

**PROPOSED SYLLABUS FOR
BACHELOR OF HEALTH SAFETY
AND ENVIRONMENT**

BHARATHIAR UNIVERSITY: COIMBATORE-641 046

B.Sc. Health Safety and Environment (HSE)

(For the CPP/CPOP students admitted from the academic year 2017-2018 and onwards)

SCHEME OF EXAMINATION - CBCS PATTERN

Part	Study Components	Course title	Hrs/w eek	Examinations				Credits
				Dur. hrs	CIA	Marks	Total Marks	
Semester – I								
I	Language –I		6	3	25	75	100	4
II	English- I		6	3	25	75	100	4
III	Core Paper I- Legal Frame Work for HSE		5	3	25	75	100	4
	Core Paper II- HSE Foundations		6	3	25	75	100	4
	Allied 1: Chemistry		5	3	20	55	75	3
IV	Environmental Studies #		2	3	-	50	50	2
Semester II								
I	Language- II		6	3	25	75	100	4
II	English- II		6	3	25	75	100	4
III	Core Paper III : Occupational Health Studies		4	3	25	75	100	4
	Core Practical I : Occupational Health Studies		6	3	40	60	100	4
	Allied 2: HSE Common Skills		4	3	20	55	75	3
	Allied Practical : Common Skills		2	3	20	30	50	2
IV	Value Education – Human Rights #		2	3	-	50	50	2
Semester III								
I	Language –III		6	3	25	75	100	4
II	English- III		6	3	25	75	100	4
III	Core Paper IV- Safety in Construction		5	3	25	75	100	4
	Core Paper V- Environmental Science		4	3	25	75	100	4
	Allied 3: Physics		4	3	20	55	75	3
IV	Skill based subject I-Inspection techniques and report writing		3	3	20	55	75	3
	Tamil @ / Advanced Tamil # (OR)		2	3	50	50	50	2

	Non- major elective- I (Yoga for Human Excellence # / Women's Rights# / Constitution of India #)						
	Semester IV						
I	Language- IV	6	3	25	75	100	4
II	English- IV	6	3	25	75	100	4
III	Core Paper VI- Occupational Health Studies 2	4	3	25	75	100	4
	Core Practical II- Occupational Health Studies 2	3	3	40	60	100	4
	Allied 4: Biology	4	3	20	55	75	3
	Allied Practical: Biology	2	3	20	30	50	2
IV	Skill based subject II - Training	3	3	20	55	75	3
	Tamil @ / Advanced Tamil # (OR) Non- major elective- II (General Awareness #)	2	3	50		50	2
	Semester V						
III	Core Paper VII- Ergonomics	5	3	25	75	100	4
	Core Paper VIII- Environmental Management	6	3	25	75	100	4
	Core Paper IX- Measuring performance	6	3	25	75	100	4
	Core Paper X- HSE Audits	5	3	25	75	100	4
	Elective I	5	3	25	75	100	4
IV	Skill based subject III –Accident investigation and reporting	3	3	20	55	75	3
	Semester VI						
III	Core Paper XI- Fire Safety	5	3	25	75	100	4
	Core Practical III- Fire Safety	6	3	40	60	100	4
	Core Practical IV- Industrial Inspection and reporting	6	3	40	60	100	4
	Elective II	5	3	20	55	75	3
	Elective III	5	3	20	55	75	3
IV	Skill based subject IV –Risk Assessment	3	3	30	45	75	3
V	Extension Activities @	-	-	50	--	50	2
	Total					3500	140

* @ No University Examinations. Only Continuous Internal Assessment (CIA)

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§ Includes 25% / 40% continuous internal assessment marks for theory and practical papers respectively.

Elective- I	Elective- II	Elective- III
OHSMS	Health and Safety in Oil and Gas Industry	Soil Sampling
HSE Training Methods and Techniques	Electrical Safety	International Organisations for HSE
Hazard Identification and Risk Assessment	Hazard Communication	Confined space and Excavation

SEMESTER I

Core 1 : Legal Frame Work for HSE

Unit – 1

National and International Regulations:- National Legislation, Legislation of Developed Countries, Standards, Guidance, Codes of Practices.

National: Factories Act, Mines Act etc and its enforcement

International: ILO Codes of Practices, Occupational Safety and Health Administration USA, Health and Safety Executive United Kingdom etc. How these countries develop and implement legislation, standards, guidance and codes of practices

Unit – 2

The statutes relating to OH&S in India: Statutes for safety at workplaces, Statutes for safety of substances, Statutes for safety of activities

Safety and health statutes for regulating OH&S of persons at work in four sectors:- Mining, Factories, Ports, Construction

Unit – 3

ILO:- Responsibilities, Conventions, Recommendations and Ratification. ILO Guide Lines on Occupational Safety and Health. Guidelines contributing the protection of workers from hazards and to the elimination of work-related injuries, ill health, diseases, incidents and deaths.

Application of Guidelines in national level and organizational levels

Unit – 4

Enforcement of Legislation: National and state function of enforcement agencies. Monitoring by UNO, ILO, WHO.

National: Ministry of Labour, DGMs, DGFASLI, States of India.

