

NSQF Aligned Curriculum for
One Year Post Diploma Programme in
INDUSTRIAL SAFETY

Effective from session
2023-24

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Annual System
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Prepared by:

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**CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION U.P., LUCKNOW
IN CDC MEETING HELD ON 11.08.2023**

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PREFACE

A safe and healthy workplace not only protects workers from serious injury & illness and also protects from property/machinery loss. It also decreases cost towards injury/illness cause due to the unsafe act and condition and unhealthy work place. Safe and healthy work practices reduce absenteeism and increase productivity and quality of products & services as well as raise employee's morale in sustainable way.

To build a safe and healthy work place, the hazards apparently hidden there should be identified by the trained and the competent person. As per the statutory provisions, safety officers in the industries must be trained and competent enough to identify hazards and estimate risk followed by appropriate measure to mitigate them.

Post Diploma in Industrial Safety course is one year full time regular course. After completion of PDIS course, the certificate is issued by the concern Board of Technical Education. PDIS is the essential qualification for appointment of safety officer as per statutory/legal provision for any factories/construction sector/hazardous industry/ port as per applicable Statues. The qualified Safety Officer capable to implement better Occupational Safety & Health standards, OSH Acts/Rules/Regulations and to minimize accidents, injuries and occupational illnesses. In this way, they can help to reduce or eliminate direct and indirect costs involved in various incidents.

ACKNOWLEDGEMENTS

We are thankful to all concerned expert for their efforts and contribution in reviewing and framing the revised curriculum for Post Diploma in Industrial Safety. Special acknowledgment is extended to the Institute of Research Development and Training under Directorate of Technical Education, Government of Uttar Pradesh

LIST OF EXPERT MEMBERS PARTICIPATED/CONTRIBUTED FOR FINALISING THE COURSE CURRICULUM OF PAST DIPLOMA INDUSTRIAL SAFETY			
Sl. No.	Name and Designation	Organisation	Remarks
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4	Smt. Dhanashree Acharakar, Assistant Director (Industrial Hygiene)	Regional Labour Institute, Kanpur	Member
5	Shri. Samir Pandey, Assistant Director (Safety)	Regional Labour Institute, Kanpur	Member
6	Shri. Manoj B Kasulla, Additional Assistant Director (Safety)	Regional Labour Institute, Kanpur	Member
7	Shri Vijay Kumar Dwivedi , Senior Scientific Assistant	Regional Labour Institute, Kanpur	Member
8	Prof. Devendra Kumar Verma, Professor	Institute of Research Development and Training, Kanpur	Chairman
9	Shri Monit Kumar, Research Assistant/Technical Assistant	Institute of Research Development and Training, Kanpur	Member
10	Smt. Shruti Dwivedi, Library Information Assistant)	Regional Labour Institute, Kanpur	Member

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1. SALIENT FEATURES OF POST DIPLOMA COURSE IN “INDUSTRIAL SAFETY”

- 1) Name of the Programme : Post Diploma course in INDUSTRIAL SAFETY
- 2) Duration of the Programme : **One year (Full time) regular offline mode**
- 3) Entry Qualification:
 - (a) Recognized degree in any branch of Engineering
OR
Technology and relevant experience for a period of not less than two years.
OR
 - (b) Recognised Diploma in any branch of Engineering or Technology and relevant experience for a period of not less than 5 Years.
OR
 - (c) Recognised degree in science with Physics or Chemistry and relevant experience for a period of not less than 5 Years.
- 4) Mode of admission : Industry sponsored/non sponsored candidates by merit based upon qualifications, experience and personnel interview /aptitude test.
- 5) Qualification & Experience:
 - i) Educational Qualification: Degree or Diploma in any branch of Technology / Engineering or Degree in Physics or Chemistry as a major Subject from recognized university/ institute
Note:
 - a) B.Sc degree with Physics or Chemistry as a major subject will be considered, only from UGC approved College/University.
 - b) Diploma in Engineering will be considered only from State Board/Directorate/Council of Technical Education or AICTE approved institutes.
 - c) B.E/B.Tech degree will be considered only from AICTE/UGC approved institutes or Universities.
 - ii) EXPERIENCE:
 - a) Practical experience in a Supervisory Capacity or above for a period of 2 years in the case of Degree in Engineering/Technology and 5 years in the case of Diploma in Engineering /Technology or Degree in Physics or Chemistry in the following fields:
Practical experience in Manufacturing, Maintenance or Safety Department in a Factory as defined under The Factories Act, 1948.
Or
Building and other Construction works as defined under The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.
Or
Central/State Government approved Research, Training or Educational Institutes in the field of Industrial Safety
Or
Government Departments entrusted with the Administration of any Safety Legislation in India
Or
Port or Dock work as defined under The Dock Workers (Safety, Health and Welfare) Act,1986. The establishment/ agency should have registration with the respective Port Authority or State Government.

