Curriculum
for

One Year Diploma Programme
in

FIRE AND SAFETY MANAGEMENT

(Institute of Entrepreneur Development, UP)

Prepared by:

Curriculum Development Centre
National Institute of Technical Teachers Training and Research
Sector 26, Chandigarh - 160 019

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1. PREFACE

The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Academic institute play an important role in meeting the requirements of trained manpower for different organizations. The initiative has been taken by Institute of Entrepreneur Development, Uttar Pradesh to design a one-year diploma in Fire and Safety Management.

In order to meet the requirements of future manpower, we will have to revamp our existing education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programme has been designed by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However, best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the IED, UP to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

2. ACKNOWLEDGEMENTS

We gratefully acknowledge the assistance and guidance received from the following persons:

i) Director, Institute of Entrepreneur Development, Lucknow, Uttar Pradesh for taking keen interest in the design of this curriculum.

ii) Director, National Institute of Technical Teachers' Training and Research, Chandigarh for his support and academic freedom provided to Curriculum Development Centre.

iii) All the participants from industry/field organizations, academic institute for their professional inputs during curriculum workshops.

iv) Faculty from different departments of NITTTR, Chandigarh for design of curriculum.

Coordinator

3. SALIENT FEATURES OF DIPLOMA PROGRAMME

1) Name of the Programme:	Diploma Programme in Fire and Safety Management
2) Duration of the Programme:	One years (Two Semesters)
3) Entry Qualification:	10 +2
4) Intake:	As prescribed by the IED, UP
5)Pattern of the Programme:	Semester Pattern
6) NSQF Level:	Level - V
6) Skill Development:	More than 70 % practice oriented
7) On site / In-house Training:	Six weeks
8) Project Work/Internship:	Project Work / Internship has been included in the curriculum to enable the students to familiarize with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

4. EMPLOYMENT OPPORTUNITIES

Diploma holders in Fire and Fire Management can find employment in following divisions:

Fire Fighters, Other; Fire Fighters, other includes all other Fire Fighters engaged in extinguishing or controlling fire not elsewhere classified.

Fire Inspectors, Other; include all other associate professionals engaged in government, industrial and other enterprises, who inspect different structures to ensure compliance with central/state government laws and with approved plans, specifications and standards, or inspect fire prevention systems and investigate fire sites to determine cause of fire not elsewhere classified.

While in employment, the following areas of activity in different organizations (industry and service sector) are visualized for diploma holders in Fire and Safety Management:

As the scope of this course is gradually increasing based on the demand of firefighting personnel, more and more candidates are opting to earn a Diploma in Fire and Safety Management after the completion of 12^{th} grade. Candidates after passing out from the program have wide scope in the department of armed forces, MNCs and public sectors, industries, construction firms, Oil companies etc. hired as safety supervisors and trainers, wherever the risk of accidents and need of security measures are more. The overall goal of the program is training the students in getting a broader view of the situation at hand and being able to appropriately deal with conditions of fire, preventing accidents and ways of controlling mishaps.

Diploma in Fire and Safety Management course prepares the students to deal real-life situations with strength and courage without panicking as well as safeguarding the lives of others. As the issue of safety is one of the primary and important aspects in the present time, candidates after the successful completion of the course, find it lucrative to find a job in private and government sectors.

They can work for Refineries, Industries, Electricity boards, Fire safety Training Institutes, Armed forces, Chemical plants and other such guiding them towards safety.

Below is listed description and profile of jobs which can be chosen by the graduates after the completion of the course which are as follows:

Safety Supervisor	Work includes under the guidance of the regional safety manager, carry on the necessary steps in order to ensure the safety of staff, company and people.
Fireman	Responding at the time of emergency, save lives during fire, providing emergency services and medical assistance.
Safety Officer	Developing and monitoring hazardous situations, provide safety measures and develop measures for public safety.
Safety Instructor	Work involves providing training, designing new methods and developing better training, monitor individual as well as organizational performance.
Instructor	Train the subordinates and staff to carry on rescue operations.
Station Master/ Supervisor	Management and monitoring the activities of staff and subordinates.
Fire Officer	Supervise all other departments of safety. Assure all the rules are followed with care
Safety Consultant	Inspection of workplaces, design programs to enhance safety measures.

5. **LEARNING OUTCOMES**

After undergoing this programme, students will be able to:

1.	Apply safe working practices.
2.	Comply environment regulation and housekeeping.
3.	Interpret & use company and technical communication
4.	Understand and apply the concept in productivity, quality tools, and labour welfare legislation in day to day work to improve productivity & quality.
5.	Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
6.	Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
7.	Utilize basic computer applications and internet to take benefit of IT developments in the industry.