International: Enforcement by Occupational Safety and Health Administration in USA, by Health and Safety Executive in United Kingdom, and various enforcement agencies in Middle East Countries

National and International statistics on Health and safety

Unit – 5

Fines and Punishments:

Inspections by National and state agencies, Inspection procedures and powers by enforcement agencies in USA, UK and Middle East Countries

Fines and punishments set by national and international governments, recommendations by International agencies monitoring health and safety

OSHA Citations, HSE's actions against violation in United Kingdom

Reference

India

The Factories Act

The Mines Act

The Workmen's Compensation Act

The Employees' State Insurance Act

The Public Liability Insurance Act, 1991

Building and other Construction Workers (Regulation and the Employment and Conditions of Service) Act, 1996

Dock Workers (Safety, Health and Welfare) Act, 1986. Act No. 54 of 1986.

UK

Management of Health and Safety at Work Regulations 1999

Workplace (Health, Safety and Welfare) Regulations 1992

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR)

Control of Substances Hazardous to Health Regulations 2002 (COSHH)

USA

Occupational Safety and Health act of 1970

OSHA Code of Federal regulations 1910 and 1926

Core 2 : HSE Foundations

Unit -1

Health, Safety and Human Relation: Definitions, Safety as a practice in life, Risk Perception, Health care, Environmental Health, Public health etc.

Safety at home, safety at rural areas, child labour, welfare. National initiatives to eradicate child labour and awareness

Unit – 2

Safety at work – Socio – Economic reasons. Introduction to health and safety at various industries. Arrangements by organisations to protect the workers. Interest of stake holders and neighbours,

Training and awareness programmes on safety at work. Health monitoring in India. Health monitoring in USA, UK and Middle east countries

Unit – 3

Definitions: Hazard, Hazardous event, Risk, Health, Safety, Environment etc.

Acceptable definitions and meaning of a number of terms used in Health and safety originated by national and international organisations

Unit – 4

Responsibilities and accountabilities in Industries:

National level: Responsibilities and accountabilities of owners, employers, workers, stake holders, suppliers, manufacturers, government entities etc

International: Responsibilities and accountabilities entrusted on Government organisations in UK, USA and Middle East Countries

Unit – 5

Introduction to health and safety management systems and its implementation and accreditations: OHSAS 18001, ILO-OSH 2001, ISO 45000, HSG 65

Examples of management systems from other areas: ISO 9001, EMS 14001, ISO 22000 etc

Organisations involved in developing occupational health and safety management systems: International organisation for Standardisation, British Standards Institution, Health and safety executive, International labour organisation

Accreditations and monitoring of management systems

Reference

Occupational health and safety management systems – requirements (OHSAS 18000 series)1

ISO 14001 (Environmental Management Systems)

OSHA, Code of Federal Regulations – USA

Managing for health and safety (HSG 65 – UK)

Encyclopaedia of Occupational Health and Safety, ILO

HSE Guide Volume I, II and III, NSC – India

Safety, Health & Working Conditions – Training Manual - Publication of Joint Industrial Safety Council, Sweden and ILO, Geneva

ALLIED 1 : CHEMISTRY

Unit I:

Chemical Bonding

1. Molecular orbital theory, bonding, antibonding and non-bonding orbitals. Molecular orbitals. MO configuration of H₂, N₂, O₂, F₂. Bond order. Diamagnetism and paramagnetism.
- 2 Preparation and properties, structure, preparation and uses of Borane- NaBH₄, Borazole Chemistry.

Unit II:

1. Industrial Chemistry Synthesis, properties and uses of silicones. Fuel gases: natural gas, water gas, semi water gas, carburetted water gas, producer gas, oil gas (manufacturing details not required)
2. Dye Chemistry Terms: Chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic effect, hypsochromic effect- Dyes: azo and triphenylmethane dyes- Preparation one example Methyl Orange, Malachite green.

Unit III:

1. Covalent bond: orbital overlap, hybridization, geometry of organic molecules- CH₄, C₂H₄, and C₂H₂. Inductive effect. Electrometric, mesomeric, hyperconjugative and steric effects. Effect in properties of compounds.
2. Stereoisomerism
Conditions of optical activity-Optical isomerism of tartaric acid, Racemisation, Resolution of racemates- Geometrical isomerism of maleic and fumaric acids.

Unit IV:

1. Solutions types. Liquid in Liquid. Raoult's law - - Deviation from ideal behaviour –positive deviation-Negative deviation- Fractional distillation.
2. Kinetics- Rate, order, molecularity, pseudo first order, determination of order. Effect of temperature on the rate. Energy of activation.

Unit V:

1. Conductance-Types(definition only)- Ostwald dilution law - Kohlraush's law - - Applications Conductometric titrations.
2. pH and its calculations- Buffers in living systems-Action of buffer solutions - . HendersonHasselbalch equation

SEMESTER II

Core 3 : Occupational Health Studies 1

Unit – 1

Chemical Safety

Various forms of chemicals, classifications of chemicals (according to Globally Harmonised System of Classification and Labelling of Chemicals (GHS), purpose of the chemical classifications, routes of entry to human body, defense mechanism of human body. Risk assessment for chemicals.

Unit – 2

Biological Hazards

Biological agent, various types of biological agent, assessment of biological and control of biological agents at workplaces (hierarchy of controls).

Unit – 3

Noise

Meaning of noise, nature of sound, wave property, sound pressure and sound intensity, measuring sound (dB), effect of sound to human (acute and chronic), noise risk assessment, control measures according to hierarchy of controls.

Unit – 4

Radiation

Meaning of radiation, types of radiation, ionizing and non-ionizing radiations (with workplace examples) control measures for radiations.

Unit – 5

Vibration

Meaning of vibration, effects of vibration to humans, risk assessment, control measures according to hierarchy of controls.

