

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



**SYLLABUS EFFECTIVE FROM: 2017-18
M.Sc. INDUSTRIAL HYGIENE AND SAFETY
SEMESTER-I**

**RULES FOR DEGREE OF THE MASTER OF SCIENCE (M.Sc.) IN
INDUSTRIAL HYGIENE AND SAFETY**

RPG.IHS.1 A candidate for admission to the Post-Graduate degree Programme for M Sc . INDUSTRIAL HYGIENE & SAFETY must have passed the Bachelor of Science Degree Examination or Bachelor of engineering from a recognized university. Two years of industrial experience is preferred.

2. Student who has passed qualifying examination from any other University or examining body and is seeking admission to this Programme must produce an eligibility certificate from this University.

RPG.IHS.2: The examination for the various theory courses and laboratory work will be conducted under semester system. For this purpose each academic year will be divided into two semesters.

RPG.IHS.3: The ratio between the external and internal assessment will be 70:30

RPG.IHS.4: Candidate will be required to attend at least 75% of the total theory, lectures, practical and project work organized under each of the course by them during the semester.

RPG.IHS.5: (i) The head of the department in consultation with other teachers of the department will prepare in the beginning of the semester a detailed scheme of the periodic test(s), seminars, quizzes etc., and the program for the test examinations and the same will be announced to the candidates. (ii) The record of the test examinations as well as seminars and quizzes will be maintained by the department. (iii) Every candidate shall maintain a regular record of this practical and project work which shall be duly certified by teacher(s) from time to time.

RPG.IHS.6: Candidate will be required to obtain at least 33% marks in the internal evaluation separately in each head of passing. A candidate who fails to obtain 33% marks in not more than two heads of passing may be allowed to appear at the university examination by the Head of the department concerned on the recommendation of the committee appointed to assess the candidate's overall performance. (Note: Head of passing will mean a course in theory or practical, or project work).

RPG.IHS.7: A teacher offering a particular course will be one of the examiners at the university examination and the examiner may be either a teacher from same university or from outside the university.

RPG.IHS.8: The final results for the awards of the degree will be declared on the basis of the grand total of all the semesters examinations prescribed for the degree examination.

RPG.IHS.9: No candidate will be allowed to reappear in course in which he / she has already passed.

RPG.IHS.10: Standard of passing: The standard of passing of M. Sc. (Industrial Hygiene and Safety) degree examination will be as under:-

- i. To pass any semester examination for the M. Sc. degree a candidate must obtain at least 40% marks in the university examination and 40% marks in the aggregate of university and internal examination in each course of Theory, Practical and project work.
- ii. Those of the successful candidates who obtain 50% or more marks in the aggregate of all the semesters taken together will be placed in the Second class and those who obtain 60% or more marks in the aggregate will be placed in the first class.
The successful candidates who obtain 70% or more marks in the aggregate of all the semesters taken together will be declared to have passed the examination in the first class with distinction.

RPG.IHS.11: i) A candidate who fails in more than two courses (any two out of total heads of passing in the particular semester) in a particular semester will not be admitted for further study at a subsequent semester and will be required to repeat the courses in which he/she has failed by joining the department as a regular student in the semester in which these courses are again offered.

A candidate failing in not more than two courses at any semester examination will be promoted to the subsequent semester according to the following scheme.

ii) A candidate failing in the first semester will be permitted to prosecute his / or study up to the third semester but will not be permitted to go to the fourth semester until he / she has cleared all the courses of the first semester even though he / she may have passed in the second and / or third semester.

A candidate failing in the second semester will be permitted to prosecute his /her studies up to the fourth semester.

M. Sc. (Industrial Hygiene and Safety) Choice Based Credit System (CBCS)

SEMESTER – I

CORE COURSES AND FOUNDATION COURSE

r No.	Paper Code	Title of Paper	L	P	Total Credits	Total Marks	External Marks	Internal Marks
1	PS01CIHS21	Introduction to Industrial Hygiene, Occupational Health & Environmental Toxicology	4		4	100	70	30
2	PS01CIHS22	Safety Management	4		4	100	70	30
3	PS01CIHS23	Air Sampling Analysis	4		4	100	70	30
4	PS01CIHS24	Safety Engineering-I	4		4	100	70	30
5	PS01CIHS25	Practical, Seminar ,viva Based on PS01CIHS21 and PS01CIHS23	-	8	4	100	70	30
6	PS01CIHS26	Comprehensive Viva-Voce	1		1	50	50	-
7	PS01FIHS21	Introduction to Human Physiology, Biostatistics and Epidemiology	4		4	100	70	30

**SEMESTER – II
CORE COURSES**

Sr No.	Paper Code	Title of Paper	L	P	Total Credits	Total Marks	External Marks	Internal Marks
1	PS02CIHS21	Industrial Ventilation	4		4	100	70	30
2	PS02CIHS22	Hazard Identification, Assessment and Control Techniques	4		4	100	70	30
3	PS02CIHS23	Physical Aspects of the Environment	4		4	100	70	30
4	PS02CIHS24	Safety in Chemical Industry	4		4	100	70	30

5	PS02CIHS25	Practical, Seminar and VIVA Based on PS02CIHS21 and PS02CIHS23	-	8	4	100	70	30
6	PS02CIHS26	Comprehensive Viva-Voce	1		1	50	50	-
Elective Courses								
6	PS02EIHS21	Industrial Visits and Seminars	4	-	4	100	70	30
7	PS02EIHS22	Accident Case Studies	4	-	4	100	70	30