Specific Learning Outcomes:

- Select suitable chemicals (industrial, inflammable liquid) usable on the workplace.
- Identify, select & execute the application of different types of extinguisher, hose &
- hose fittings.
- Select and prepare the hydrant and pump system for proper application.
- Plan and execute the concept of hydraulics in work place.
- Select and categorize electrical hazard and risk & its mitigation.
- Methods of using ladder in practical field.
- Select the BA set and its application in appropriate place.
- Identify and use of small and special gears.
- Plan and execute elementary treatment at any incidental spot.
- Utilization of knots and hitches in different special job and fire.
- Plan and execute to up lift various gears with proper techniques. Introduction to
- Hazard and Risk evaluation & the proper method of rescue & F.F.
- Analyze the concept of accident caused and prevention, accident investigation,
- analysis and safety management.
- Select & apply provisions related to safety, health and welfare in respect of Factory
- Act, 1948.
- Assessment of available resources and their proper use.
- Interpret appropriate techniques of CPR.

- Identify the importance of lighting, ventilation, work related stress and its
- measurement.
- Plan and execute fixed firefighting installations for their effective utilization.
- Select and use PPE, its care and maintenance.
- Select Automatic Fire Detection cum Alarm System to plan their effective utilization.
- Plan and execute fire station administration.
- Identify communication system in different organization and their scope of use.
- Accustomed with different fire situations and firefighting using extinguishers.
- Plan and execute disaster response practices, IRS/JRT and salvage technique.
- Select and apply correct rescue method.
- Categorize building construction that can ensure fire and life safety.
- Plan and execute fire protection measures based on construction and occupancy.
- Plan and survey Airport & Aircraft, port and ship for rescue system and fire fighting
- system on it.
- Identify occupational hazards associated with different dangerous chemicals, dust,
- gases, mist, vapours etc. to plan and execute rescue operations in these cases.
- Observed safety precautions while working at height, confined place and work
- permit system.
- Identify the characteristics of various fire suppression agents including water.
- Understand safety in manual and mechanical handling of materials.
- Analysis hazard evaluation and risk analysis exercise.

6. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES

The following curriculum areas have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Apply safe working practices.	Fire & Safety Procedures Fire & Safety Mechanisms – I Fire & Safety Mechanisms – II Fire & Safety Workshop
2.	Comply environment regulation and housekeeping.	Industrial, Construction and Environmental Safety
3.	Interpret & use company and technical communication	Fire & Safety Mechanisms – I Fire & Safety Mechanisms – II
4.	Understand and apply the concept in productivity, quality tools, and labour welfare legislation in day to day work to improve productivity & quality.	Fire & Safety Procedures Fire & Safety Workshop Emergency Planning & First Aid
5.	Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	Fire Engineering and Science Risk Management & Hazard Control System
6.	Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	Project Work / Internship On site / In house Training Seminar
7.	Utilize basic computer applications and internet to take benefit of IT developments in the industry.	Fire & Safety Procedures Fire & Safety Mechanisms – I Fire & Safety Mechanisms – II

7. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Hours Per Week in each Semester	
		Semester I	**Semester II**
1.	Fire Engineering and Science	8	-
2.	Risk Management and Hazard Control System	8	-
3.	Fire and Safety Procedures	7	-
4.	Fire and Safety Mechanisms I	7	-
5.	Fire and Safety Workshop	10	-
6.	On site / In house Training Seminar		2
7.	Industrial, Construction and Environmental Safety		6
8.	Emergency Planning and First Aid		6
9.	Fire and Safety Mechanisms II		6
10.	Project Work / Internship		20
Total		**40**	**40**

STUDY & EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN FIRE AND SAFETY MANAGEMENT

FIRST SEMESTER :

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	Fire Engineering and Science	2	-	6	5	25	25	50	50	3	50	3	100	150
1.2	Risk Management and Hazard Control System	2	-	6	5	25	25	50	50	3	50	3	100	150
1.3	Fire and Safety Procedures	1	-	6	4	25	25	50	50	3	50	3	100	150
1.4	Fire and Safety Mechanisms I	1	-	6	4	25	25	50	50	3	50	3	100	150
1.5	Fire and Safety Workshop	-	-	10	5	-	40	40	-	-	60	3	100	100
Total		**6**	-	**34**	**23**	**100**	**140**	**240**	**200**		**260**		**460**	**700**

On site / In-house Training : After First semester, students shall undergo Training of 6 Weeks.