Reference

Occupational Health Services Convention, 1985 (C161), ILO AND Recommendation, 2006 (No. 197)

Occupational Safety and Health Convention (C155) and Recommendation (R164)

Protocol of 2002 to the Occupational Safety and Health Convention, 1981 (P155)

Radiation Protection Convention, 1960 (No. 115) (C115) and Recommendation (R114)

Protection of workers against noise and vibration in the working environment, ILO Code of Practice

HSG167: Biological monitoring in the workplace: A guide to its practical application to chemical exposure

NSC Publication: Packaging & Labeling of Hazardous Chemicals

NSC Publication: Safe Handling of Hazardous Chemicals

CORE PRACTICAL I- OCCUPATIONAL HEALTH STUDIES 1

- Monitoring chemical hazards
Measuring chemical presence in different forms
- Laboratory section (biological agents)
Laboratory study of biological agents causing occupational diseases
- Work station assessment
Designing and use of work station

Allied 2 : HSE Common Skills
Communication skills

Unit 1

Methods of communication :-

Verbal communication, written, videos , posters , graphics

Unit 2

Developing communication skills:-

Training, leader ship and negotiation skills, interpersonal skills, improving communication skills,

Judging the competent, vocabulary

Unit 3

Work place communication:-

Management reports, meeting, tool box talk, formal and informal communication with employee,

Circulation of policy and procedures

Unit 4

Accident communication

Legal authorities, insurance, enforcement authority, media, corporate level communication,

Unit 5

Communication of best practices

Communicating best practices in corporate level, measuring effectiveness of communication and reporting, essential skills in communication to directors and board members, maintenance records.

Reference

HSG 65 – UK

OHSAS-18001

ÀLLIED PRACTICAL: COMMON SKILLS

- Tool box talk
- Motivational speech
- Report writing
- Hazard identification
- Health and safety statistics

SEMESTER III

Core – 4 : Safety in Construction

Unit – 1

Equipment and maintenance

Types of equipments used for construction activities (Earth moving, lifting, conveying, concrete mixer, tunneling, piling, de watering equipment etc). Selection of equipment (suitability), Maintenance strategies, strategies for preventive maintenance

Unit – 2

Work Environment

Effect of work environment (wind, rain, heat, cold, dust and noise), handling hazardous chemicals, tools and equipment, Slips, trips and falls etc. Welfare facilities (drinking water, sanitary, rest etc. Safe movement of workers at workplace

Unit – 3

Work Material and substances

Various materials used in construction, hazards associated with the use, control measures to reduce the risk, substance misuses (drugs and alcohol) etc and control measures.

Unit – 4

Storage of Material

Material storage including hazardous, flammable and waste (indoor and open storage), falling materials and controls

Unit – 5

Disposal of waste

Safe handling and storage of construction wastes (concrete, spoils, timbers etc.), use of skip for storing wastes, using licensed contractors for disposing waste to the government disposal areas.

Reference

Building and other Construction Workers (Regulation and the Employment and Conditions of Service) Act, 1996

Safety and Health in Construction, ILO Code of Practice

Safety and Health in Construction *Convention*, 1988 (C 167). *Convention* concerning Safety and Health in Construction

NSC Publication: Hazardous Waste Management

OSHA Code of Federal regulations 1910 and 1926

HSG 150: **Health and safety in construction**

Core 5 : Environmental Science

Unit – 1

Atmosphere: Layers of earth, Air, water, Life on earth, greenhouse gas phenomena, carbon cycle, airborne contaminants, Light pollution, noise pollution. Extreme weather conditions and effect on occupations

Unit – 2

Ecology: Organisms and their environment, relationship between a population of organisms and some physical characteristic of their environment. Industrial developments and its impact on certain species by water pollution and air pollution,

Unit – 3:

Emissions to the atmosphere: Emission types, ozone depletion, pollutants that causes harm to the environment,

Unit – 4

Monitoring atmospheric emissions

Methods of monitoring atmosphere, sampling methods, regular monitoring by companies and authorities, benefits of monitoring

Unit 5

Emissions to the water

Water Pollutants, source of pollution, prevention of pollutants, effluent discharges, water quality scales, potable water, waste water treatment, flooding,

Reference

Working Environment (Air, Pollution, Noise and Vibration) Convention, 1977 (No 148) (C148) and Recommendation (R156)

National Environment Policy - 2006

An Appeal to Reason: A Cool Look at Global Warming; Nigel Lawson

NSC Publication: Environmental Protection Information Package

NSC Publication HSE Guide Volume I, II and III

The world summit on sustainable development (WSSD) Plan Implementation

Earth in the balance: Ecology at the Human Spirit; Al Gore

The Economical Environmentalist; Prashant Vaze

ALLIED 3 : PHYSICS

UNIT- I

Gravitation: Newton's law of Gravitation-Determination of G by Boy's method mass and density of earth – acceleration due to gravity- Determination of g by compound pendulum.

Elasticity: Basic concepts – bending of beams – depression of cantilever Determination of Y by uniform and non- uniform bending method- Torsion in a wire Determination of rigidity modulus by torsional pendulum.

UNIT II

Heat and thermodynamics : Vanderwaal's equation of state-critical constants of a gas- derivation of critical constants in terms of Vanderwaal's constants – Joule – Thomson – effect – Theory of J-K effect – liquefaction of gases – Dewar's method and K-Onnes method.- properties of liquid Helium I and II.