Note:

- a) The qualifying experience shall be from any one of the above mentioned fields.
- b) The foreign country work experience will not be considered.
- c) Experience during training period or probationary period or Apprentice will not be considered as a qualifying experience.

- 6) Intake : As approved by the UP Board of Technical Education, UP
- 7) Pattern of the Programme : Annual Pattern
- 8) Ratio between theory and Practical : 70:30 (Approx.)

Note: As the eligibility criteria for this course requires industrial experience of at least 2 years. Hence, the ratio of 70:30 is decided.

- 9) Student Centered Activities:

A provision of 3-6 periods per week has been made for organizing Student Centered Activities for overall personality development of students. Such activities will comprise of co-curricular activities such as expert lectures, self-study, sports & games, cleaning drive, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits and other cultural activities, disaster management and safety etc.

- 10) Project work

A project work has been included in the curriculum to enable the student get familiarize with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

- 11) Term Work

2- EMPLOYMENT OPPORTUNITIES FOR POST DIPLOMA HOLDERS IN INDUSTRIAL SAFETY

After successful completion of PDIS course, students will be eligible to work as the qualified safety officer required under various labour laws;

1. Factories registered under the Factories Act, 1948
2. MSIHC installation as defined under the MHISC,1989
3. Major Ports as defined under the Dock Workers (Safety, Health & Welfare) Act,1986
4. Construction establishments as defined under the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996

NOTE: The employment opportunities are governed by the prevailing statutes amended time to time

3- LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN INDUSTRIAL SAFETY

After completion of the course, students will be developed as an Occupational Safety and health professionals and will be able to carry out:

- Interpret and apply legislative requirements, standards, and best practices in a variety of workplaces.
- Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards.
- Collect, manage, and interpret information and data to identify trends and issues of occupational safety and health at workplace.
- Design, support, and evaluate health & safety programs and implement procedures using management principles and processes appropriate to the task.
- Affect/manage change by advancing OH&S principles within management systems, cultures, practices, and priorities.
- Apply basic adult learning and assessment principles in the design, development and delivery of training and information on various parameters of OSH within the workplace.
- Set and achieve work priorities and goals individually and as a team member.
- Use a range of effective communication skills and methods to clearly and briefly convey regulatory and technical information and data to designated audiences.
- Use current technologies and applications appropriate to the task.

4- DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

- Safety Management
 - Understand significance of Safety Management and implementation of Safety management systems
 - Apply Principles of accident prevention utilizing benefits of employee participation
 - Design and impart safety education and training for employees
- Safety in Engineering Industry
 - Understand importance of plant and work station design in safety
 - Know significance of housekeeping in OSH
 - Understand concepts of safety in machine guarding, use of tools, material handling and storage
 - Appraise hazard associated with hot and cold work
- Safety in Construction Industry
 - Appraise hazards associated with different construction operations including storage, stacking and handling of materials of construction
 - Understand importance of Safety planning and Evaluate techniques of accident prevention in construction operations
- Appraisal, Analysis, Inspection and Control Procedures
 - Evaluate different plant & equipment safety appraisal & control techniques
 - Appraise Hazard identification techniques and contribute for accident investigation, reporting and analysis
- Safety Legislation and Standards
 - Understand various ILO convention & recommendations and safety Legislation in India
 - Learn & apply provisions made under various Legislations and use relevant standards.
- Industrial Hygiene and Occupational Health
 - Understand and apply concepts of Industrial Hygiene and work physiology including selection criteria & use of personal protective equipment
 - Appraise Application of ergonomics in safety and health management
 - Identify and diagnose Occupational health issues
- Safety in Chemical Industry
 - Evaluate hazards associated with chemical processes and major accident hazard control
 - Assess safety in transportation, storage and handling of hazardous chemicals
 - Contribute for safety aspects during maintenance in chemical plants
 - Understand industrial fire safety aspects
- Environment and Disaster Management
 - Understand elements of Environment Management system and ecosystem
 - Evaluate factors contributing water, air, soil and noise pollution and their effects
 - Apply various techniques of Environmental monitoring and waste management
 - Fulfil Sustainability reporting requirements
 - Identify effects of natural disaster leading to Major Hazards accidents and develop system in line with National Disaster Management Framework

5- ABSTRACT OF CURRICULUM AREAS

Sl. No.	Learning outcome	Subject
1.	Understand significance of Safety Management and implementation of Safety management systems	Safety Management
2.	Apply Principles of accident prevention utilizing benefits of employee participation	Safety Management
3.	Design and impart safety education and training for employees	Safety Management
4.	Understand importance of plant and work station design in safety	Safety in Engineering Industry
5.	Know significance of housekeeping in OSH	Safety in Engineering Industry
6.	Understand concepts of safety in machine guarding, use of tools, material handling and storage	Safety in Engineering Industry
7.	Appraise hazard associated with hot and cold work	Safety in Engineering Industry
8.	Appraise hazards associated with different construction operations including storage, stacking and handling of materials of construction	Safety in Construction Industry
9.	Understand importance of Safety planning and Evaluate techniques of accident prevention in construction operations	Safety in Construction Industry
10.	Evaluate different plant & equipment safety appraisal & control techniques	Appraisal, Analysis, Inspection and Control Procedures
11.	Appraise Hazard identification techniques and contribute for accident investigation, reporting and analysis	Appraisal, Analysis, Inspection and Control Procedures
12.	Understand various ILO convention & recommendations and safety Legislation in India	Safety Legislation and Standards
13.	Learn and apply provisions made under various Legislations and use relevant standards	Safety Legislation and Standards
14.	Understand and apply concepts of Industrial Hygiene and work physiology including selection criteria & use of personal protective equipment	Industrial Hygiene and Occupational Health
15.	Appraise Application of ergonomics in safety and health management	Industrial Hygiene and Occupational Health
16.	Identify and diagnose Occupational health issues	Industrial Hygiene and Occupational Health
17.	Evaluate hazards associated with chemical processes and major accident hazard control	Safety in Chemical Industry
18.	Assess safety in transportation, storage and handling of hazardous chemicals	Safety in Chemical Industry
19.	Contribute for safety aspects during maintenance in chemical plants	Safety in Chemical Industry
20.	Understand industrial fire safety aspects	Safety in Chemical Industry
21.	Understand elements of Environment Management system and ecosystem	Environment and Disaster Management
22.	Evaluate factors contributing water, air, soil and noise pollution and their effects	Environment and Disaster Management
23.	Apply various techniques of Environmental monitoring and waste management	Environment and Disaster Management
24.	Fulfil Sustainability reporting requirements	Environment and Disaster Management
25.	Identify effects of natural disaster leading to Major Hazards accidents and develop system in line with National Disaster Management Framework	Environment and Disaster Management

