

BHARATHIAR UNIVERSITY – COIMBATORE 641 046
PG DIPLOMA IN FIRE SAFETY ENGINEERING & MANAGEMENT

(For the CCII students admitted during the academic year 2016-2017 & onwards)

SCHEME OF EXAMINATIONS

Paper	Subject	Ins.Hrs/ week	Examinations			
			Dur. H	CIA	Marks	Total Marks
I	Industrial Safety Management – 1	6	3	25	75	100
II	Fire Science	6	3	25	75	100
III	Construction Safety	6	3	25	75	100
IV	Safety at Work Place	6	3	25	75	100
V	Occupational Health and Industrial Pollution Cxontrol	6	3	25	75	100
VI	Industrial Safety Management – 2	6	3	25	75	100
VII	Fire Technology	6	3	25	75	100
VIII	Safety Management and Law	6	3	25	75	100
IX	Industrial Project work *	-	-	-	-	100
X	Practical and viva-voce	6	3	40	60	100
TOTAL						1000

*Project work: For Report 80% Marks & Viva-voce 20% Marks

Paper – 1 - INDUSTRIAL SAFETY MANAGEMENT – 1

Objective: To help students to understand the fundamentals of Safety Management like the scope and nature of occupational health and safety, the moral-social-economic reasons for maintaining safety and the basic approach to prevention of accidents and illness at work place.

Unit-1 – Introduction to health & safety

Scope of business standardization – ISO 9001 – ISO 14001 – OHSAS 18001 – Integrated Management System -Need for integration of Safety, Health & Environment – Role of top management – Role of National Government & International bodies in formulating framework for regulation of safety – Fundamentals of Safety

Unit-2 - Scope & Nature of occupational health & safety

The scope and nature of occupational health and safety - moral-social-economic reasons for maintaining safety-Definitions: Health – Safety – Welfare- Near Miss – Accident – Dangerous occurrence – Environment – Environmental protection – Hazard – Risk – occupational illness – occupational accident

Unit-3 – Safety Management

Introduction to safety and safety management - Accident causation – Hazard – Trigger – Risk – Heinrich Triangle – Frank Bird Triangle - Domino Theory – General Instructions for safety – Industrial safety practices – classification of accidents – Terms and definitions- General Safety rules

Unit-4 – Introduction to Health & Safety Management System

Safety Management – Management, Organisation and Administration - Objectives of Safety Management – Approaches to prevent accident – Safety Department – Organisation structure – Responsibilities of: Management , Workers, Directors and senior managers, Safety Managers, Safety specialists, Supervisors, Contractors, Joint occupiers, Manufacturers & Suppliers – Safeguarding the public

Unit-5 - Role of National Governments & International bodies in Health & Safety

Role of ILO – ILO Conventions & Recommendations – Responsibilities of Government, Social organizations & Public Authorities – Role of enforcement agencies – Consequence of non compliance – Barriers to good standards of safety

Paper – II - Fire Science

Objective: This course will enable students to refresh and understand basic science and gradually introduce them to fire chemistry, fire physics and fundamentals of fire related science. The students will have a strong foundation in basic fire engineering and various fire control measures on completion of this course.

UNIT-1 - History of fire service - Basic physics

Units - Guidelines for writing the units - Force, resultant force - Laws of force - Laws of motion - Mass and weight, work, power, energy - Law of conservation of energy - Mechanics – rest and motion - Distance and displacement - Speed and velocity - Acceleration, retardation - Acceleration due to gravity - Newton laws of motion - Machines and engines - Efficiency - Friction

UNIT –2 - Basic Chemistry and physics of fire

Atomic structure - Elements, compounds - Pure substance and mixture - Physical and chemical changes - Condition for the changes - Energy changes - Effects of heat on matter - Combustion - Temperature - Specific heat capacity - Catalyst - Neutralization - Sublimation - Heat of decomposing - Chemical reaction - Exothermic reaction and endothermic reaction - Transmission of heat - Flash and fire point - Ignition temperature - Flammables and combustible chemicals - Spontaneous combustion - Triangle of combustion -Tetrahedron fire - Spread of fire

UNIT -3 – Fire prevention & Control

Classification of fire - General Causes of fire - Detection of fire - Extinguishing methods - First aid fire fighting equipments - Fire bucket, Fire beater, hose reel hose - Portable extinguisher - depends on weight - depends on operating method - depends on content - depends on position of nozzle - Construction - Operation - Maintenance – refilling – Building design and fire protection

UNIT -4 - Fixed fire fighting installations using water

Hydrant or fire water system - Classification of hydrant system - Sprinkling system - Major foam pourer system - Steam drenching system - Emulsification - Special fires and fire fighting - Air craft fire - Ships fire