Sound: Doppler effect – derivation and applications – determination of frequency of alternating current by Sonometer – Ultrasonics – production, properties and applications

UNIT III

Solar Physics: solar constant – measurement of solar radiations by Pyroheliometer and Pyranometer – general applications of solar energy – flat-plate collector - box type cooker - solar water heaters – solar photo – voltaic cells – general applications of solar cells.

UNIT IV

Electricity: Conversion of Galvanometer into Ammeter and voltmeter – figure of merit of a galvanometer – Ballistic Galvanometer – theory and charge of sensitiveness – measurement of capacitance – measurement of Thermo EMF and resistance by potentiometer – applications of electromagnetic induction - Transformers – theory, energy loss and applications

UNIT V

Magnetism : Basic concepts of magnetic materials – magnetic properties of Dia, Para and Ferro magnetic materials – Area of (B-H) loop – electric and magnetic circuits – Curie temperature – applications of Ferrites in computer memory

Books for references:

1. Properties of matter and sound – Brijlal subramaniam
2. Properties of matter and sound – R. Murugesan
3. Solar Energy utilization – G.D. Ravi
4. Solar Energy Utilization – Sukhatme
5. Heat and Thermodynamics -- Brijlal subramaniam
6. Heat and Thermodynamics – Narayanamurthi and Nagarathinam
7. Sound -- Brijlal subramaniam
8. Sound – R.L. Seihgal
9. Electricity and magnetism — R. Murugesan
10. Electricity and magnetism — Narayanamurthi and Nagarathinam
11. Electricity and magnetism -- Brijlal subramaniam

SKILL BASED SUBJECT I
Inspection techniques and report writing

UNIT I

The basic purpose and benefits of safety inspection ,Type of incidents , Skill level of inspectors, composition of inspection team

UNIT II

Type of inspections , General pre-use check of equipments ,Preventive maintenance inspection-Mandatory inspection , Planning and conduct of inspection , Monitoring and reviewing performance

UNIT III

Check list, types of checklist, develop and use of check list, strength and weakness of checklist, training the personnel carrying out inspection with checklist

UNIT IV

Preparation for inspection, Inspection techniques, Inspection frequency, health surveillance

UNIT V

How to write an inspection report, Structure of inspection report, How to communicate the findings with relevant parties, Develop recommendations and follow-up on implementation

SEMESTER IV

Core 6 : Occupational Health Studies 2

Unit – 1

Health effects at work

Major types of health effects, effect of drugs and alcohol on employees' attendance and performance, Musculoskeletal disorders, skin, hearing impairment, lungs, carcinogens,

Unit – 2

Protecting workers' health. WHO fact sheet

Lack of regulatory enforcement, different occupations and present coverage levels of occupational health, occupational diseases and injuries insurance, health services, how WHO responds to the issues.

Unit – 3

Occupational Mental ill-Health

Causes of work related mental ill - health, categories of psychological experience, Job stress, Consequences of mental health problems in the workplace, changes in the nature of work, developing work skills, the work place and mental well - being

Unit – 4

Occupational Toxicology

Toxic materials and substances used in work, exposure limits, monitoring of toxic presence, health monitoring of workers, Industrial Hygiene, epidemiological studies, toxicological investigation

Unit – 5

Welfare

Safe working environment, first aid, eating facilities, toilet and washing facilities, rest facilities, drinking water, Facilities for storing and drying clothing, First-aid appliances, Shelters, rest rooms and lunch rooms,

REFERENCES:

1. Ladou J. (ed.) Textbook of Occupational and Environmental Medicine. Chapter 13. pp. 171-179.
2. Rees D and Cantrell A. No need for milk in the prevention of occupational illness. *Occup. Health Southern Afr.* 1995; 1(4): 25.
3. Toxicology Tutorial available at the website <http://www.sis.nlm.nih.gov/Tox/ToxTutor.html>
4. Factories act 1948
5. COSHH
6. ILO, Welfare Facilities Recommendation, R102, 1956

CORE PRACTICAL II- OCCUPATIONAL HEALTH STUDIES 2

- Make a report on different types of health effects in different work place
 - Automobile Garage
 - Sewing Mill
 - Power Plant
 - Construction site
- List the control measures to reduce health effects in work place
- First Aid
 - Examination of causality
 - First aid kit
 - CPR
 - Wearing and removal of gloves

ALLIED 4 : BIOLOGY

UNIT I: Cytology and micro organisms

Cytology: cell wall, protoplasm, mitochondria, chloroplast, endoplasmic reticulum, golgi complex, lysosomes, endosomes, microbodies, ribosomes, centrioles, nucleus, nucleolus- Membrane structure, solute transport techniques: simple diffusion, facilitated diffusion, active transport- Chemical composition of cell.

UNIT II: Bio-molecules

Proteins: classification, Properties, and functions- Carbohydrates: classification, structure and configuration. Biological importance of monosaccharides(glucose & fructose), di saccharides(Maltose & sucrose) and polysaccharides(Starch and Cellulose)- Lipids: Classification, types and structure with examples.

UNIT III: Micro Organisms

Micro organisms: History, identification. Micro organisms of forensic importance- Microbial role in diseases- Kochs postulates- Micro Biology: - advent of sterilization, cultural techniques- Microbial Forensics: Scope and Importance.

UNITIV: Antigen - Antibody Reaction

Antigen, antibody, Production of antibody. Structure and functions of antigen and antibody complex- Antigen antibody reactions: types, principle- Agglutination, precipitation and flocculation- Immunochemistry: importance and scope- Immunochemical techniques: characteristics, roles and methods- particle and label methods.