**SEMESTER – III
CORE COURSES**

Sr No.	Paper Code	Title of Paper	L	P	Total Credits	Total Marks	External Marks	Internal Marks
1	PS03CIHS21	Medical Surveillance and Biological Monitoring	4		4	100	70	30
2	PS03CIHS22	Hazardous Waste Management	4		4	100	70	30
3	PS03CIHS23	Principles of Ergonomics	4		4	100	70	30
4	PS03CIHS24	Safety Engineering- II	4		4	100	70	30
5	PS03CIHS25	Legislation on Safety & Health	4		4	100	70	30
6	PS03CIHS26	Comprehensive Viva-Voce	1		1	50	50	-
Elective Courses								
1	PS03EIHS21	Advanced Safety Management and Engineering Techniques	4	-	4	100	70	30
2	PS03EIHS22	Safety in Construction Industry	4	-	4	100	70	30

**SEMESTER – IV
CORE COURSES**

Sr No.	Paper Code	Title of Paper	L	P	Total Credits	Total Marks	External Marks	Internal Marks
1	PS04CIHS21	OHSAS Standard AND ISO14001:2015	4	-	4	100	70	30
2	PS04CIHS22	Project Work / Dissertation*	-	-	20	500	500	-
3	PS04CIHS23	Comprehensive Viva-Voce	1		1	50	50	-

* Each student has to work in industry or complete the assigned project work on hygiene/safety or both in research institute/small scale industries/ institutions/MNCs / consultancies etc . Minimum duration of the Project Work/Dissertation work will be 12 weeks. The student will be guided from the department and also from the concerned authority under whom he is working.

Scope: The scope of the course is very wide. The students passing with the M. Sc. degree in Industrial Hygiene are expected to have opportunity at:

- a. Safety Officers in Industries
- b. Industries as Hygienists
- c. Chemical, Pharmaceutical, Petroleum Industries
- d. Safety and Environmental consultants
- e. Safety Executives in Major Accident Hazard Installations

Duration: Two years Master Degree Course in Science with Four Semesters (CBCS).

Eligibility: BE or B Sc

Number of Seats: 15(Fifteen)

* Each student has to work in industry or complete the assigned project work on hygiene/safety or both in research institute/small scale industries/ institutions/MNCs / consultancies etc .Minimum duration of the Project Work/Dissertation work will be 12 weeks. The student will be guided from the department and also from the concerned authority under whom he is working.

SEMESTER - I

PS01CIHS01: Introduction to Industrial Hygiene, Occupational Health & Environmental Toxicology

Introduction of Industrial Hygiene

- 1.1 Historical aspects of Industrial Hygiene, Definition, Units, mathematics and measurements concerning to it
- 1.2 Role of Industrial Hygienist and scope
- 1.3 Difference between industrial hygiene and occupational health
- 1.4 Work co-ordination between industrial hygienist, safety officer and factory medical officer for the purpose of safety, hygiene & health.
- 1.5 Introduction of ACGIH, OSHA, NIOSH
- 1.6 Hierarchy of Control
- 1.7 Benefits of Industrial Hygiene
- 1.8 Personal Protective Equipment: Need of PPE, Selection and applicable standards, on Respiratory Protection: Head, Ear, Face, Hand, Foot and Body Protection, Respiratory Protection: classification, Training, maintenance, testing procedures

SAMA /IS coding for PPES

- 1.9 Introduction of Occupational Health
 - Aim and Definition as per word health organization
 - History of OH in India & foreign countries
 - Discipline of occupational health and interlink with other subjects
 - Role of occupational doctor in industries
 - Importance of occupational history & key elements of industrial hygiene, safety and medical program.

1.10 Practical aspects in hazard Communication

Occupational hazards: chemical agents, physical agents, biological agents, psychological agents, physiological agents, etc. Effects of the occupational hazards on human health.

2.0 Occupational Diseases

- 2.1 Notifiable diseases under schedule III of the factories act 1948
- 2.2 Silicosis: Property, Use & Application of compound in various industries, Common silica Types, Definition, Health related problems and other diseases, Mesothelioma, Pathology, sign & symptoms, Diagnoses Tests, Treatment, and Exposure Limits. Some of the case studies done by national and international research agencies
- 2.3 Asbestosis: Property, Use & application of compound in various industries, Common Asbestos Types, Definition, Health related problems and other diseases, Mesothelioma, Pathology, sign & symptoms, Diagnoses Tests, Treatment, and Exposure Limits. Some of the case studies done by national and international research agencies.
- 2.4 Bysinosis: Property, Use & application of compound in various industries, Health related problems, Pathology, sign & symptoms, Diagnoses Tests, Treatment, and Exposure Limits. Some of the case studies done by national and international research agencies.
- 2.5 Coal miners' pneumoconiosis
- 2.6 Occupational Asthma: Definition, List and characteristic of related compounds, causes, types, Pathophysiology, symptoms, diagnoses, symptoms.

- 2.7 Occupational Stress: Definition, Common stressor, Established model & Studies
- 2.8 Occupational Health related other diseases: Introduction, Definition, causes, symptoms, health impairment for following terminology
 - 1) Anorexia 2) Hemoptysis 3) Rales 4) Sarcoidosis 5) Emphysema 6) Bronchitis 7) Scleroderma
- 2.9 Occupational health related problems due to the cold and heat
- 2.10 Occupational Dermatitis: types, compounds, characteristics, sign and symptoms, tests etc.
- 2.11 Musculoskeletal Injuries in various industries: Definition & explanation of Strain, Sprain, Tendonitis, Tenosynovitis, Bursitis, Myositis, Arthritis and it's treatment/Control ,Occupational health problems in Hospitals/Agriculture/general cottage type of Industries

3.0 Occupational health services at the work place

- 3.1 Occupational health center
 - Ambulance van.
 - Factory medical officer, staff and equipment

3.2 Introduction of Toxicology

- 3.3 Aim, What is the toxicology?
- 3.4 Routes of entry into the body
- 3.5 Absorption, distribution, and excretion of toxic substances
- 3.6 Site of action - local or systemic effects
- 3.7 By the organ they effect