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	On site / In house Training Seminar	-	-	2	1	-	40	40	-	-	60	03	60	100
2.2	Industrial, Construction and Environmental Safety	2	-	4	4	-	40	40	-	-	60	03	60	100
2.3	Emergency Planning and First Aid	2	-	4	4	25	25	50	50	3	50	3	100	150
2.4	Fire and Safety Mechanisms II	2	-	4	4	25	25	50	50	3	50	3	100	150
2.5	Project Work / Internship	-	-	20	11	-	50	50	-	-	150	03	150	200
Total		**6**	-	**34**	**24**	**50**	**180**	**230**	**100**		**370**		**470**	**700**

9. DETAILED CONTENTS

1.1 FIRE ENGINEERING AND SCIENCE

L	T	P
2	-	6

RATIONALE

This course provides a multidisciplinary introduction to fire dynamics covering fundamentals applicable to fire safety engineering in the built environment, manufacturing, and process industries. The course covers fundamental fire science and basic fire models; as well as the principles of fire safety engineering.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Discuss the role of fire science and engineering in the design of engineering systems
- Manipulate concepts related to the quantification of fire hazards and processes
- Perform basic fire engineering calculations, recognizing the associated limits of applicability
- Critically appraise simple fire engineering designs

DETAILED CONTENTS

Unit I

Physics of Fire: Matter, Physical Properties of Matter Related to Fire, Density, Relative Density, Vapour Density, Pressure, Thermal Expansion, Gas Laws (Boyles Law, Charles Law), PH Value, Iodine Value, Insulation, Solubility, Melting Point, Boiling Point, Fire Resistance, Fire Rating, Flash Point, Fire Point, Spontaneous Ignition Temperature, Flammability / Explosive Range

Unit II

Chemistry of Fire: Combustion, Factors involved in Combustion, Fire Triangle / Fire Tetrahedron, Types of Combustion, fire spread -Products of combustion and their effects on human life - vapour clouds –flash fire –jet fires –pool fires –unconfined vapour cloud explosion, shock waves -auto-ignition –boiling liquid expanding vapour explosion.

Unit III

Characteristics of Fire: Energy changes - Physical Properties of Matter Related to Fire - Combustion - Temperature - Specific heat capacity - Catalyst – Neutralization – Sublimation - Heat of decomposing - Chemical reaction - Exothermic reaction and endothermic reaction - Transmission of heat

Unit IV

Regulations: Section 38 of Factories 1948 – Overview of Indian explosive act, Gas cylinder rules, SMPV Act, Indian petroleum rules, PNGRB, Environmental Protection act - Overview of ISO 45000, BIS Codes related to Fire Fighting Equipment, Installation, Maintenance & Testing

Unit V

Case Studies – Flixborough - Mexico disaster - Pasedena Texas - Piper Alpha – Peterborough; Bombay Victoria dock ship explosion – Bhopal Gas Tragedy. Fire in Sri Krishna Aided Higher Secondary School in Kumbakonam, Tamil Nadu; Fire in multi-storey market in Calcutta; Uphar Cinema Fire in New Delhi; Fire in AMRI Hospital in Calcutta; Fire in Brand India Fair at Meerut; Fire in Shree Leela Footwear Factory in Agra; Fire during Religious Congregation ar Baripada, Orissa; Dabwali Fire Accident; Puttingal Temple Fire

LIST OF PRACTICALS

1. Analysis and interpretation of data Extract and tabulate given data and express that data in the form of:- a) Graphs b) Histograms and bar charts c) Circular diagrams (pie charts) Obtain median, mean and norm values from given data Extend graphs to:- a) Project values from given data (extrapolate) b) Deduce values from missing data (interpolate)
2. Mechanics Define the SI system of units in terms of basic and derived units Describe and carry out simple calculations involving the equations of motion Describe Newton's Laws of Motion Use vector quantities to find resultant values Apply vector methods to force and motion problems Calculate moments around a fulcrum including the use of levers and parallel force Carry out calculations involving centres of gravity and buoyancy
3. Define the following terms and demonstrate the relationship between them:- a) Density b) Specific gravity c) Pressure in fluids Solve problems involving the terms referred Define "streamline flow"

4. Show how the principle of atmospheric pressure is used in pumping systems either as an aid to flow or as a means of measuring flow Use the laws of friction to calculate energy losses in piped water supplies in relation to pumps, define water power, brake power and efficiency. Carry out basic calculations involving these terms
5. Heat Define and calculate: - a) Specific heat capacity b) Latent heat of vaporisation Apply the use of calculations involving the transfer of heat Calculate linear, superficial and volumetric expansion using the relevant coefficients Apply the Gas Laws to calculations involving changing conditions of heat

RECOMMENDED BOOKS

1. Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986.
2. Gupta, R.S., "Hand Book of Fire Technology" Orient Longman, Bombay 1977.
3. "Accident Prevention manual for industrial operations" N.S.C., Chicago, 1982.
4. DinkoTuhtar, "Fire and explosion protection"
5. Carl Goodson, "Essentials of fire fighting" Fire protection publications;5th edition
6. Pann Well, "Fire engineering's skill drills for Fire Fighter", Pann Well; 1st & 2 nd edition.

Note: This subject contains five units of 20 % equal weight age with more than 60% hands on practice sessions for effective skill development.