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6- HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in periods per week			Distribution of Periods in a year			
		L	T	P	L	T	P	Total
1.	Safety Management	2	1	-	80	40	-	120
2.	Safety in Engineering Industry	2	1	2	80	40	80	200
3.	Safety in Construction Industry	2	1	-	80	40	-	120
4.	Appraisal, Analysis, Inspection and Control Procedures	2	1	-	80	40	-	120
5.	Safety Legislation and Standards	2	1	-	80	40	-	120
6.	Industrial Hygiene and Occupational Health	2	1	2	80	40	80	200
7.	Safety in Chemical Industry	2	1	2	80	40	-	120
8.	Environment and Disaster Management	2	1	-	80	40	-	120
9.	Project	-	2	4	-	80	160	240
10.	Term Work	-	-	2	-	-	80	80
11.	Student Centered Activities	-	-	4	-	-	160	160
	Total	16	10	14	640	400	560	1600

7- SCHEME FOR ONE YEAR POST DIPLOMA PROGRAMME IN INDUSTRIAL SAFETY

Annual system

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT (Sessional)			EXTERNAL ASSESSMENT						
						Th	Pr	Total	Th	Hrs	Pr	Hrs	Total		
1.1	Safety Management	2	1	-	-	30	-	30	70	2.5	-	-	70	100	
1.2	Safety in Engineering Industry	2	1	2	-	30	20	50	70	2.5	30	3	100	150	
1.3	Safety in Construction Industry	2	1	-	-	30	-	30	70	2.5	-	-	70	100	
1.4	App. Analysis Insp. And Control Procedures	2	1	-	-	30	-	30	70	2.5	-	-	70	100	
1.5	Safety Legislation & Standard	2	1	-	-	30	-	30	70	2.5	-	-	70	100	
1.6	Industrial Hygiene and Occupational Health	2	1	2	-	30	20	50	70	2.5	30	3	100	150	
1.7	Safety in Chemical Industry	2	1	-	-	30	-	30	70	2.5	-	-	70	100	
1.8	Environment & Disaster Management	2	1	-	-	30	-	30	70	2.5	-	-	70	100	
1.9	Project	-	2	4	-	-	100	100	-	viva	100	-	100	200	
1.10	Term work	-	-	2	-	-	50	50	-	viva	50	-	50	100	
#Student Centered Activities (SCA)		-	-	4	-	-	30	30	-	-	-	-	-	30	
Total		16	10	14	-	240	220	460	560		210		770	1230	

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Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, Cultural Activities and self study etc.

(1) Total session will be of 40 weeks.

(2) Effective teaching will be at least 25 weeks.

(3) Remaining periods will be utilised for revision etc.

(4) Each period will be of one hour.

NOTE:- Award of certification criteria;

-Minimum Passing Marks In Theory 33%

- Minimum Passing Marks in Practical & Viva 40%

- Minimum Passing Marks in sessional 50%

- First Division 60% and above

- First Division with Honors 80% and above

PATTERN OF EXAMINATION:

The examination question papers should covers basic concepts of all topics. The questions covering the length and breadth of the syllabus of the respective papers should be included so that degree of knowledge acquired by the students during a course of study cab evaluated.

TYPES OF QUESTIONS	No. OF QUESTION	MARKING	TOTAL MARKS
Objective	01	10x01 Each	10
Very Short Questions	05	02x02 Each	20
Short Questions	04	04 Each	16
Descriptive & Narrative Type Questions	04	06 Each	24

Essay type long questions prompts students to do selective memory based study thus should be discouraged in order to judge their skill, knowledge and aptitude, the question paper of each papers must be set with following marking system.

8. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 30 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

- i. 10 Marks for general behavior and discipline
(by HODs in consultation with all the teachers of the department)
- ii. 5 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)
 - a) 75 - 80% 2 Marks
 - b) 80 - 85% 4 Marks
 - c) Above 85% 5 Marks
- iii. 15 Marks maximum for Sports/Cultural/Co-curricular activities as per following:
(by In-charge Sports/Cultural/Co-curricular)
 - a) 15 - State/National Level participation
 - b) 10 - Participation in two of above activities
 - c) 5 - Inter-Polytechnic level participation

Note: There should be no marks for attendance in the internal sessional of different subjects.