UNIT V: Physiology

Physiology: introduction,molecular, cellular and tissue physiology- Systems: control and regulation, support and movement, fluids and transport, environmental exchange and reproductive- Characters, functions and importance of the system.

REFERENCE BOOKS

- Molecular biology of cell, Bruce Alberts et al, ninth edition, CBS Publishers, 2002.
- Cell and Molecular Biology, Gerald Karp, Third edition, John Wiley and sons.inc., 2002.
- The Cell – A Molecular Approach, Geoffery M Cooper, Roberte Hauseman, Fourth edition, American Society For MicroBiology.
- Fundamentals of Biochemistry, Voet and Voet, Third edition, John Wiley and sons publishers 2007.
- Principles of Biochemistry, Lehninger Albert, Fifth edition, W H Freeman Publishers 2005.
- Principles of Anatomy and Physiology, Tortora, G. & Grabowski, S. ninth edition. Wiley page 733, 2000.
- Advanced immunochemistry, Eugene D Day.
- Handbook of Immunochemistry, Miroslav Ferencik.

ALLIED : BIOLOGY- PRACTICALS

1. Safety precautions in laboratory.
2. Introduction to biochemical instrumentation.
3. Examination of plant cell.
4. Examination of animal cell.
5. Examination of micro organisms.
6. Blood Grouping- agglutination method.
7. Blood grouping- absorption elution method.
8. Microscopic examination of blood cells.
9. Electrophoresis technique.
10. Culturing of microbes from saliva/blood.

SKILL BASED SUBJECT II

Training

UNIT I

Identifying the training topic and developing them, Factors to consider when developing health safety and environment training, Skill level of trainer

UNIT II

Competency training, Third party involving in training, Assessing competency of workers, Training for skilled workers

UNIT III

Resources to deliver training , Scheduling training , New employ training, Training for the personnel,
Training for those changing jobs

Unit IV

Teaching methods, Legal requirements, Referencing assessments, Monitoring efficiency of training, Developing training for management level staffs

Unit V

How to monitor the effectiveness of training, refresher training, Training on transferrable skill to supervisory staff, Preparing trainer reviews after completion of training

SEMESTER V

Core 7 : Ergonomics

Unit -1

Occupational Ergonomics

Meaning Ergonomics, Principles of ergonomics and their applications, benefits of ergonomics, work related musculoskeletal disorders, regulations, designing the job and work station, suitable employee selection for job, monitoring, training.

Unit – 2

Work-Related Musculoskeletal Disorders

Disorders to soft tissues such as muscles, tendons, ligaments, joints, blood vessels and nerves, Examples of WMSDs: Sprain, Strain, Tendonitis, Tenosynovitis, Carpal Tunnel Syndrome, Tennis elbow, Pitcher's Shoulder, White Finger, Digital Neuritis. Symptoms of work related musculoskeletal disorders, increased risk factors and indicators

Unit – 3

Hazard Analysis

Awkward positions: shoulders, neck, back, knees. High Hand Force: arms, wrists, hands. Mechanical stress, highly repetitive motion, heavy frequent or awkward lifting, manual handling

Unit – 4

Controls

Effective design of job or job-site and the tools or equipment used in the job, engineering controls, work practice controls, job safety analysis/risk assessments, training, tool handle design, use of personal protective equipment, job shifts, develop working procedures

Unit – 5

Ergonomic solutions for: Manual handling, awkward lifting awkward posture, back angle, gripping, wrist and hand issues, working at computer stations, lighting at work.

Reference

- RS,Bridger, (2008) *Introduction to Ergonomics*, USA: CRC Press
NASA, (2008) *Anthropometry and Biomechanics Vol1 Sec3*, USA: NASA
HSE (1997) *HSG57 Seating at Work*. HSE Books, London
HSE (2004) *Research Report 258*, HSE website, London
Ambient factors in the Workplace, International Labour Organisation (ILO) Code of Practice (CoP)
Ergonomic Checkpoints: Practical and easy-to-implement solutions for improving safety, health and working conditions, second edition, ILO Geneva 2010
Cal OSHA (2007) *Ergonomic Guideline for Manual Material Handling*, USA: DHHS publication

Core 8 : Environmental Management

Unit – 1

Introduction to ISO 14001 - 2015

Plan, Do, Check, Act model. ISO and accreditation bodies, Origin of Management system, Implementation and monitoring globally, benefits of implementing ISO 14001, determining the scope of the management system

Unit – 2

Leadership

Range of key activities of the top management needed to demonstrate leadership and commitment, management to ensure that a suitable environmental policy is developed, implemented and monitored throughout the organization. Define roles and responsibilities and ensure that the awareness is gained through communication and training

Unit – 3

Planning

Actions to address risks and opportunities, Environmental objectives and planning to achieve them: Planning the context of environmental management system, to establish environmental objectives and plans, ensuring that these are clear, measurable, monitored, communicated, updated and resourced.

Unit – 4

Support

Resources, Competence, Awareness, Communication, Documented Information
Determine and provide the resources needed for the establishment, implementation, maintenance and continual improvement of the environmental management- covering all aspects of people and infrastructure, establish competence criteria for each function and role relevant to the environmental management system, improve awareness and methods to ensure effective communication is in place

Unit – 5

Operation, performance evaluation and improvement

Operational planning and control, Emergency Preparedness and Response, Monitoring, measurement, analysis and evaluation, Internal audit, Management review, Nonconformity and corrective action, Continual improvement.