UNIT – 5 - Fixed fire fighting installations not using water, Ropes & Drills

Complete CO2 flooding system - Complete DCP spraying system - Complete Halon flooding system- Investigation of fire - Point, Time and cause of ignition - Arson and detection of fires – Ropes – various types of ropes, knots & uses – Drill – Squad – Discipline – Command and Control - parade

Paper – III – Construction Safety

Objective: This course will enable the students to know about the industry related health hazards and diseases and various methods and process implementation to avoid and eliminate health hazards. Also gives a good theoretical and practical understanding on various safety measures in construction industry. The students can have a thorough knowledge about various hazards involved in the construction industry and hazard control methods, their engineering and management.

UNIT 1 - Safety, Health and Environment in Construction

Introduction and stages in construction – stages of project construction – Safety during receiving, unloading, shifting and storage – guidelines for storage – General safety facilities in construction sites – Interface between civil & erection works - Construction Safety - Contractors Safety

UNIT 2 – Construction hazards & safety measures - 1

Asbestos - Cement Manufacture - Confined Spaces - Demolition and Explosives - Electrical Safety - Excavation Safety - Eye Safety - Falls - Fall Protection – Head Protection - Hearing Conservation - Heat Stress - Heavy Equipment Safety

UNIT 3 – Construction hazards & safety measures - 2

Ladder Safety - Lockout/Tag out - Outdoor Safety - Painting Safety - Personal Protective Equipment
Personnel Lift Safety - Respiratory Protection - Road Construction Safety - Scaffolding Safety - Subcontractor-Safety - Tools – Safety - Trenching and Shoring - Welding Safety

UNIT 4 – Mechanical handling of material & equipment

Hoisting equipment – tools & tackles – crabs & winches – conveyors – ropes – chains – sheaves – hooks – safe rigging methods – banks man – lifting plan – guidelines for safe lifting

UNIT 5 – Storage and Handling of Hazardous Materials

Storage & handling of compressed gases – Acetylene – Oxygen – LPG – Hydrogen - COSHH

Construction Safety documentation

HSE Policy – Project HSE Plan – Organisation chart – Emergency plan - Environmental Plan – Lifting Plan – Hazard / Risk Log – Fire Safety Plan – Permits – SOPs – ACOPs – Best Practices – Work Instructions – Injury Log – First Aid Log – Accident report – Accident Investigation report – Accident Record – Near Miss Report & Record – Illness record – Preparation of agenda points, minutes of meeting, Report of meeting pertaining to Safety Committee- Inspection Check list & report – Internal Audit Check list & report

Paper – IV - Safety at Work Place

OBJECTIVE

This course will covered extensively about, how safety can be achieved through engineering control measures at various work places. On completion of this course the student will have clear risk analysis capacity, correct and effective safety engineering approaches towards risk and hazards at any place of work.

UNIT - 1

Introduction - Work place design concepts - Purchasing policy - Personal protective equipment, Respiratory and non respiratory Machinery guard: Types of machine guard fixed and removal type

UNIT - 2

Housekeeping: Definition – Advantage of housekeeping - 5's concept of housekeeping - Industry hygiene's - Material handling - Safety steps of manual handling - mechanical handling - types of mechanical handling.

UNIT - 3

Ventilation - Natural ventilation - Dilution ventilation - Mechanical ventilation - Local exhaust - ventilation - Advantages of ventilation – Lighting - Artificial lighting - Types of artificial lighting - Advantage of illumination

UNIT - 4

Ergonomics - Office ergonomics – Definition – Objectives - Physical aspects of muscular work place design - Remedies

UNIT - 5

Work permit and NOC – Definition - Types of work permit - Hot permit - Cold permit - Excavation permit - Confined space entry permit - Acid entry permit - Preparation of work permit.

Paper – V - Occupational Health and Industrial Pollution Control

OBJECTIVE

The object of the course is to understand the health related problems and disease related with various occupation. It also included the measures which are to be taken to avoid occupational related health problems. It is also aimed a detailed study about environmental engineering and various pollution control methods adopted by various industries.

UNIT - 1

Introduction - Industrial Hygiene and Environmental Engineering - Occupational Health - Common occupational diseases – Mode of causation and effects - Prevention and control - Evaluation of injuries - Medical Examinations - ILO recommendations

concerning occupational health services - Health records - Work Physiology - Classification of work load – work capacity and man - job alignment.