1.2 RISK MANAGEMENT AND HAZARD CONTROL SYSTEM

L	T	P
2	-	6

RATIONALE

This course introduces the student into the process for conducting a hazard analysis and developing a risk management plan to support safe and effective system requirements. Risk management is the application of systematic thinking to the problem of making system safer and more effective.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Identify and describe the risk management concept, including objectives, the five step risk management process, types of risk assessment, and key terms
- Discuss hazard identification to include causal factors of accidents
- Understand hazard identification techniques and hazard assessment process
- Develop control operations and risk decisions
- Implement control options, including dissemination and responsibilities Discuss supervision and evaluation

DETAILED THEORY CUM PRACTICAL CONTENTS

Unit I

Introduction: Introduction, hazards, hazard identification & monitoring, different stages of process life time – Risk/Hazard reduction approaches and inherent safety Review-Selection of Risk/Hazard evaluation techniques - Factors influencing the selection of hazard evaluation techniques - decision making process - hazard review for management changes - combined

Unit II

Hazard Evaluation Techniques I - Non Scenario Based Checklist analysis, safety review, relative ranking, Fire Risk Audit

Unit III

Hazard Evaluation Techniques II – HIRA & C (Hazard Identification, Risk Assessment & Control w.r.t. Fire - Scenario Based Fault Tree Analysis & Event Tree Analysis –what-if analysis/checklist analysis -Failure Mode and Effect Analysis (FMEA)

Unit IV

Risk Reduction Methods/Controls: Elimination, Substitution, Engineering Control, Administrative Control, PPEs

Unit V

Project Work related to: HIRA & C; Fire Risk Audit; Emergency Management Plan.

RECOMMENDED BOOKS

1. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Commonwealth Science Council, UK
2. Hazop and Hazon, by Trevor A Klett, Institute of Chemical Engineering.
3. "Guidelines for Chemical Process Quantitative Risk Analysis", second edition, Centre for Chemical Process safety, AICHE, 2000
4. Guidelines for Hazard Evaluation Procedures, Third Edition,Centre for Chemical Process safety, AICHE 2008

Note: This subject contains five units of 20 % equal weight age with more than 60% hands on practice sessions for effective skill development.

1.3 FIRE AND SAFETY PROCEDURE

L	T	P
1	-	6

RATIONALE

It's crucial that any working environment complies with all building regulations, to ensure the safety of their employees and the protection of their building. Fire safety should always be taken seriously, and there's plenty of ways to easily prevent the event of a fire as much as possible. This course describes the basic fire and safety procedures.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Apply safe working practices
- Comply environment regulation and housekeeping
- Identify and Select suitable chemicals (industrial, inflammable liquid) usable on the workplace.
- Identify, select & execute the application of different types of extinguisher, hose & hose fittings.
- Select and prepare the hydrant and pump system for proper application.

DETAILED THEORY CUM PRACTICALCONTENTS

Unit 1

Responsibilities of Fire Safety Supervisor /Fireman, Topography, Turnout, First Step to taken after reaching at Accident/Fire spot, Analyzing the scenario, Deciding action plan

Unit 2

Fire Classification, Principles of Fire Extinction/Suppression, Fire Causes & Preventive Measures, Hazards in Fire, Category of Fire Protection Equipments & Systems (Active & Passive); Portable Fire Extinguishers: Type, Construction, Application & Maintenance, Fixed/Modular Fire Extinguishers, Fire Detection System, Fire Beaters, Fire Hooks

Unit 3:

Hydraulics & Modes of Water Supply, Fire Pumps, Hoses (Types & application), Foam & Foam making equipment, Hydrant/Landing Valves, Couplings (Male & Female), Branches: Types & application, Hose Reels

Unit 4:

PPEs & other Safety Gadgets: Firemen Helmet, Firemen Axe, Gas Masks, Safety Goggles, Safety Shoes, Heat/Flame Retardant Gloves

Unit 5:

Upkeep & Maintenance of Fire Protection / Detection Equipment & System

RECOMMENDED BOOKS

1. Fire Safety In Building By: V.K. Jain Publishers: New Age International Publishers Edition: 2nd Edition Year of Publication: First Print – 1996 Re-print – 2002
2. Electrical And Mechanical Service In High Rise Buildings ,Design and Estimation Manual By: A.K. Mittal Publishers: CBS Publishers &Distributors Edition: 1st Edition Year of Publication: 2007
3. Design of Water Based Fire Protection Systems By: Robert M. Gagnan Publishers: South Western Dujebury Edition: 1st Edition Year of Publication: 2006
4. Industrial safety management By: L.M. Deshmukh Publishers: Tata Megraw Hill ,New Delhi Year: 2006 Edition: First
5. Industrial safety health and environment Management System By: R.K. Jain & Sunil S. Rao Publishers: Khanna Publishers Year: 2008 Edition: Second
6. Electrical Safety, Fire Safety Engineering and Safety Management by: Rao.S /Saluja H.L. Publishers: Khanna Publishers Year: 1998 Edition: First edition

Note: This subject contains five units of 20 % equal weight age with more than 60% hands on practice sessions for effective skill development.