9.1- SAFETY MANAGEMENT

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RATIONALE

Safety professionals in factory are required to assist the top management in creation and implementation of safety systems for enhancing the Safety of the factory. This requires knowledge of general management techniques and their application to SHE system.

LEARNING OUTCOMES

On successful completion, Students will be able to

- Appraise the Safety management system
- Apply Principles of accident prevention
- Understand and contribute for Planning, organising and directing for safety
- Conduct Safety education and training for employees
- Contribute Employee participation in safety
- Apply Safety management information system
- Introduce and apply national and international SHE management system

DETAILED CONTENTS

1. INTRODUCTION TO SAFETY MANAGEMENT SYSTEM

(15 Periods)

1.1 Management:

Concept, definition, nature and importance. Role and functions of Manager. Elements and functions of Management.

1.2 Management Principles:

General principles of Management. Authority, responsibility & power of management. Span of Control.

Delegation and decentralization of authority.

1.3 Industrial Safety:

History of Safety. Movement in India and abroad. Need for safety, legal, humanitarian, economic and social considerations.

1.4 Safety Management:

Role of management in Industrial Safety. Safety Management - Principles & practices. National policy on Safety, Health & Environment at workplace

2. PRINCIPLES OF ACCIDENT PREVENTION

(12 Periods)

2.1 Definitions:

Accident, Incident, injury, hazard, risk, danger, unsafe acts, unsafe conditions, dangerous occurrences, Type of Accidents, etc.

2.2 Accident Prevention: Theories of accident causation;

H. W. Henrich, Frank bird and Multiple causation theories of accident occurrences. Principles of accident prevention.

3. PLANNING FOR SAFETY (9 Periods)
- 3.1 Planning: Definition, purpose, nature, scope and procedures, etc..
 - 3.2 Strategic planning and process of implementation. Management by objectives and its role in safety. Policy formulation and effective planning for safety.
4. ORGANISING FOR SAFETY (12 Periods)
- 4.1 Organising : Definition, need, nature and principles.
 - 4.2 Organisation for Safety : Organisation structure & safety department
 - 4.3 Safety Officer : Role, responsibility authority & qualifications/attributes.
 - 4.4 Safety Committee : Structure & functions. Line & staff functions in safety department.
5. DIRECTING FOR SAFETY (9 Periods)
- 5.1 Direction: Definition, Process, Principles & techniques.
 - 5.2 Leadership: Roles, functions & attributes of a leader. Leadership styles and safety management
 - 5.3 Communication: Fundamentals, importance, process, types & channels. Essential rules for communication. Two-way communication. Barriers and break-downs in communication. Communication with management, employees & union. Communication and group-dynamics.
 - 5.4 Managerial Communication: A tool for management of frustrations, conflicts & attitudes towards safety & health.
6. SAFETY EDUCATION AND TRAINING (9 Periods)
- 6.1 Training for Safety: Assessment of needs. Design & development of training programmes. Training methods and strategies. Training programmes for new entrants, Evaluation of training programmes.
 - 6.2 Training Programmes: Types of training programmes. Seminars, Conferences, workshop, etc.
7. EMPLOYEE PARTICIPATION IN SAFETY (9 Periods)
- 7.1 Employee Participation: Purpose, nature, scope and methods. Safety committee and Union participation.
 - 7.2 Trade Unions: History of trade unions in India. Role of trade unions in safety and health.
 - 7.3 Safety Promotion & Publicity: Safety suggestion schemes. Safety competitions Safety incentive Schemes. Audio visual publicity, Other promotional methods
8. HUMAN BEHAVIOUR AND SAFETY (12 Periods)
- 8.1 Human factors contributing to accidents.
 - 8.2 Human Behavior: Individual differences. Behavior as function of self and situation. Perception of danger and acceptance of risks. Knowledge and responsibility vis-a-vis safety performance. Maslow, Herzberg, Douglas McGregor's and Adman's equity

theories of motivation and their application to safety. Role of management, supervisors and safety department in motivation.