UNIT - 2

Industrial Hygiene - Physical hazards: Noise – Vibration - Improper illumination - Thermal radiation - X-rays and UV radiations - Ionizing & non ionizing radiations - Effects of exposure - Maximum permissible exposure limits - Preventive & control measure

UNIT - 3

Chemical hazards - Dangerous properties of chemicals - Dusts - Gases - Fumes - Mists - Vapours - Smoke - Threshold limit values material safety data sheets

UNIT - 4

Environmental Engineering - Pollution prevention - Air pollution - Nature of pollution - Control devices -Wet & dry scrubbers – Filters - Electrostatic precipitators - Absorption and incineration process - Water pollution - Physical & Chemical pollutants – Biological - Radioactive pollutants and sources of water pollutants

UNIT - 5

Industrial waste control - Stream pollution - Liquid waste solid waste - Gaseous waste and their harmful effects - Waste control - Waste treatment - Physical treatment Sedimentation Flotation and filtration chemical treatment Neutralization of acidic or alkaline waste - biological treatment - Trickling filters - Ultimate disposal of waste

Paper-VI - INDUSTRIAL SAFETY MANAGEMENT – 2

Objective: To help students to understand broad aspects of Safety Management like the PDCA cycle, HSEMS, OHSAS 18001 Management System, Policy, Organising, Planning & Implementing, Evaluation, Action for Improvement, Audit, Safety Culture & Legal aspects of Safety

Unit-1 – Health & Safety Management Systems

Defining an effective safety and health management system - The management models, eg. HSG65, BS 8800, OHSAS 18001, ILO-OSH 2001 - PDCA – ILO-OSH 2001 Safety & Health Management System – OHSAS 18001 HSEMS – OHSAS guidelines – ANSI/AIHA Z 10 standard - Policy – Purpose and importance of setting Policy – Key features and contents of Health & Safety Policy

Unit-2 – Organising for Health & Safety

Organising for Health & Safety - setting goals & objectives – Management leadership – Employee involvement – Concept & significance of Safety Culture – Internal and external factors influencing Safety behavior – Improving safety culture and climate- Improving human reliability – Communication -consultation - Work site Analysis – Review of culture

Unit-3 – Risk Management

Risk Analysis & Risk Management – Principles of hazard identification – Hazard analysis & risk control – Quantitative & qualitative assessment - Carrying out a Risk assessment - Preventive and protective measures – Process safety management - Safe Systems of Work – Permit to Work Systems

Unit-4 – Monitoring Health & safety

Active & Reactive monitoring – Investigating Incidents – Fault Tree Analysis – Failure Modes and Effects Analysis – Recording & Reporting incidents - LTI – LTIFR - Safety Training – Safety Auditing - Performance Review

Unit-5 – Principles of Management

Functions of Manager – Planning – Organising – Staffing – Leading – Controlling – Leadership – different leadership styles - the importance of vision, the motive to lead, and organizational climate - various aspects of effective leadership, to include influence, follower motivation and effective followership - role of ethics and values in guiding organizational behavior - methods used to effectively manage groups and teams.

Paper – VII - Fire Technology

COURSE OBJECTIVE This course will enable the students to various fire prevention methods, fire protection method and the modern equipments used for fire prevention and fire protection. That includes working principle, design and construction, operation, maintenance, transportation and safe custody etc. with appropriate practical in related equipments and systems.

UNIT -1 - Hose

Types of hose - Characteristic - Frictional loss - Material used - Cause and prevention of mildew - Causes and prevention of shock - Causes and prevention of rubber acid - Care and maintenance - Types of hose fittings - Couplings - Component parts of inter locking couplings - Suction coupling wrenches - Branches, nozzles and branch holders - Foam making branches - Nozzles - Collecting head and suction hose fittings - Breechings - Adapters - Maintenance of hose fittings

UNIT -2 - Rope, Lines, knots and ladders

Introduction - Manufacturing materials - Types of ropes and size - Cordage - Causes of deterioration of ropes and lines - Different type of knots - Different type of lines - Purpose of knots - Ladders -Introduction - Hook ladder, escape ladder, turn table and extension ladder - Hook ladder belts

UNIT – 3 - SCBA and foam making equipments

Introduction - Physiology of respiration - Effects of respiration - Essential fetchers of BA set - Description and technical details - Care and maintenance various BA sets - Advantage and disadvantage of various BA set - Foam & foam making equipments - Definition - Different type of foam concentrate - Storage - Characteristics - Foam branch and its type - Mechanical foam generator

UNIT -4 - Pumps, primers, tenders and water relays

Introduction, definition - Different types of pumps - Different types of primers - Working principle of various pumps primers - Maintenance and troubleshooting - Testing of pumps - Advantages and disadvantages - Water relay system - Open circuit system - Closed circuit system - Different type of tenders and Fire alarm system - Operation and maintenance of various tenders - Water, foam, Co₂, DCP and emergency tenders