1.4 FIRE AND SAFETY MECHANISM - I

L	T	P
1	-	6

RATIONALE

Fire safety is the set of practices intended to reduce the destruction caused by fire. Fire safety measures include those that are intended to prevent ignition of an uncontrolled fire, and those that are used to limit the development and effects of a fire after it starts. Fire safety measures include those that are planned during the construction of a building or implemented in structures that are already standing, and those that are taught to occupants of the building.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Describe different types of medical situations and related medical first-aid. Medical first-aid: Shock-sign and symptoms, asphyxia-sign and symptoms, wounds and hemorrhage, scalds and frost bites, heart attack, sprain; fractures and dislocation, snake bites, resuscitation.
- Evaluate surroundings and emergency situation correctly.
- Assess the condition of the casualty in order to identify medical emergencies and trauma conditions.
- Identify the various hazards and risks in the workplace. Hazards and Risks: Fire, electric short circuit; electric shock and electrocution, Medical emergency, Inflammable & toxic liquid/ gases, accidents, flooding, oil and lubricant spills in the premises, malfunctioning elevators; escalators; staircase and ladders, ventilation and suffocation, improper use of safety gear and non-adherence to safety norms, hygiene and sanitation.
- List the leading causes of injuries.

DETAILED THEORY CUM PRACTICAL CONTENTS

Unit 1

National Building Code of India 2016, Part IV (Life and Fire Safety)

Unit 2

Passive Fire Protection: Stages of Fire Development, Fire Spread, Fire Growth & Curves, Protected Escape Routes, Load Bearing Capacity, Integrity & Insulation, Fire Stopping, Fire Barrier, Fire Rated Compartments, Ceilings, Glazing, Duct

Unit 3:

Fire Load Calculation: Methodology of Designing of Fire Protection System: Fire Extinguishers, Fire Detection System, Fire Hydrant System.

Unit 4:

Search & Rescue Procedures, Method used to Search & Rescue trapped person, Obtain instruction about Rescue situations, Assess the situation, Plan Rescue operations, Ensure prompt communication, Suitable Rescue equipments, Analyze floor plan, Apply rescue techniques, Rescue using fall protection equipments.

Unit 5:

Accident Causation, Key component of safety triad, Five components that makes accident chain, Accident prevention measures, Safety management system, State personal protective equipment, Safety warnings, Importance of mock drill, Demonstrate safety steps, Ensure self and others safety.

RECOMMENDED BOOKS

1. Safety Management in The Construction Industry Publishers: A Guide Published by National Institute of Construction Year: 2005 Edition: Second edition
2. Construction Technology by: Grundy. J. Publishers: Viva Books Pvt. Ltd. Year: 2006 Edition: First Edition
3. Fire Protection and Prevention By: Brendra Mohan San Publishers: UBS Publishers & Distributors Pvt Ltd. Edition: 1st Edition Year of Publication: 2008
4. Hand Book of Fire Technology By: R.S. Gupta Publishers: Orient Longman Publishers Edition: 2nd Edition Year of Publication: 2005
5. Hand Book of Fire and Explosion Protection Engineering By: Dennis P Nolan Publishers: Crest Publishing House Edition: 1st Edition Year of Publication: 2007

Note: This subject contains five units of 20 % equal weight age with more than 60% hands on practice sessions for effective skill development.

1.5 FIRE AND SAFETY WORKSHOP

L	T	P
-	-	10

RATIONALE

Fire safety is the set of practices intended to reduce the destruction caused by fire. Fire safety measures include those that are intended to prevent ignition of an uncontrolled fire, and those that are used to limit the development and effects of a fire after it starts. This workshop will give hands on experience to implement it in actual situation.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Participate with team members in mock fire and emergency drills.
- Follow established protocol for working in a team during emergency situations.
- State the factors which can affect work performance.
- State information about licensing and certification requirements for driving vehicles and providing emergency care.
- State the implications of change in the workplace on own job such as introduction of new processes; introduction of new personnel; introduction of new technology including new communication systems; implementation of new work practices and services; building restructure, etc. State the implications of external change on the organization such as at an international, national or state/territory level changes in society, changes to legislation, changes to organizational policies and procedures; community expectations; political changes
- State various communication modes for diverse situations.

DETAILED CONTENTS

Unit 1

Mock Drill, Aim of Mock Drill, Reasons of Mock Drill, Fire Fighting Command, Water Relaying, Types of Relay, Merits & Demerits of Relay, Definition of Fire Pump, Types of Fire Pump, Mechanism of Fire Pump, Cooling System

Unit 2

Factors which can affect work performance, Potential effects of non-meeting commitments

Unit 3:

Various communication modes, Operational & non-operational communication process, Effective non-verbal communication techniques

Unit 4:

Effective verbal communication techniques, Group communication techniques, Apply written communication skills

Unit 5:

Inspect communication equipments, Ensure instructions received are clearly understood, Seek response from other members, Receive fore call with alertness, Follow organizational procedures, Identify organizational priorities, Deal with conflict in calm manner.