Reference

ISO 14000 (EMS)

ISO Publication: Environmental Management – The ISO 14000 family of international standards

ISO Publication: ISO 14001 – Key Benefits

Core 9 : Measuring performance

Unit – 1

Methods of monitoring

Types of monitoring to ensure the performance (active and reactive monitoring), frequency of monitoring, key responsibilities of all levels of employees, measuring performance an essential element to the management system, actions on monitoring reports by management

Unit – 2

Accident investigation

Regulations related to accident investigations, reporting forms, investigation team, insurance and compensation, accident statistics, documentation, definition of hazard, risk accidents, near miss, immediate cause and root causes

Unit – 3

Causes of accidents

Immediate causes, underlying causes and root causes,

Unit – 4

Reasons for Investigation

Legal reasons, Information and insights gained from an investigation, Benefits arising from an investigation, events that should be investigated, starting the investigation, what is involved in the investigation,

Unit – 5

Accident investigation methods

Step one: Gathering the information Step two: Analysing the information Step three: Identifying risk control measures Step four: The action plan and its implementation

Reference

Investigating accidents and incidents: A workbook for employers, unions, safety representatives and safety professionals HSG245 HSE Books ISBN 978 0 7176 2827 8

www.hse.gov.uk/pubns/books/hsg245.htm

HSE's RIDDOR website: www.hse.gov.uk/riddor

NSC Publication: OECD Manual on Guiding Principles for Chemical accident Prevention, preparedness and Response

Prevention of Major Industrial Accidents Convention, ILO, C174 and Recommendation R181

Recording and notification of occupational accidents and diseases, ILO Code of Practice

The Factories Act

The Mines Act

Core 10 : HSE Audits

Unit – 1

Introduction to audit

Define audit and methods of audit. Responsible personnel for audits, internal audits and external audits, Communication between auditor and organization, confirmation of audit dates, HSE audit and legislation.

Unit – 2

Audit – Documents

Review of documents: Policy documents, training, maintenance, employee complaints register, accident statistics, first aid register, chemical inventories,

Unit – 3

Audit – Observation

Work place observation by the auditors

Unit – 4

Audit: Interview

Interview workers, line managers, supervisors and management.

Unit – 5

Review

Review of audit findings by management and corrective actions for any NCRs raised by the audit.

Reference

Occupational health and safety management systems – requirements (OHSAS 18000 series)1
ISO 14001 (Environmental Management Systems)
OSHA, Code of Federal Regulations – USA
Managing for health and safety (HSG 65 – UK)
HSE Guide Volume I, II and III, NSC – India

SKILL BASED SUBJECT III
Accident investigation and reporting

UNIT I

Meaning of various categories of incident- Near miss, Accident, Injury accident, Damage to property, Illness, Dangerous Occurrences

UNIT II

Accident statistics and costs based on ILO statistics, Weekly incident reporting, Types of near misses, Types of accidents , Types of dangerous occurrence

UNIT III

Legal requirements, ILO, Indian factories act, Reporting forms, How to report accidents

UNIT IV

Accident causation, Accident Investigation techniques (based on ILO cop recording and notification of occupational accidents and diseases, internationally recognised models

UNIT V

National and international Reporting procedures, Identifying witness, Interviewing witness, Monitoring and reviewing performance

SEMSTER VI
Core 11: Fire Safety

Unit - 1

Introduction to Fire Science

Combustion triangle, sources of fuel, sources of ignition, types of fire, combustible and flammable materials, flash point, fire point, flammable (explosive limits), causes of fire, fire spreading methods, lower explosive limits, upper explosive limits, flammable range.

Unit – 2

Fire – Prevention, Protection, precaution

Methods of heat transmission, Methods of extinguishing, Types of extinguishers used for types A, B, C, D fire, Common Causes and Consequences of Fire in Workplaces, control of ignition sources, storage of flammable liquids, structural measures to prevent the spread of fire, Fire detection, fire warning and fire fighting equipment

Unit – 3

Fire Risk assessment

Step 1: Identify the fire hazards, step 2: identify the people at risk, step 3: Evaluate, Remove, or reduce and protect from Risk. Step 4: Record, Plan, inform, instruct and train, step 5: Review Competence of a risk assessor, composition of risk assessment team.

Unit – 4

International Fire Organisations

NFPA, SFPE, IFE. Developing or assisting standards for nations around the world, development of training programmes on fire safety engineering, Professional Memberships, certifications by these organisations, Life safety codes by NFPA.

Unit – 5

Fire Safety in Construction Industries

Fire wardens/Fire Marshals, Emergency procedures, handling, use, transportation and storage of flammable materials, national standards for fire and explosives, national regulating agencies, fire safety training, role of state governments.

