvar, Prantice Hall, New Jersey, USA.
9. Effects and Damage Calculations of accidents with hazardous materials, M. Molag, T.N.O Course Book – Risk Analysis, T.N.O Apaldoorn, Netherlands.
10. Gas dispersion modeling, Engineers India Ltd. Central Labour Institute, Mumbai.
11. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Raghvan K.V., Khan A.K, Common wealth Science Council, London.
12. Chemical Reactor Design for Process Plant, Haward F. Rase, Wiley Interscience Publications, New York.
13. Pressure Vessel Deisgn, John F. Hurvey, Affiliated East West Press (P) Ltd., New Delhi.
14. Process control, Harriott, Tata McGraw Hill Book Co.

15. Impact of hazardous waste on Human Health by Johnson.
16. OHSAS – 18001, Training Manual
17. Fire Protection Manual of NFPA, USA.
18. OISD Guidelines
19. DOT Guidelines, USA
20. IMDG Code.
21. IATA Code.
22. Explosions, their anatomy and desctritiveness by Robinson, McGraw Hill, NY.
23. Major Chemical Hazards by Marshal, Ellis Horwood
24. AlChE, USA Publications.
25. HAZOP and HAZAN by Kletz.
26. Assurance technologies, by Raheja, McGraw Hill, NY.
27. Technique for assessing industrial hazards, Manual by World Bank.
28. Safety in process plant design by Wells.
29. Probit Analysis by Finney, Cambridge University Press.
30. What Went Wrong; Catastrophy of Process Plant Disasters by Klez.
31. Industrial Accidents – Their Causes and Remedial Measure by K.U. Mistry, Siddarth Prakashan, 108, Western Plaza, Near Bhulka Bhavan SCHOOL, Adajan Road, Surat – 395 009. (Gujarat).
32. Fundamentals of Industrial Hygiene Safety and Health by Dr.K U Mistry 2012 Third Edition
33. Response to Occupational Health Hazards ,Jacqueline Karnell Corn (IHS Cor 12 LIBRARY NO.)

**PS03EIHS22 :Safety in Construction Industry**

**1.0 Scope of Safety in Construction**

Basic Philosophy

1.1 Parameters of Safety in Construction

1.2.1 Studies, Statistics and Results

1.2.2 Site Planning and Layout

1.2.3 Safe Access

1.2.4 Safety Work Permit & Checklist

1.2.5 Good Housekeeping

1.2.6 Statutory Provisions Indian Standards

**2.0 Construction Machinery**

2.1 Lifting Appliances and Gear

2.2 Transport, Earth-moving and Material Handling Equipment

2.3 Plant Machinery, Equipment and Hand Tools

2.4 Underground Works & Aboveground Works

2.5 Excavation

2.6 Drilling, Loading and Blasting

2.7 Shoring and Underpinning

2.8 Tunnelling and Shaft Sinking

2.9 Scaffolding, Ladders and Staircases

2.10 Structural Frames, Formwork and Concrete Work

2.11 Erection and Dismantling of Steel and Prefabricated Structures

2.12 Cast-in-situ Concrete Structures

2.13 Wall and Floor Openings

2.14 Formwork and Slipforms

2.15 Structural Steel Work and Erection Welding and Cutting Operations Lifting Machinery and Equipment

**3.0 SAFETY IN DEMOLITION OPERATIONS**

Planning and permit.

3.1 Planning the sequence of demolition

3.2 Safety precaution to be taken for and during demolition carrying out repairs, addition and alterations.

3.3 Movement of Materials and Men

**4.0 Health and Welfare of Construction Workers**

4.1 Dust Hazards

4.2 Noise & Vibration

4.3 Heat and Humidity

4.4 Other Hazards

4.5 First-aid and Health Services

4.6 Welfare

4.7 Accident Reports and Records

4.8 Ergonomics

**Suggested Books**

1. Safety and Health in Construction, ILO, Geneva.
2. Safety in Construction Industry, NSC, Mumbai - 22.
3. Safety Manual of Construction Projects. (EPL).

4. Industrial Safety & Pollution Control Handbook, NSC & ADP.
5. The Building and other Construction Workers Act, 1996 and the Central Rules, 1998.
6. The Factories Act, 1948 and the GFR 1963.
7. Indian Standards on Civil Engineering.
8. Ergonomics at work by David J. Oborne, John Wiley and Sons