LIST OF PRACTICALS

1. Carry out tasks to ensure safety of workplace in line with organizational procedures and within limits of authority
2. Keep emergency and escape routes free from obstructions
3. Report violation to appropriate authority in a timely manner where violation is not addressable within limits of own authority.
4. Wear personal safety gear and clothing as per organizational procedure
5. Check violators of defined safety and security instructions and report violations
6. Report to superiors and emergency service organizations for assistance in the event of emergencies
7. Assess and respond for life safety of self and others
8. Practice safety steps in an emergency
9. Use body protection and respiratory protection gear
10. Ensure self and other's safety keeping in view basic industrial safety management

RECOMMENDED BOOKS

1. English communication – By- Orient Black Swan

2. Fire Protection And Prevention By: Brendra Mohan San Publishers: UBS Publishers & Distributors Pvt Ltd. Edition: 1st Edition Year of Publication: 2008

3. Guidelines for the Establishment of Safety Management System at Construction Worksites

4. Risk assessment- A Practical Guide, 1993, Institution of Occupational Safety and Health, United Kingdom

Note: This subject contains five units of 20 % equal weight age with more than 60% hands on practice sessions for effective skill development.

2.1 ON SITE OR IN HOUSE TRAINING

L	T	P
-	-	2

RATIONALE

On site or In house training will improve skills with specific hardware, software, applications or social media. It will also help the diploma student to understand how certain technologies are used in specific industries or companies.

LEARNING OUTCOMES

After undergoing this training, students will be able to:

- Develop Professional behaviour
- Develop Project related skills
- Gain experience to add to resume
- Improve confidence, competency in specific areas
- Expand network with company or industry

2.2 INDUSTRIAL, CONSTRUCTION AND ENVIRONMENTAL SAFETY

L	T	P
2	-	4

RATIONALE

This course will enable the students to adequately use the management tools that will allow them to structure a Safety, Environment and Occupational Health plan suited to the project, complying with the local laws and regulations in force. The objective of this course is to train and motivate students in maintaining and improving the quality of the environment and preventing and abating environment pollution.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain formal and informal procedures of basic industrial safety management.
- Identify various safety signages and warnings.
- Ensure self and other's safety keeping in view basic industrial safety management
- Check violators of defined safety and security instructions and report violations
- Operate equipment safely to support communications as per organizational policies and procedures.

DETAILED CONTENTS

Unit 1

Industrial Safety: Overview of Industrial Safety Management, Safety w.r.t. Plant & Machinery, Safe Working Practices, PPEs (Personal Protective Equipments), Safety in Transportation and Automotive Equipment, Mechanical Hazards, Chemical Hazards, Safety in Hazardous Areas, Safe Work Permit System.

Unit 2

Environmental Safety: Pollution, Environment Pollutants, Energy, Man & Environment, Energy Conservation, ETP, STP.

Unit 3

Hand tools and Power tools - Safety while using Grinding stone - Welding and gas cutting safety – Identification of Dangerous points - Lubrication Safety-Safety in Cold Forming and Hot Working of Metals.

Unit 4

Hazardous waste management in India-waste identification, characterization and classification-technological options for collection, treatment and disposal of hazardous waste-selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic and radioactive wastes incineration and verification - hazards due to bio-process-dilution-standards and restrictions –recycling and reuse.

Unit 5

Responsibilities, Safe Practices at Construction Site, Plant, Machinery, Equipment & Tools, Construction/Project Activities, Excavation, Scaffolding, Platforms & Ladders, Structural Work, Proof/Pressure Testing, Working at Heights, Demolition, Radiography, Safety Awareness & Training

LIST OF PRACTICALS

1. Visit to construction site, Erecting and dismantling scaffolding for single storied , Multi storied buildings ,Demonstration of Safety harness and ladders ,Showing how to use power tools and hand tools safely, Conducting Tool box meeting, Mock drill (Falling from height) ,Awareness about site evacuation plan ,Safe way to material handling ,How to wear personal protective equipments.
2. Demonstration and training how to use breathing apparatus, Emergency evacuation drill,Train students how to rescue employees using emergency rescue equipments inside confined space. With the help of gas detector train students check the level of oxygen and other, Gases in industries, Training of using of window meter to measure speed level of wind, Train students use noise level meter and find out different level of noise of different equipments and teach them how to be safe, Train students how to use personal protective equipment, First Aid training and demonstration.