4.0 Effects by the Organ

- 4.1 Hematotoxicity, Hepatotoxicity
- 4.2 Nephrotoxicity, Neurotoxicity
- 4.3 Dermatotoxicity, Pulmonotoxicity

Suggested Books

1. Toxicology Fundamentals, Target organs, and Risk Assessment, 2nd edition, Hemisphere Publishing Corps, 1991 Lu, Frank C, Basic,
2. The Basic Science of Poisons Amdur M. Doull, J and Klassen, C.D.
3. Handbook of Occupational Safety & Health Lawrance Slote,
4. U S Department of Labor, Occupational Outlook Handbook
5. Industrial toxicology Philip L. Williams and James L. Burson,
6. Inhalation Toxicology Research Methods, Applications and Evaluationm, Harry Salem
7. Industrial hygiene & Toxicology, Volume –2, Frank a. Petty
8. Environmental Occupational Medicine, Third Edition, William N.Rom
9. Occupational Lung Diseases by Hans Weill and Ter
10. Pulmonary Function Tests In Clinical and Occupational Lung Diseases by Albert Miller
11. Occupational Health Recognizing and Preventing Work-Related Diseases Edition 2 by Barry S Levy, David H Wegman
12. Occupational Cancer in Developing Countries by N Pearce, E. Matos, H. Vainio
13. Lead versus Health: Sources and effects of Low Level Exposure by Micheal Rutter and Robin Russell Jones
14. Asbestos Abatement : Risks and Responsibilities by The Bureau of National Affairs, Inc.
15. Asbestos : Medical and Legal Aspects Edition 3 by Barry I Castleman
16. Occupational Health & Hygiene : Guidebook for the WHSO by David Grantham
17. Copper : Medical and Biologic Effects of Environmental Pollutants by The National Research council

18. Control of silicosis in Vermont Granite Industry : Progress Report by US Department of Health, Education and Welfare
19. Mercury Contamination : A Human Tragedy by Patricia A D'itri and Frank M D'itri
20. Physiology of Respiration by Julius H Comroe
21. ILO Encyclopedia Volume I
22. ILO Encyclopedia Volume II
23. Guide to Occupational Exposure Values by ACGIH
24. Coppers Pocket Environmental Compliance Dictionary by Copper Sr.
25. The VNR Dictionary
26. Hundred (100) Problems in Environmental Health by Jack E Mckee
27. Environmental Health : New Directions by J Shields
28. Asbestos Sampling and Analysis by Gyan S Rajhans and John L Sullivan
29. Control of silicosis in Vermont Granite Industry : Progress Report by US Department of Health, Education and Welfare
30. Occupational Lung Diseases Edition 2 by Morgan and Seaton
31. Effects of Exposure to Toxic Gases : First Aid & Medical Treatment Edition 3 by Matheson Gas Products
32. Toxicology by Mickel A Kamrin
33. Effects of Exposure to Toxic Gases Edition 2, by William Braker and Allen L Mossaman
34. Occupational Carcinogenesis by Umberto Saffiotti, Joseph K Wagoner
35. Toxicology Principal and Practice Volume 2, by Fredierick Sperling

PS01CIHS22: SAFETY MANAGEMENT

1. Introduction

1.1 The concept of safety

1.1 Need, Nature & Importance, Focus on “Human Resource”. Safety of “Man” at the center. The concept development as accident prevention, occupational health and

Environmental protection, The modern concept of SHE or HSE

1.2 Problems of industrial safety

1.2.1 Occupational health and environmental pollution.

1.2.2 Nature and size of the problem

1.2.3 Factors and size of the problem

1.2.4 Factors impeding safety

1.2.5 Reasons of accident prevention

1.2.6 As the place of industry in society has become inevitable, safety in industry is also inevitable

1.2.7 Importance of Safety Technology and Engineering for minimizing the accidents.

1.3 Philosophy of safety: Meaning of Philosophy and Safety Philosophy. Its Scope Explanation of basic definitions and safety terminology

Incident, accident, major accident hazard (MAH), oversight, error, mistake, near miss, injury, unsafe act, unsafe condition, hazard, risk etc.

1.4 Accident Causation Theories

1.4.1 H.W. Heinrich's Ten Axioms of industrial safety

1.4.2 Heinrich's Domino Theory and his "ratio".

1.4.3 William Hadden's Energy Theory.

1.4.4 V L Groves Multiple Causation Theory

1.5 Accident Prevention

1.5.1 Five Fundamentals of Accident Prevention – Organisation, Fact Finding, Analyses of the facts, selection of remedy and application of Remedy.

1.5.2 Models of Accident Prevention ;Kepner-Tregoe Model ,Performance Cycle model,Updated safety management model.

1.5.3 Five "E"s of accident prevention – engineering control, Education and training, Enforcement, Enthusiasm and Example setting.

1.5.4 Approaches to preventive Action: Proactive Approach, Reactive Approach

2. Safety Psychology

2.1 Meaning of psychology, safety psychology and its importance Psychological factors affecting work and accidents.

2.1 Attitudes, Aptitudes, Frustration, Conflict, Morale, Fatigue, Boredom & Monotony.

2.2 Role of these factors in accident causation and techniques to remove ill effects due to them.

2.3 Human Behavior

2.3.1 Knowledge and responsibility vis-à-vis safety performance.

2.3.2 Old concept of "Accident Proneness" and its debate

2.4 Motivation for Safety:

2.4.1 Need and Nature of Motivation

2.4.2 Theories of motivation and their application to safety

2.4.3 Role of management, supervisors and safety department in motivation.

2.5 Behavior based safety (BBS) Management Program:

2.5.1 Criteria for estimation and strategies

2.5.2 Management techniques of accident control

- 2.6 General management: Origin and Evolution of Management Thoughts, Definitions, nature and importance of Management
- 2.7 Elements of management functions – planning, organizing, staffing, directing, controlling and co-coordinating, General Principles of Management
- 2.8 Managerial Role, Authority, Responsibility and power
 - 2.8.1 Span of Management
 - 2.8.2 Delegation and decentralization of authority.