Reference

National Building code of India (Fire and Life Safety Code)

NFPA Life Safety Code

Statutory norms on Fire Safety under the Factories Act, the Petroleum Act and the Explosives Act

NSC Publication: HSE Guide Volume IV (Fire Safety and Disaster Management)

NSC Publication: Safety in Welding and Gas Cutting Operations

Core practical III- Fire Safety

- Fire fighting equipment
- Evacuation
- Mock fire drills
- Fire Risk Assessments

Core practical IV- Industrial Inspection and reporting

- Inspection procedures
- Report writing
- Identifying hazards & control measures
- Reporting procedures
- Documentation

SKILL BASED SUBJECT IV **Risk Assessment**

UNIT I

Definition –Hazard, Hazardous event, Risk, Risk assessment, Competency of the risk assessors, Composition of risk assessment team

UNIT II

Principles of risk assessment, Forms of risk assessment, Qualitative risk assessment, Quantitative risk assessment

UNIT III

Risk assessment procedures (Internationally recognised model e.g. Five steps to risk assessment), Identifying hazards (Ranges of hazards, methods of identifying work place hazards)

UNIT IV

Identifying the people at risk, Assessing and evaluating the risk, Controlling the risk, Control measures, Principles of prevention

UNIT V

Recording the risk assessment, Reviewing the risk assessment, Monitoring control measures, Responsibility of middle level staff.

Elective 1: OHSMS

Unit – 1

Management Systems in Health and Safety

OHSMS Models

ILO-OSH Model- Policy, Organising, Planning and Implementation, Evaluation, Action for improvement – Continual Improvement

OHSAS 18001 & hsg 65 Model – Plan, Do, Check, Act.

Unit – 2

Benefits of implementing Management systems:

Safer workplace: An OHSMS enables to identify hazards, assess risks and put the necessary risk control measures in place to prevent accidents

Morale: Implementing an OHSMS shows a clear commitment to the safety of staff, establishing a positive health and safety culture, and contributing to a more motivated, efficient and productive workforce.

Reduced costs: Fewer accidents mean less expensive downtime for your organization and improved insurance liability rating

Monitoring: The regular assessment process will help continually monitor and improve your health and safety performance

Unit – 3

Elements of management systems in detail:

Policy and planning, Hazard identification, risk assessment and risk control, Legal and other requirements, Objectives, targets and management programmes, Implementation and operation, Checking and corrective action, Management review

Unit – 4

Audits: Measuring the performance by auditing the system: To comply with legislation, To assess whether the H&S management system is working, responsibilities are carried out by all parties, procedures are being followed, arrangements are made, accidents and incidents are reported, aims and objectives are set and reviewed timely etc.

Unit – 5

Management Review:

Review and actions by Management: Results from internal audits and evaluations, Occupational Health and Safety performance of the organization, Reviewing whether the objectives been met, Follow-up actions from previous reviews, Recommendations for improvements

References

OHSAS 18000 series

HSG – 65

ILO OSH 2001

Elective 1: HSE Training Methods and Techniques

Unit – 1

Training Need Analysis

Size of the organisation, Activities, materials & risk associated with these, type of workers and others who might be present, level of competency required, existing knowledge and awareness, trainings already undergone, need for refresher training, frequency of training, legal and organizational requirements, type of training (classroom, on the job) etc.

Unit – 2

Training the Trainer

Competency required for the trainer, Resources for training development and practicals, target audience, process of adult learning, methods of communication determining course objectives, sources of information, preparation of training presentation, practice session / micro teaching

Unit – 3

Planning and Delivery

Result of Training need analysis, course objective, target audience, information sources for development, hardware / software / multimedia requirements, scheduling & delivery

Unit – 4

Assessment

Importance of assessment, methods of assessment eg. Quizzes, written examination, form of exam eg. Multiple choice, comprehension, practical, feedback from candidates, feedback from supervisors or managers, observation of work practice

Unit – 5

Review

Importance of monitoring and review of training effectiveness, Training analysis, review of topics and subject as per changes and developments, identification of opportunity for improvement, action for improvement, industrial practice, identification of new methods and resources etc.

References

Various books on pedagogical science

Electvie 1: Hazard Identification and Risk Assessment

Unit – 1

Types of Hazards

Mechanical, physical, chemical, biological, Ergonomic hazards, environmental hazards

Unit – 2

Hazard Identification methods

Workplace inspection, work observation, worker involvement and consultation, documents from manufactures, incident investigation reports, audit and inspection reports, best practice developments, national and international standards

Unit – 3

Risk Assessment Methods

Importance of risk assessment, legal requirements, qualitative and quantitative risk assessments, risk assessment formats, stage of risk assessment (Five steps as per HSE), hierarchy of risk controls, principles of prevention, requirement to give special consideration to certain category

Unit – 4

Risk Assessment Matrix

Risk Matrices, Risk Assessment and Job Hazard Analysis, Hazard Identification, So far as is reasonably practicable.

Unit -5

Risk Assessment Practical

Practical application of risk assessment learnt, evaluation and feedback

References

HSE. *5 Steps to risk assessment*. Available: www.hse.gov.uk
Risk assessment, A brief guideto controlling risks in the workplace, INDG163

Elective 2: Health and Safety in Oil and Gas Industry

Unit – 1

Introduction to Process Safety

Inherent hazards in Oil and Gas industry, risk management techniques, legal requirements, documentary evidence required

Unit – 2

Hydrocarbon Process Safety

Selection of contractor, hazard communication, responsibility, management of change, permit to work system, isolation methods, shift hand over

Unit – 3

Onshore and offshore activities

Maintenance of plant & equipment, Storage tanks & safety features, Containment, hydrocarbon vapor clouds, BLEVE, draining of LPG storage tanks, pipeline cleaning & inspection, fire protection and emergency controls

Unit – 4

Transportation

Marine transport, types of vessels, loading & unloading of vessels, Land transport, Tankers, Filling arrangements, driver training, routes, rail transport

Unit - 5

Process Safety Management

Hazard and operability study, fault tree analysis, qualitative and quantitative risk assessments

Reference

Guidance by Ministry of Petroleum and Natural Gas.