RECOMMENDED BOOKS

1. Electrical Safety, Fire Safety Engineering and Safety Management By: Rao.S /Saluja H.L. Publishers: Khanna Publishers Year: 1998 Edition: First edition
2. Safety Management In The Construction Industry Publishers: A Guide Published by National Institute of Construction Year: 2005 Edition: Second edition
3. Construction Technology By: Grundy. J. Publishers: Viva Books Pvt. Ltd. Year: 2006 Edition: First Edition

4. Industrial safety management By: L.M. Deshmukh Publishers: Tata Megraw Hill, New Delhi Year: 2006 Edition: First
5. Industrial safety health and environment Management System By: R.K. Jain & Sunil S. Rao Publishers: Khanna Publishers Year: 2008 Edition: Second

Note: This subject contains five units of 20 % equal weight age with more than 60% hands on practice sessions for effective skill development.

2.3 EMERGECNY PLANNING AND FIRST AID

L	T	P
2	-	4

RATIONALE

This course describes emergency procedures and techniques of basic life support for adult, child, or infant victims of airway obstruction, respiratory arrest and/or cardiac arrest. This course will provide working knowledge of AED technology and exposure of first aid/CPR scenarios.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Recognize and use a three step plan of action in an emergency
- Assess appropriate action in a variety of adult, child and infant emergency situations.
- Demonstrate first aid skills in a variety of adult, child and infant emergency situations.
- Demonstrate appropriate and correct usage of AED technology.

DETAILED THEORY CUM PRACTICAL CONTENTS

Unit I

Hazard Communication Safe Handling of hazardous substance- Understanding Material Safety Data Sheet (MSDS) - Use of hazardous and Toxic substance - Storage and Handling - Transportation of Hazardous substance

Unit II

First Aid: Definition & Aim of First Aid, A,B,C of First Aid, DTD (Diagnosis, Treatment & Disposal) of First Aid, Body Structure, Bandages – Roller & Triangular, CPR (Cardio Pulmonary Resuscitation), Management of Wounds, Bleeding, Fractures, Burns, Bites of Animals, Electric Shock, Poisoning, Stretcher: Types & application, Stretcher Formation

Unit III

Emergency Management Plan (On Site & Off Site); Statutory Requirements; Nature, Causes and Consequences of Hazards; Risk Assessment; Preparation of Emergency Management Plan; Infrastructure; Actuation of On-Site Emergency Plan/Declaration of Off-Site Emergency; Testing and Updating of On-Site Emergency Plan; Annexure I - Factories Act Guidelines; Annexure II-Schedule 11 of EP Act; Annexure III- Resource Mobilization Guidelines; Annexure IV-Meteorological Data Format; Annexure V-MSDS as per SCHEDULE 9, Rule 17

Unit IV

First Aid Introduction- Action at Emergency. Principles of First Aid- Shocks : Electrical Shock - Artificial Respiration - Cardio Pulmonary Resuscitation – Chocking Fainting - Poisoning - Open Wounds - Control of bleeding - Burns and Scalds - Heart Attack - Resuscitation. Disorder of respiratory system.Disorder of Circulation.

Unit V

Wound & Bleeding. Disorders of consciousness - Bone, Joint & Muscle injury - Burns & Scalds - Effect of heat &cold - Foreign bodies – Poisoning - Dressing & Bandages - Handling & transport of injured - Emergency First Aid.

RECOMMENDED BOOKS

1. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Commonwealth Science Council, UK
2. Hazop and Hazon, by Trevor A Klett, Institute of Chemical Engineering.
3. "Guidelines for Chemical Process Quantitative Risk Analysis", second edition, Centre for Chemical Process safety, AICHE, 2000
4. Guidelines for Hazard Evaluation Procedures, Third Edition, Centre for Chemical Process safety, AICHE 2008

Note: This subject contains five units of 20 % equal weight age with more than 60% hands on practice sessions for effective skill development.

2.4 FIRE AND SAFETY MECHANISM - II

L	T	P
2	-	4

RATIONALE

Fire safety is the set of practices intended to reduce the destruction caused by fire. Fire safety measures include those that are intended to prevent ignition of an uncontrolled fire, and those that are used to limit the development and effects of a fire after it starts. Fire safety measures include those that are planned during the construction of a building or implemented in structures that are already standing, and those that are taught to occupants of the building.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain the meaning and purpose of aid fire-fighting.
- Describe the elements of fire control like ground cover fire components, vehicular fire components, flammable liquids fire components, flammable gases fire components.
- Describe watch room procedures and mobilization.
- Report fire details on call to control room or fire-brigade team and Raise alarm to personnel in the area using available means such as public address system, word of mouth, loudspeakers, etc.
- Work with Computers
- Use smart phones and mobile applications for fire safety management

DETAILED THEORY CUM PRACTICAL CONTENTS

Unit 1

Electricity & Fire Risks: Electricity and Electrical Conduction, Conduction in solids, liquids & gases, Effects of Electricity, Measurement of Electricity, Resistance of Conductor, Static Charge, Heating Effects of Current, Switch-Gears & Protective Devices, Fire Risks.