9. FINANCIAL ASPECTS OF SAFETY (12 Periods)

9.1 Cost of Accident:

9.2 Financial costs- direct and indirect social costs of accidents. Compilation procedures for financial costs. Cost data, Budgeting.

10. SAFETY MANAGEMENT INFORMATION SYSTEM (9 Periods)

10.1 Source of information on safety, health and environment, compilation, Processing retrieval and analysis of information.

10.2 Status and future scope of computer utilization in safety. Health and Environment (SHE) Service in Industries.

11. INTRODUCTION TO NATIONAL AND INTERNATIONAL SHE MANAGEMENT SYSTEM : (12 Periods)

11.1 Total Quality Management and its application to SHE, ISO standard for management systems of Occupational Health & Safety ISO 45001:2018

11.2 National Policy on Safety, Health and Environment at Work Place

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion and literatures review.

MEANS OF ASSESSMENT -

As per BTE, UP guidelines

RECOMMENDED BOOKS

Sl no	Title	Author
1	Industrial Accident prevention	H E Heinrich, Dan Peterson, Nester Roos
2	Accident Prevention Manual (Vol 1 &2) (ISBN: 978-08-7-91235-8)	--
3	Accident Prevention Manual for industrial operations (ISBN: 978-08-7-912024-5)	
4	Supervisor's Safety Manual (ISBN 978-08-7-912288-1)	
5	Loss Control Management	Frank E Bird, Jr & Robert G Loftus
6	Management guide to loss control	Frank E Bird, Jr
7	Techniques of safety management	Dar. Peterson
8	Industrial Safety and environment	A K Gupta
9	A course of Industrial Safety	K U Mistry

Websites for Reference:

- www.dgfasli.gov.in
- www.ilo.org
- www.osha.gov
- www.osha.europa.eu

SUGGESTED DISTRIBUTION OF MARKS

TOPIC NO.	Time Allotted (Periods)	Marks Allotted (%)
1	15	12
2	12	12
3	9	10
4	12	10
5	9	8
6	9	8
7	9	8
8	12	10
9	12	7
10	9	5
11	12	10
TOTAL	120	100

9.2- SAFETY IN ENGINEERING INDUSTRY

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RATIONALE

Various types of machines are in use in factories and advent of newer machines is continued. A qualified safety professional is expected to provide basic guidance in safe use of machines. This paper covers various mechanical and other hazards which are encountered at the work place.

LEARNING OUTCOMES

On successful completion, Students will be able to

- Understand importance of plant design and safety at work station
- Know significance of housekeeping in OSH
- **Contribute for safe machine guarding**
- Understand concepts of safe Material handling and storage
- **Demonstrate safe use of hand tools and portable tools**
- **Appraise hazard associated with hot and cold work**

DETAILED CONTENTS

1. PLANT DESIGN AND SAFETY AT WORK STATION

(12 Periods)

1.1 Plant Layout and design: Types of Plant Layout and design. Elements of consideration.

1.2 Work station design : Concept of workstation and its design for improving safety and productivity.

2 HOUSEKEEPING

(12 Periods)

Significance of housekeeping in OSH. Disposal of scrap and other trade wastes. Prevention of spillage. Marking of gangways and other locations. Use of colour as an aid for good housekeeping. Clean-up campaigns. Cleaning methods. employee assignment, Inspections and check-list. Result of good housekeeping.

3. SAFE GUARDING OF MACHINES

(12 Periods)

Statutory provisions related to safeguarding of machinery and working on/near unguarded machinery. Principles of machine guarding. Ergonomics of machine guarding. Type of guards. Design, Selection, maintenance and repair of guards. Incidental safety devices and methods.

4. MATERIAL HANDLING AND STORAGE

(18 Periods)

4.1 MANUAL MATERIAL HANDLING -Basic principle of correct lifting and handling of materials. Avoidance of excessive muscular effort. Maximum loads that may be carried. Lifting and carrying of objects of different shapes, size and weight. Safe use of accessories for manual handling. Ergonomics of manual handling.