3.0 SHE management & planning for safety

- 3.1 Planning: Definition, purpose, nature, scope and procedure.
- 3.2 Range of planning and variety of plans
- 3.3 Strategic planning and tools of implementation
- MBO i.e. management by objectives and its role in safety, health and environment (SHE) Safety Policy – Formulation and implementation. Statutory provisions

3.3 Organizing for safety

- 3.4 Organising : Definition, need, nature and principles
- 3.5 Organising for safety of SHE Department
 - 3.5.1 Types, structure functions and responsibilities
 - 3.5.2 Line and Staff Functions and responsibilities
 - 3.5.3 Role of supervisors, Workers and Trade Unions
 - 3.5.4 Directing for safety, Direction : Definition, process, principles and techniques,
 - 3.5.5 Leadership:
 - 3.5.5 Role, functions and attributes of a leader
 - 3.5.6 Leadership styles in safety management

3.6 Communication

- 3.6.1 Purpose, process, types and channels
- 3.6.2 Essential rules of communication
- 3.6.3 Two way communication
- 3.6.4 Barriers in communication
- 3.6.5 Essential of effective communication.
- 3.6.6 Communication and group dynamics. Team building
- 3.7 Controlling for safety 3.8

Controlling: Definition, need, benefits, types, areas, elements and control technique

- 3.8 MBE i.e. management by exception
- 3.9 Monitoring by Safety Standards
 - 3.9.1 Application and use of Indian Standards on Safety and Health IS:14489 and IS:15001, OHSAS 18001.

3.9.2 ILO and EPA Standards

4.1 Safety Education and Training

4.2 Safety Department, Need of Safety Officer, Safety Officers Rule and their role. Assessment of Training, Elements of training cycle Assessment of training needs Objectives of training program

4.3 Techniques of training Design and development of training programs , Training methods and strategies ,Types of safety training

4.3.1 Evaluation and review of training programs Modern methods of training, Modern teaching aids , Competence building technique (CBT)

4.3.2 Concept for training. Safety as on line function, Role of multimedia and communication, Applications of computers, Relevance of WTO regarding SHE. Employee and various Organizations participation in safety

4.4 Employee and various Organizations participation in safety Employee Participation

4.4.1 Purpose, Areas and methods of participation

4.4.2 Workers and Union's participation, Role of Supervisor, Role of Safety specialists (Consultants and Professionals)

4.5 Safety Promotion and Publicity Safety suggestion schemes, Safety competitions Safety incentives schemes, Audio visual publicity and other promotional method, Safety performance awards and recognition

4.6 Safety Committee: Structure, functions, meetings, minutes and implementation of its own remarks. Statutory provisions Approaches to compliance and violations

4.7 Economics of safety: Cost of accidents Direct and indirect costs and their ratio, Usefulness to convince management ,Financial Costs

4.7.1 Financial costs to individual, his family, organisation and society. Cost compilation procedure. Utility and limitations of cost data Budgeting for safety. Purpose and procedure of safety budgeting

4.7.2 Consideration of performance rates

4.8 Management information system

4.9 Sources of information on safety, health and environment protection. Compilation and collation of information, its analysis and use. "Benchmarking" for safety performance

4.10 Modern methods of programming Storing and retrieval of MIS for SHE

4.10.1 Computer software application and limitations. Causes of MIS failure. Advantages and disadvantages of computerized information system. Status and future goals of computer utilization in SHE services in industries.

4.10.2 Integration between departmental MIS.

Suggested Books

1. Accident prevention manual for industrial operations, national safety council, 425 North Michigan Ave, Chicago, Illinois, USA.
2. Encyclopedia 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. Occupational Safety Management & Engineering by Willi Hammer.
5. Safety at work by John Ridley.
6. Industrial accident prevention by H.W. Heinrich, McGraw Hill Book Co.
7. Techniques of Safety Management by Dan Pederson.
8. Effective safety and health training by Jack W.Boley.
9. Safety Training Methods (Practical solutions for the Next Millennium) by Jack B.Revelle
10. Safety by Objectives (second edition) by Dan Petersen
11. Safety Training for the Supervisor by James E.Gardner
12. Safety Management in Construction and Industry, Brauer, Safety & Health for Engineers
13. What Went Wrong ; Edition III Kletz, Trevor A,
14. Fundamentals Of Industrial Safety and Health ; Dr.KU Mistry Third Edition 2012

PS01CIHS23 :AIR SAMPLING ANALYSIS

1) Introduction to air sampling and analysis

1.1 Types of sampling

1.1.1 Importance of personal, Workplace and Area/ambient Sampling/monitoring (Passive, Grab, Active, Integrated)

1.1.2 Definitions TLV, PEL, REL, IDLH, STEL Ceiling limits

1.1.3 Various organizations & Limits: ACGIH, OSHA, NIOSH, Factory Act 1948

1.1.4 Sampling Duration and Rate

1.2 Respiratory system & correlation with respirable, inhalable and total dust

1.2.1 BMRC, ACGIH curve, size selective sampling

1.3 Types of contaminants

- 1.3.0 Nature of Air Contaminants (Gases & Vapor, Particulate Matter, Odors and sampling consideration)

Dust

- 1.3.1 What Is Dust?
- 1.3.2 How Is Dust Generated?
- 1.3.3 Types Of Dust
- 1.3.4 Why Is Dust Control Necessary?
- 1.3.5 Introduction of Equipment, accessories like media, calibrator etc. for Personal/workplace/area dust monitoring
- 1.3.5 Calculation of Dust concentration
- 1.3.7 Preventing & Control Dust Formation
- 1.3.8 Dust Control Systems