UNIT -5 - Fire Alarm

Introduction of Electronics and Electricity- Semi conductor Physics - Circuit Control And Protective Devices - Transistors - Principles of fire detectors - Parts of fire alarm unit - Control panel - Type of detectors - Automatic fire detection - Classification of detector - Control and indicating equipment - Trouble shooting and maintenance - Intruder alarms

Fire safety procedures

Fire Risk assessment – Control measures to minimize the risk of fire – storage of flammable liquids & gases – structural measures for preventing spread of fire and smoke – electrical equipment to use in flammable atmosphere – Means of escape – Fire Marshal – Fire Drills – Building Plans

Paper VIII - Safety Management and Law

OBJECTIVE

The purpose of this course is to make the students to understand the handling of various safety management techniques and planning's to achieve complete safety. It also teaches different safety laws, acts and statutory matters concern with safety department.

UNIT - 1

Introduction - Safety Management - Roll and functioning – Risk - Hazard

UNIT - 2

Risk assessment - Risk control - Risk avoidance - Risk retention - Risk transfer - Risk reduction - Risk - assessment process - Probabilistic Risk assessment

UNIT - 3

Damage control - Total loss control - System safety analysis - Hazard operability study - Failure mode effect analysis - Fault tree analysis - Job safety analysis

UNIT - 4

Emergency planning and disaster management - Natural calamities - Fire explosion - Toxic gas release -Industrial explosion - On site emergency plan - Off site emergency plan - Mock drills - Compensations and fire insurance

UNIT - 5

Laws on safety (Introduction and objectives): Factory act - Workmen compensation act - Indian boilers act - Indian Electricity act and rules - Indian explosives act - Gas cylinder rules - Environmental protection act - Insurance laws

Paper – IX - Industrial Project work

OBJECTIVE

Student will undergo one month in-company training programme for the purpose of study, familiarization and preparation of industrial safety and fire management system.

Paper – X – Practical

DRILLS AND PRACTICAL SCHEDULE

OBJECTIVE

To provide entire practical related with safety and fire management according to the syllabus prescribed.

UNIT-1

Drills - Squad drill - Hose drill - Knots and lines - Hydrant drill - MTU drill - Ladder drill - Picking up drill

UNIT-2

Practical training - First Aid Fire Fighting Equipments - Breathing apparatus - Hydraulic pressure testing - Industrial exposure training

UNIT-3

Practical training - Personal Protective equipment - Fire alarm -First aid - Smoke chamber/confined space - Industrial exposure training

NOTE:

- 1) Drills and practical training will continue throughout the year according to unit wise.
- 2) Industrial exposure training may conducts at various industries and organizations.

Annexure – 1

REFERENCE BOOKS AND JOURNALS REQUIRED FOR THE PROGRAMME

1. Industrial Safety Management N.K. Tara Fdar, K.J Tara Fdar
2. Fire Service First Responder Daniel Limmer, Michael Grill, IFSTA Senior Editor-Michael A Wieder
3. Safety A personal Focus David L Bever
4. Fire Equipment David L. Bever
5. Industrial Safety National Safety Council of India
6. Hand book of fire and Explosion Protection Engineering Principles for Oil, Gas, Chemical and Related Facilities- Dennis. P. Nolan, PE
7. Engineering Chemistry Jain & Jain
8. Industrial Management Jain & Bawa
9. Thermodynamics Aroma & Domkundwar
10. Hand book of Hazardous Air pollutions Dennis P Nolan P.E
11. Remediation and Treatment Technologies. Dennis P Nolan P.E
12. Fire Technology R.S. Gupta
13. Major hazard control Inter National Labor Office
14. Encyclopedia of occupational health and safety Inter National Labor Office
15. Safety, health and working condition in the transfer of technology Inter National Labor Office
16. Radiation protection Inter National Labor Office
17. Fire service Manual (4 volumes)
18. TAC and NBC rules. Kerala Fire Force
19. Publications from Inter National standard organizations like ISO, OSHA, IOSH, NEBOSH etc.
20. Industrial Safety, Health and environment Management systems. RK Jain and Sunil S Rao
21. Industrial Safety Management – LM Deshmukh
22. ILO Convention – 155 & Recommendation – 164
23. Indian Factories Act 1948
24. Management of International Health & Safety – Roger Passey
25. Construction Safety Hand Book – K Muraleedharan Pillai
26. ILO Convention – C-167 – Construction
27. Safety Management in the construction Industry - Guide Published by National Institute of Construction – Second edition – 2005
28. ILO Convention – 155 & Recommendation – 164
29. ILO Encyclopedia of occupational health and safety