4.2 MECHANICAL HANDLING OF MATERIAL

4.2.1 Lifting machinery: Safety aspects in design, construction, testing and examination. Safety in operation and maintenance. Safety features, safe working load, destructive and

non-destructive testing. The competent persons, duties and responsibilities under the various legislations.

4.2.2 Material handling equipment: Safety in design, operation, inspection and maintenance of power trucks, tractors, Lifts, hoists and conveyors.

4.2.3 Use, care and maintenance of lifting tackles and accessories.

4.3 STORAGE OF MATERIAL –Safety in Stacking, de-stacking and storage of material.

5. HAND TOOLS AND PORTABLE TOOLS (12 Periods)

Safe use of various types of hand tools, Portable power tools and non-sparking tools. Their selection, inspection, maintenance and repair. Main causes of tool accidents and its control. Centralized tool management system.

6. ELECTRICAL HAZARDS (12 Periods)

Dangers from electricity. Safe limits of amperages, voltages. Safe distance from lines. Capacity and protection of conductors. Joints and connections. Means of cutting of power overload and short circuit protection. Earth fault protection. Earth insulation and continuity tests. Protection against over-voltage. Hazards arising out of 'borrowed' neutrals. Flame proof electrical equipments, precautions in their selection, installation, maintenance and use. Control of hazards due to static electricity and lightening.

7. HOT AND COLD WORK (30 Periods)

Introduction to various hot and cold processes in engineering Industry

7.1 HOT WORK

7.1.1 Foundry operation: Flow sheet, safety in use of different types of furnaces and other equipment and machineries used in foundry.

7.1.2 Forging operation: Different forging operation hazards inclusive of heat radiation. Safe work practices of forging operation.

7.1.3 Safety in hot rolling mills operations.

7.2 COLD WORK

Safety in the use of Power Presses (all types), Shearing, Bending, Rolling, Drawing, Turning, Boring, Milling, Planing and Grinding inclusive of the need for selection and care of tools.

7.3 OTHER OPERATIONS

Safety precaution in Welding, cutting, soldering and brazing operation. Selection, care and maintenance of associated equipment, instruments. Safety in finishing operations like Cleaning, Polishing and Buffing. Safety in maintenance of these machines. Safety in various heat treatment methods.

7.4 Role of preventive maintenance in improvement of safety and health in engineering industry.

8. Workplace Environment (12 Periods)

8.1 Illumination

8.2 Noise & Vibration

8.3 Ventilation

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion, practical and literatures review.

MEANS OF ASSESSMENT -

As per BTE, UP guidelines

RECOMMENDED BOOKS

Sl no	Title	Author
1	Accident Prevention Manual for Industrial Operation	National Safety Council 444, North Michigan Avenue, Chicago
2	Industrial Safety: Concepts & Practices	K T Kulkarni
3	A course of Industrial Safety	K U Mistry

Websites for Reference:

- www.dgfasli.gov.in
- www.ilo.org
- www.osha.gov
- www.osha.europa.eu

SUGGESTED DISTRIBUTION OF MARKS

TOPIC NO.	Time Allotted (Periods)	Marks Allotted (%)
1	12	10
2	12	10
3	12	10
4	18	15
5	12	10
6	12	10
7	30	25
8	12	10
TOTAL	120	100

PRACTICAL

(80 Periods)

LIST OF PRACTICALS

SAFETY IN ENGINEERING INDUSTRY

1. Measurement of Illumination Level by LUX Meter.
2. Measurement of number of air changes in a room by Velometer.
3. Measurement of Sound Levels.
4. Measurement of Static Charge/Electricity with the help of Static Charge Meter.
5. Measurement of Vibrations of machines and equipment.
6. Measurement of Insulation Resistance.
7. Continuity test for Electrical Circuits.
8. Earthing continuity test.