Solvent, Aerosol & Gaseous

- 1.3.9 How is solvent & gaseous exposure generated?
- 1.3.10 Introduction of Equipment, accessories & filters for Personal/workplace/area dust monitoring
- 1.3.11 Solvent and gas exposure monitoring techniques
- 1.4 **Area/ambient Sampling**
- 1.4.1 Type of Plumes
- 1.4.2 Plume Behavior
- 1.4.3 Methods for measurement of Plumes
- 1.4.4 Stack Sampling Methods for Extractive Sampling: Particulate Matter, Methods for measurement of Gases Like Oxides of Nitrogen, Oxides of Sulfur, Ammonia and Chlorine

2) Air monitoring instruments: Instruments for Dust sampling: Principle and theory

- 2.1.1 Personal sampler, high volume sampler
- 2.1.2 Calibrator
- 2.1.3 Accessories like Cassettes, cyclone, and IOM sampler
- 2.1.4 Filters, Types and size of filters, Efficiency, requirement of Analytical Procedure and characteristics, Availability
- 2.2 **Instruments for solvent and gas sampling**
- 2.2.1 Low flow sampler
- 2.2.2 Calibrator
- 2.2.3 Accessories like Charcoal & silica gel tube, impinger etc.
- 2.3 **Monitoring Method**
- 2.3.1 Sampling train: How to do/Requirement etc.
- 2.3.2 Sampling strategy: Pattern of exposure, Sampling for Estimation of Average
 - Exposure, Sampling high exposure periods, Sampling for peak exposures
 - Sampling form
 - Sample shipment

Calibration of Air Sampling Instruments

- Flow Rate Metering Instruments
- Procedures of Calibration flow and volume meters
- Methods for calibration and the determination of collection efficiency
- Gas and Vapor Calibration

3) Direct reading air monitoring instruments

- Types, principles, application, advantages & disadvantages (At least 5 equipments)
- 3.1 Grab Sampling, Advantages and limitation. **Gas detector tubes:** Application and use of dragger tubes in Factory

3.2 Preparation of known concentration of air contaminants

Knowledge of standards, Standard curve for
Solid, Liquid and Gases

4) Environmental Air Sample Analysis

4.1 . Analytical Instruments and it's Principle, Analysis of compound,
working and required accessories

4.1 Atomic absorption Spectrophotometer/ICP

4.2 FTIR, Gas Chromatography/HPLC, PCM

4.3 Manual chemical methods of analysis Introduction, reagent, standard
preparation

4.4 Advantages and Disadvantages

4.5 Passive Sampling: Principles, Operating Procedure, Passive Badges and
Dosimeter Tubes

4.6 Sampling Airborne Microorganisms and Aeroallergens

Factors to be considered in the selection of samplers for collecting airborne
microorganisms, Characteristics of Aeroallergens Sampler Selection
Sampling plan and analysis

Suggested Books

1. The Calculation Atmospheric Dispersion From A Stack by A Concawe
Publication
2. Smoke, Dust and Haze : Fundamentals of Aerosol Behavior by S K Friedlander
3. Statistical Method For Environmental Pollution Monitoring by Richar O Gillbert
4. Advances in the Analysis of Air Contamnants by Morris Katz
5. Proceedings Operation and Maintenance Procedures for Gas Cleaning
Equipment Speciality Conference by Air Pollution Control Association
6. Methods for Measuring and Evaluating Odorous Air Pollutants at the Source
and in the Ambient Air
7. Human Exposure Assessment for Airborne Pollutants : Advances and
Opportunities by National Academy Press
8. Monitoring Toxic Substances by Dennis Schuetzle
9. Methods of Air Sampling and analysis by Inter Society Committee
10. A Decade of Respirable Dust Research for the Mineral Industries by Raja V
Ramani, Roberts L Frantz & Richard Bajura
11. Air Sampling Instruments for Evaluation of Atmospheric Contaminents Eidtion
3 by ACGIH

12. Air Sampling Instruments for Evaluation of Atmospheric Contaminants Edition 7 by Susanne V Hering (13 copies)
13. Air Sampling Instruments for Evaluation of Atmospheric Contaminants Edition 7 by Susanne V Hering
14. SKC The World Leader in Air Sampling Technology : 1998 Comprehensive Catalog & Air Sampling guide
15. SKC The World Leader in Air Sampling Technology : 1996 Comprehensive Catalog & Air Sampling guide
16. Aerosol Science for Industrial hygienists by James H Vincent
17. Bisesi and Kohn's Industrial Hygiene Evaluation Methods ,Second Edition Lewis Publishers, London UK

PS01CIHS24: Safety Engineering- I

TOPICS & SUB TOPICS

1. Plant design and layout

1.1 Citing Criteria

General and Environmental guidelines. Meteorological aspects
 Separation distances, Need for planning and follow up , Plant layout and design.
 General principles for factory building Plant & equipment layout and fire protection

1.2 Statutory Provisions

1.2.1 Under the factories act and rules

1.2.2 1.4.2 Indian Standards National Building Code and other codes of practice

1.3 Ergonomic considerations for plant design and layout

1.4 Housekeeping

1.5 Housekeeping and its effects on safety

1.5.1 Indicators of bad housekeeping

1.5.2 Typical accidents due to bad housekeeping

1.5.3 Benefits of good housekeeping

1.6 Management of good housekeeping

1.6.1 Disposal of scrap and other trade wastes. prevention of spillage.

1.6.2 Marking of aisles, space and other locations.

1.6.3 Housekeeping contests

1.6.4 Use of colour as an aid for good housekeeping

1.7 Cleaning Methods

1.8 Employee assignment

1.8.1 Inspections and checklists

1.8.2 Role of preventive and productive maintenance for housekeeping

1.9 Concept of "Five S" (1) Seiri (Segregation) (2) Seciton (arrangement) 01

(3) Seiso (Cleaning) (4) Seiketsu (Maintenance of Standard) and (5) Shitsuke (Discipline)