Unit 2

Specialized Fire Protection & Safety Equipment / System: Gas Flooding System, Fire Proximity Suit, Fire Approach Suit, Fire Entry Suit, SCBA (Self Contained Breathing Apparatus), Ropes & Knots, Extension Ladders, Hook Ladders, Breaking in Tools, Cutting Away Tools, Rescue Gear Equipments, Lights of Various Kinds, Flameproof Safety Torch, Gas Detectors, Turning Over Tools, Transport Tools, Hydraulic Cutter & Spreader.

Unit 3

IT Literacy: Basics of Computer, Computer Operating System, Word processing and Worksheet, Computer Networking and Internet.

Unit 4

Watch Room, Documents in Watch Room, Fire report, Log book, Capabilities of operator of Control Room, Special Service Call, Report fire detail to control room, Process of securing area, Set up fire-fighting equipments, Measures to control big fire.

Unit 5

Effective use of Smart Phones for emergency handling, Working with Mobile Applications, Handling Mobiles as a tool for handling emergency, Various Mobile Applications for Fire and Safety.

RECOMMENDED BOOKS

1. Electrical Safety, Fire Safety Engineering and Safety Management By: Rao.S /Saluja H.L. Publishers: Khanna Publishers Year: 1998 Edition: First edition
2. Various Internet Resources.

Note: This subject contains five units of 20 % equal weight age with more than 60% hands on practice sessions for effective skill development.

2.5 PROJECT WORK

L	T	P
-	-	20

RATIONALE

Industry Based Project Work / Internship aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course by undertaking a project. The individual students have different aptitudes and strengths. Project work, therefore, should match the individual strengths of students. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Fire and Safety Engineering practices in real life situation.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- Develop necessary skills and implement these for the actual needs of the community/industry.
- Explain the working of industrial environment and its work ethics.
- Explain what entrepreneurship is and how to become an entrepreneur.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need.
- Field work and to achieve real life experience in fire and safety management.

Suggested Areas for Project Work

1. Electrical Safety
2. Energy Conservation
3. Personal Safety in Laboratory
4. Employee's Health and Safety
5. Fire Hazard & Protection
6. Safety for Home
7. Safety on Road
8. Hazard Evaluation Techniques
9. Training in Safety
10. Work Place Safety

11. Industrial Hazards
12. Road Safety
13. Implementing the Health and Safety Management System

10. EVALUATION STRATEGY

10.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation. The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative both Internal and External Evaluation.

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students. In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative

evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

10.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

1. Theory
2. Practical Work (Laboratory, Workshop, Field Exercises)
3. Project Work
4. Professional Industrial Training

1. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects may be caused through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

2. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

3. Project Work

The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

4. In-house or On site Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.

11. RECOMMENDATIONS FOR EFFECTIVE IMPLEMENTATION

This curriculum document is a Plan of Action (PoA) and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process. The document so prepared is now ready for its implementation. It is the faculty of academic institutes who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every course teacher to read them carefully, comprehend and start using them.

(A) Broad Suggestions:

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. Board may make the academic plan available to all academic institutes well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Institutes in turn are supposed to prepare institutional academic plan by referring Board plan.

3. HOD of every Programme Department are required to prepare academic plan at department level referring institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives. Teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period which is made available to them in the academic plan at Board level. With the amount of time to their credit, it is essential for them to use it judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L process effectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available, course to be taught, different learning experiences required to be developed etc.

2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of content to be covered, learning material (PPTs, VCDs, Models etc.) for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. deliver planned subject content, check desired learning outcome and reinforce learning etc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.

4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The tutorial, assignment and seminar can be thought of as terminal outcome of library experiences.

5. Concept and content based field visits with appropriate releases may be planned and executed for such content of course which otherwise is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.

6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.

7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive explicit feed back to every student. It has to be planned properly; otherwise very purpose of the same is lost.

8. The co-curricular activities like camp, social gathering, study tour, hobby club etc. may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time.

10. While imparting instructions, emphasis may be laid on the development of cognitive, psychomotor, reactive and interactive skills in the students.

11. Teachers may take working drawings from the industry/field and provide practices in reading these drawings.

12. Considerable emphasis should be laid in discipline specific contracting and repair and maintenance of machines, tools and installations.

13. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

14. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

15. Students may be given relevant and well thought out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful wage and self employment.

16. A Project bank may be developed by the concerned department in consultation with related Industry, Research Institutes and other relevant field organizations in the state.

12. LIST OF EXPERTS

S. No.	Name, Designation and Affiliation
From Field/Industries/Academic Institues	
1	Mr. Sanjiv Suri, Professor, DTE – UP
2	Dr. Sumit Verma, Chairman, Concept Education Trust
3	Mr. Jasmeet Singh, Ambition Education Trust
4	Mr. Varun Yadav, Lecturer, DTE, UP
5	Dr. K G Srinivasa, Professor, NITTTR, Chandigarh
6	Dr. Rajesh Mehra, Coordinator, NITTTR, Chandigarh