Verma, Anil (1997). Challenge of change: industrial relations in Indian industry

OSHA CFR

HSE Guidance

Hazcom

Elective 2: Electrical Safety

Unit – 1

Introduction to Electrical Safety

Electricity, Design Safety Standards For Electrical Systems, Electric Utilization Systems, General Requirements, case study - major accidents.

Unit – 2

Electrical Hazards, Domestic and Power tools

Electrical hazards from domestic equipment, electrical installations, power tools at work, electrical cables

Unit – 3

Maintenance of equipment

Lockout – Tagout, Major maintenance activities, permit to work systems, monitoring, power plant maintenance

Unit – 4

Inspection of power tools

Competent person, inspection methods, colour coding, procurement of power tools, repair or disposal of power tools, training requirement for the users

Unit - 5

Documentation

Permit to work system, safe system of work, job requests and approvals, monitoring reports, record maintenance, audit documents

References

National Electrical Code 2011
OSHA CFR 1910 and 1926
HSE Guidance

Elective 2: Hazard Communication

Unit – 1

An introduction to Hazard Communication

OSHA standards on Hazcom, types of chemicals and explosives, Transportation of hazardous materials

Unit – 2

Hazard Communication Standards

Illnesses and injuries from chemicals, Hazard Communication programme, Container Labelling, Material Safety Data Sheet, Different Industries maintaining Hazcom standards

Unit – 3

Minimizing Hazards at work

Employer and employee responsibilities, training, hazard assessment, segregation from ordinary materials and substances, written programmes, inventory of hazardous chemicals, labeling, health monitoring

Unit – 4

Material safety data sheet

Responsibilities of manufacturer, supplier and user. Each segments of material safety data sheet explained in detail with 3 or more examples.

Unit – 5

Training

Identifying training requirements and workers from different categories, hazards of chemicals, monitoring devices

References

OSHA Hazcom

COSHH 2002

Asbestos Convention, 1986 (C162) and Recommendation, 1986 (R172)

Chemical Convention, 1990 (C170) and Recommendation (R177)

Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP)

Elective 3: Soil Sampling

Unit – 1

An Introduction to soil sampling

Types of soil, groundwater, gas and contaminants. Sample handling, transportation, storage, retention and disposal, responsibilities

Unit – 2

General sampling

Sampling and Testing Frequency in bore holes, pits and trenches, standard penetration test, recording depths of sample, description of samples, Labelling, Protection and Transportation of Samples,
Retention and Disposal of Samples

Unit – 3

Soil samples

Small Disturbed Samples, Bulk Disturbed Samples, Open Tube and Piston Samples, Standard Penetration Test Samples

Unit – 4

Groundwater samples

Methods of collection and sending for testing, reports, actions at engineering departments on reports

Unit – 5

Gas and Special Sampling

Chromatographic analysis, sampling methods of both, supervision of geotechnical person, duties of Engineer

References

BS 5930 Code of practice for site investigations

BSI –DD 175 Code of practice for the identification of potentially contaminated land and its investigation (draft for development).

ICE et al, Soil Investigation Steering Group (SISG) Publication, *Soil investigation in construction, Part 4, Guidelines for the safe investigation by drilling of landfills and contaminated land*, Thomas Telford, (1993).

OSHA Standards

Elective 3: International Organisations for HSE

Unit - 1

An introduction to International Organisations

ILO, WHO, OSHA, HSE, NSC (US) NSC (India), IOSH, BCSP

Unit – 2

ILO and WHO

Purpose of the organisations, structure of organisations, how the HSE is being promoted among the member states, monitoring etc.

Unit – 3

OSHA and HSE

Regulating health and safety in USA and UK, standards, codes of practices, guidance, legislation, organization

Unit – 4

NSC (US) and NSC (India)

Purpose of establishment, how do they promote safety, roles and functions, national and international activities, both as publishers

Unit – 5

BCSP and IOSH

Difference between both organisations, aims and objectives of the organization, BCSP as a certification organization, IOSH as a membership organization

References

UK Government Legislations, Codes of practices, Health and safety guidance, Acts by British parliament

Occupational Health and Safety Act 1970 USA

Various OSHA standards

Various publications from NIOSH

Government of India Five Year Plans

IOSH Code of Conduct and their websites

BSCP Certification Manuals, reciprocal agreements with various organisations, and their website

Elective 3: Confined space and Excavation

Unit - 1

Types of Confined spaces

Types of confined spaces in construction work, oil and gas industries, municipal systems etc

Unit – 2

Confined space hazards

Types of hazards present in the confined spaces, control measures, personal protective equipment, permit to work system, atmospheric hazard monitoring, emergency procedures etc.

Unit -3

Excavation Hazards

Different types of excavation hazards, geo technical inspections, soil testing, control measures, vehicle maneuvering, training to workers

Unit – 4

Specific hazards in Excavation activities explained

Cave-in, atmospheric hazards, maintenance of water levels, dewatering, power failures, flooding etc

Unit – 5

Documentation

Maintenance documents of vehicles and equipment, excavation inspection documents, Geotechnics survey reports, soil sampling reports, ground water sampling reports, permit to work system.

References

The Factories Act

The Mines Act

OSHA CFR 1910 and 1926

Health and Safety Executive Guidance.

Safety and Health in Construction, ILO Code of Practice

Documentation of the Threshold Limit Values for Physical Agents, ACGIH