1.10 Six Sigma

2.1 Machine guarding

2.1.1 Principles of machine guarding

2.2 Ergonomics of machine guarding

- 2.3 Design and types of guards
 - 2.3.1 Design and selection of guards
 - 2.3.2 Material for guard construction
 - 2.3.3 Guarding of different types of machinery including special precautions for wood working, rubber, centrifugal machines and paper mill machinery.
 - 2.3.4 Built in safety devices
- 2.4 Maintenance and repairs of guards.
 - 2.4.1 Zero mechanical state (ZMS)
 - 2.4.2 Incidental safety devices and tools
 - 2.4.3 Lockout and Tagout
- 2.5 Machine tools**

- 2.6 Definition and classification of machine tools
- 2.7** Safety in the use of power presses, shearing, slitting, cutting, bending, rolling, drawing, turning, boring, drilling, milling, shaping, planning, broaching, slotting, grinding and CNC machines.
- 2.8** Total productive maintenance (TPM) and care, periodic checks for safe operation

3.0 Lighting (illumination) and colour

- 3.1 Purpose and benefits of good lighting. Increase of safety and productivity due to good lighting.
 - 3.1.1 Principles of Illumination
 - Adequate illumination ,Glare, shadow, contrast and colour effect,Recommended standards of illumination
 - Types of light Natural and artificial, direct and indirect
 - 3.2.1 Light source, lighting fittings and types of artificial lighting
 - 3.3 Design of lighting installation coefficient of utilization, light loss factor and day light factor
 - 3.4 Effects of colour on safety
 - 3.4.1 Colours to identify hazards
 - 3.4.2 Indian standards
 - 3.4.3 Accident prevention signs
 - 3.4.4 Psychological effects of colour
 - 3.4.5 Maintenance for lighting and colour.

3.5 Electrical safety

- 3.5.1 Hazards of electrical energy
- 3.5.2 Physiology of electric shocks
- 3.5.3 Safe limits of amperages and voltages. Safe distance from high voltage Sources
- 3.5 Resistance of skin and other materials
 - Capacity and protection of conductors, joints and connections
- 3.6 Safety from portable electrical apparatus. Use of ELCB
- 3.7 Means of cutting of power
 - 3.7.1 Overload and short circuit protection
 - 3.7.2 No load protection
 - 3.7.3 Earth fault protection
 - 3.7.4 Protection against surges and voltage fluctuations
 - 3.7.5 Hazards of “borrowed” neutral
 - 3.7.6 Earth insulation and continuity tests
 - 3.7.7 Earthing standards
 - 3.7.8 Lockout and Tag out
- 3.8 Electric work in Hazardous Atmosphere
 - 3.8.1 Hazardous area classification
 - 3.8.2 Types of protection for electrical equipment in hazardous atmosphere

3.8.3 Criteria in their selection, installation, maintenance and use.

3.8.4 Latest types of flameproof fittings and equipment.

3.9 Lightning arrestors

3.10 Static electricity ,Introduction ,Electrostatic charges and discharges (sparks)

Operations and machines generating static charge

3.10.1 Hazards and Controls ,Earthing and Bonding

3.10.2 Recommended earthing resistance for control of electricity.

3.10.3 Static charge eliminators

3.10.4 Dip Pipes Increasing conductivity with additives. Handling solids with and without flammable vapours.

4.0 Fire & explosion

4.1 Fire Phenomenon ,Chemistry of fire,Stages of fire,Factors contributing to fire
Classification of fires

Common causes of industrial fires

Spread of fire

Determination of fire load,Design of building, plant, exists, etc. for fire safety and fire resistance of building materials

4.2 Prevention of fire

Types of Portable Fire extinguishers. Water systems. Carbon dioxide systems. Foam extinguisher system. Dry chemical extinguishing systems.

Halon alternatives Hydrant and fixed installations

Special industrial fire detectors and alarms Sprinkler Systems

4.3 Automatic fire detection and extinguishing ,Special Safety Precautions

Control of fire and explosion in handling / processing flammable liquids, gases, vapours, mists, dusts etc.

PIPA for automatic fire and gas detection and getting probable scenarios on DCS.

Fighting fire-involving pesticides.

Electrical fire Effects of combustion products.

4.4 Explosion phenomena

Deflagration and Detonation

Confined and unconfined vapor cloud explosion (VCE),Boiling Liquid Expanding Vapor Explosion (BLEVE),Fire emergency action plan and drill. Control room

4.5 Material handling

4.5.1 Manual handling

Kinetics of manual handling

Maximum loads that could be lifted or carried

Safe method and procedure for lifting and carrying of objects of different shapes, size and weight

Safe use of accessories for manual handling.

Storage of materials. Safety in stacking and un-stacking, floor loading conditions.

Layout condition for safety in storage.

Ergonomics of manual handling and storage

4.5.2 Mechanical handling

Lifting machinery, lifts and hoists

Safety aspects in design and construction, testing, use and care, signaling, inspection and maintenance.

Safety in operation, inspection and maintenance of industrial trucks, cranes lifting tackles, loose gears, conveyors etc.

Types of ropes including Nylon and PP ropes.

Hazards of remote operated lifting machines.

Training of operators

Safe working load for all mechanical material handling equipment.

Competent persons in relation to safety legislation – duties and responsibilities
Worked examples

4.6 Hand tools and power tools

Main causes of tool accidents. Prevention and control of such accidents.

Centralized and personal tool issue system. Purchase, storage and supply of tools.

4.7 Inspection, maintenance and repair of tools. Detectable causes of tool failures.
Tempering, safe ending and dressing of certain tools.

Safe use of various types of hand tools used for metal cutting, wood cutting and miscellaneous cutting work.

4.8 Special hand tools such as torsion tools, shock tools, non sparking tools safe use of hand tools in hazardous area.

Portable power tools and their selection, operation, inspection, maintenance, repair and safe use. Double protection. Dead man control (operation till the button is pressed).

4.9 Working at height

4.9.1 Incidence and seriousness of fall accidents

4.9.2 Safety features associated with design, construction and use of stairways, ramps, working platforms, gangways, ladders of different types, scaffolds of different types including crawling board, Boatswain's while working at heights.

4.9.3 Safety belts their types, use and limitations. Whole body harness with double lifelines.

4.9.4 Fall arrestor device.

4.9.5 Work permit system.

4.10 Working in a confined space

4.10.1 Meaning of confined space

4.10.2 Vessel entry permit and its safe execution under supervision

4.11 Working underground

4.11.1 Hazards and controls

REFERENCE

1. Accident Prevention Manual for Industrial operations, national safety council, 425, North Michigan Ave., Chicago, Illinois, USA.
2. Encyclopedia 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. Process Plant Layout by Mecklen Burgh
5. Safety at work by John Ridley.
6. Safety engineering by Jems CoVan
7. Engineering design for control of Workplace Hazards by Richard A. Wadden & Peter A Scheff, McGraw Hill Book Co.
8. More Great Safety Meeting Ideas by Ar Fattig
9. Lift Truck Fleet Management and Operator Training by Bud Cohan
10. Safety and Accident Prevention in Chemical Operation, Second Edition, Howard H.
11. What Went Wrong? By Trevor Kletz
12. Prudent Practices in the Laboratory (Handling and Disposal of Chemicals)
13. NIOSH A Technical Report : A guide to Industrial Respiratory protection
14. Safety Training methods by Revelle and Stephens
15. Accident Prevention Manual for Industrial Operations Edition 8 y National Safety Council
16. Handbook of Occupational Safety and Health by Lawrence Slote
17. Fundamentals of Industrial Safety and health by Dr K U Mistry 2012 Revised

18. Construction safety planning by David V Maccollum
 19. The Six SIGMA Way: How GE, Motorola, and Other Top Companies Are Honing Their Performance by Peter S. Pande (Goodreads Author), Roland R. Cavanagh, Robert P. Neuman

PS01CIHS25 : Practical's, Seminar and VIVA Based on PT01CIHC01 and PT01CIHC05

PRACTICAL / SEMINAR/ WORKSHOP

Sr. No.	Practical /Seminar/Exercise/Workshop	
1	Lung function test by using Spiro meter or equivalent instrument practical includes Demonstration, Measurement of all parameters and conclusion	
2	Ear testing on audiometer and demonstration of various models on audiometer.	
3	Demonstration of medical laboratory equipment such as tetanus vision tester, blood analyzer, electrocardiography etc.	
4	Seminars on any subject of Introduction of Occupational Health (30 mins four seminars)	
5	Practical aspects in chemical hazard communication (30 mins four seminars)	
6	Occupational health services at the work place (30 mins four seminars)	
7	Introduction of Toxicology (30 mins four seminars)	
Sr.No.	Name of the Practical	Name of Equipments
1	Weighing the filters including Blank	Microbalance, Filters, Brush, Petri Disc etc.
	1.1 Introduction of Industrial hygiene analysis laboratory	
	1.2 Introduction, Calibration and Use of Microbalance	
	1.3 Filter media such as PVC, Glass, MCEF etc.	
2	2.1 Calibration of Personal (1.5 L/min, 2.5 L/min) and Pocket Sampler (100 ml/min, 250 ml/min) by using Burette (Bubble) Method	SKC Make Personal Sampler and SKC Make Pocket Samplers, Calibrated Burette, Electronics Calibrator
	2.2 Calibration of Personal and Pocket Sampler by using Electronics Calibrator	
	2.3 Comparison of Result of both methods	
3	3.1 Personal sampling of nuisance dust/wood dust/silica dust/ Any of inorganic dust) for any	do

		occupation/industry for 8 hours/Shift/Short time duration	
	3.2	Workplace Sampling of nuisance dust/wood dust/silica dust/ Any of inorganic dust) for any occupation/industry for 8 hours/Shift/Short time duration	do
		Respirable dust Sampling by using Cyclone	
		Inhalable dust sampling by using IOM Sampler	
		Total dust sampling by using cassette	
	3.3	Personal sampling/Work Place of any toxic solvent use in any occupation/industry/Chemical Laboratory/Petrol Pump for 8 hours/Shift/Short time duration	do
4	A	Oxides of nitrogen	High Volume Sampler, Stack Monitoring Kit etc.
	B	Sulphur dioxide	
	C	Ammonia	--do--
	D	Chlorine	--do--
	E	Suspended and Respirable Particulates	--do--
5		Analysis of Heavy Metal by using ICP/AAS	All Laboratory glassware, standards and AAS/ICP
6		Analysis of Solvent by using G.C/H.P.L.C.	All Laboratory glassware, standards and G.C./H.P.L.C.
7		Analysis of Nuisance Dust/Silica bearing dust by using FTIR/XRD	All Laboratory glassware, standards and F.T.I.R./XRD.
8		Asbestos fiber identification and counting by using Phase Contrast Microscope/Electron Microscope	All Laboratory glassware, standards Microscope/Electron Microscope
9		Quantitative Solvent/Dust Exposure Assessment by using Direct Reading Monitor	Direct Reading Monitor

10		Quantitative Solvent Assessment by using Dragger tube	
11		Qualitative & Quantitative Exposure Assessment for Biological contaminants in Food/Pottery/Farm/Any other Occupation	
		Total	

PS01FIHS26: INTRODUCTION TO HUMAN PHYSIOLOGY, BIostatISTICS AND EPIDEMIOLOGY

1.0 Scope of human physiology

Structure of cell, functions of its component

- 1.1 Structure & function of skeleton, joints, classification functions & their movements.
- 1.2 Blood-Composition & functions of blood elements, blood groups, coagulation of blood, blood transfusion
- 1.3 CNS- structure and function of nervous system, reflex, arc and its types, spinal cord and tracks its relation to higher parts of CNS, brain and its parts
- 2 Cardiovascular system- Heart: Functional Anatomy, Properties of the heart, The heart as a pump, Heart rate, Blood Pressure
 - 2.1 Respiratory System-Anatomy of different parts, mechanisms of respiration, regulation of respiration, gas transport between lungs and tissue, respiratory volume, Natural Defenses, pulmonary circulation, respiration insufficiency-Pathophysiology, diagnosis and oxygen therapy
 - 2.2 Digestive system-Gross anatomy of alimentary canal, functions of different parts including liver & pancreas, G.I.T. motility and secretion
 - 2.3 General aspects of Neurology, Elementary Neuroanatomy, The receptors
 - 2.4 Physiology of special senses (ear, eye, smell & taste), structure and function of skin
 - 2.5 Endocrine system: Physiological considerations of pituitary, thyroid, parathyroid, pancreas and suprarenal glands.
 - 2.6 Reproductive system: Anatomy and physiology of male and female reproductive system-spermatogenesis, ovulation, menstrual cycle, pregnancy, milk secretion, and menopause.

2.7 Excretory System: Various parts, Structure and functions of kidney, physiology of urine formation.

3.0 Introduction of Biostatistics

3.1 Overview and Introduction, Data Application, uses, scope of Biostatistics in Occupational Hygiene & Health. Common statistical Terms: Variable, Sigma, Constant, Observation, Observation unit, Data, Population, Sampling unit, Sample, Parameter, Notation for a population and sample value, Sources and Presentation of Data

3.2 Sources for collection of Occupational Hygiene, Safety, Health statistics
(Experiments, Surveys and Records)

3.3 Qualitative and Quantitative Data

Methods of Presentation 1. Tabulation 2. Drawing

Sampling distributions: Frequency distribution table, Rules for making a frequency distribution table, Frequency Distribution drawing, Histogram

3.4 Sampling Representative sample, Sample size, Sample bias, Sampling technique, simple random sampling, systematic, stratified, multistage, cluster, multiphase

3.5 Descriptive statistics: Measures of location Averages and percentiles

Measures of central tendency- Averages: Mean, median, mode, calculations of mean

Ungrouped series and grouped series with examples. Measures of location- percentiles

Variability and its Measure: Types of Variability Measures of variability of individual observations: Range, Mean Deviation, Standard Deviation, Coefficient of variation, Standard error of mean, standard error of difference between two means, standard error of proportion

3.6 Normal Distribution and Normal Curve: Demonstration of a Normal Distribution, Normal Curve, Standard normal deviate, asymmetrical Distributions

3.7 Sampling Variability and Significance:

Sampling distribution, significance, estimation of population parameter, testing

Statistical hypothesis, Type 1 and type 2 errors, tests of significance, Z test, one tailed and two tailed tests. Significance of difference in means: standard error means, application and uses, standard error of differences between two means of large samples, small samples, t- test, unpaired, paired, variance ratio test, analysis of variances test.

3.8 Significance of difference in proportion of large samples: standard error of proportion, application and uses, standard error of difference between two proportions, SE.

3.9 The Chi-Square test: Alternate test to find the significance of difference in two or more than two proportions, as a test of association between two events in binomial or multinomial samples, as a test of goodness of fit, Calculation of Chi square value, restriction in application of Chi squares test

4. Introduction to epidemiology

4.1 Overview of epidemiology, definition, role of epidemiology, aims and goals epidemiology, measuring health and diseases: Case, Incidence and Prevalence Prevalence and Prevalence point, Examples, Cumulative Incidence (Risk), Odd of disease, Incidence Rate, Risk ratio, Rate ratio, Odd ratio, Case Fatality, Attribute Risk

4.2 Routine sources of Epidemiological Data

4.3 Definition, Types and it's value and limitation

4.4 Screening and validity of test

4.5 Analytical and experimental methods used in studies of disease in human populations

4.6 measures of exposure effect, Estimating exposures, chronic disease, infectious disease, occupational exposures, environmental and life style factors.

4.7 Epidemiological studies: Experimental and Non experimental: Case study and study design

4.8 **Descriptions of source of data, methods of collection, causation, interpretation of observations in case-comparison and cohort studies**

4.9 Cohort Study, Elements of cohort study, Advantage and disadvantage of cohort study
Cross sectional study: Definition, Types of cross sectional studies, Comparison with cohort studies

4.10 Case Control Studies: Definition, Types of Case Control studies, Methods, Intervention study

Suggested Books

1. Guyton, Arthur C., Physiology of the Human Body, 6th Ed. Saunders College Pub. Philadelphia
2. Review of medical physiology by Ganong
3. Grant's methods of Anatomy
4. Human Physiology by C.C. Chatterjee
5. *Elements of Human Anatomy- Physiology and Health education- by Derasari and Goyal
Twenty Third Edition 2012-2013 BS Shah Prakashan Ahmedabad*
6. Best and Taylor- Physiological basis of medical physiology
7. Human Physiology and Anatomy by Tortora

Books for Epidemiology and Biostatistics

1. Hennekens, Epidemiology in Medicine, 1st Edition
2. Rosner: Fundamentals of Biostatistics – 3rd Edition
3. Introduction to Biostatistics by P.S.Sundar Rao J Richard 3rd edition
4. Methods in Biostatistics by Dr. B.K.Mahajan
5. C.D. on Indo-US Workshop on Environmental & Occupational Epidemiology by National Institute of Occupational Health
6. Statistical Methods for Environmental Pollution Monitoring By Richard O.Gilbert