9.3 - SAFETY IN CONSTRUCTION INDUSTRY

L T P
2 1 -

RATIONALE

Steep rise in construction activities has brought in several new hazards to which the construction workers are exposed. With the advent of building and other construction worker statutes in the country, this subject has gained importance for those who wish to get more information in this field.

LEARNING OUTCOMES

On successful completion, Students will be able to

- Understand importance of safety in Construction establishments
- Appraise hazards associated with different construction operations
- Apply safety with regard to storage, stacking and handling of materials of construction
- Understand importance of Safety planning and
- Evaluate techniques of accident prevention
- Demonstrate HEALTH AND WELFARE measures

DETAILED CONTENTS

1. MEANING OF SAFETY IN CONSTRUCTION : (12 Periods)
Basic philosophy. Peculiarities and parameters governing the safety in construction. Accidents and hazards - their causes and effects.
2. SAFETY IN CONSTRUCTION OPERATIONS : (30 Periods)
 - (a) Underground Works: Excavation, drilling and blasting, trenching, strutting, tunneling , piling and safety in use and operation of related machinery and equipment.
 - (b) Above Ground Works: Centering, shoring, formwork, concreting wall and floor openings, staircases and railings, structural steel work including welding, cutting, erection, etc. and safety in use and operation of related machinery and equipment.
 - (c) WORKING AT HEIGHTS: High incidence of serious accidents in working at heights. Types of operations. Safety features associated with design, Construction and use of stairways, ladders and rungs, ramps, gangways, floors, Ladders of different types, different types of scaffolds Working on roofs. Other safety requirements while working at heights.
 - (d) Underwater and near water Operations: Well sinking, caissons, cofferdams. Safety in use and operation of related machinery and equipment.
 - (e) Movement of Materials And Personnel's: Heavy/long items. Railway wagons, motor trucks, vehicles, Hazardous materials etc.
 - (f) Special Works: High rise buildings, bridges, roads, railways, asphaltting, pneumatic caissons, electrical installations and lifts, etc.
 - (g) Fire prevention and protection. Structural Soundness.

3. SAFETY IN DEMOLITION OPERATIONS : (18 Periods)

Types, Planning and permit : Precautions prior to demolition. protection of the public. Precautions during demolition. Sequence of demolition operations from safety point of view.

4. SAFETY WITH REGARD TO STORAGE, STACKING AND HANDLING OF MATERIALS OF CONSTRUCTION : (18 Periods)

Hazards. Ill-effects and safety measures with respect to materials such as cement, limes, aggregates, fly-ash, timber, steel, glass, paints, varnishes, petroleum products, explosives, etc.

5. SAFETY PLANNING AND ACCIDENT PREVENTION : (18 Periods)

Site planning and design layout, Policy statement. Safety budget. Safety Organisation. Training, Implementation. Accident investigation and reporting. Monitoring safety performance.

6. HEALTH AND WELFARE : (18 Periods)

Occupational hazards. Occupational diseases. Personal protective equipment. Health and welfare measures. First-aids- facilities and other appropriate measures. Hospitals. Clinics. Special precautions for specific work environments like Underwater, High Altitude and Confined space. Welfare Measures for construction workers. Treatment of injuries and rehabilitation.

7. STANDARD & CODES: (6 Periods)

Indian Standard for construction operation including National Building Code of India and Green Building concept

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion and literatures review.

MEANS OF ASSESSMENT -

As per BTE, UP guidelines

RECOMMENDED BOOKS

Sl no	Title	Author
1	The Chain Tester's Handbook	Chain Tester Association of Great Britain, London
2	Rigging Manual	Construction Safety Association of Ontario, Canada
3	Handbook of rigging for Construction and industrial operation	W E ROSSANGEL
4	Report no 67 (1945)	N C Nelson, Great Britain Medical Research Council Industrial Health Research Board
5	Illumination Engineering Vol. 54	H R Blackwoll
6	Forthlight Roofs	V R. & B.K.S. Ind. J.

Websites for Reference:

- www.dgfasli.gov.in
- www.ilo.org
- www.osha.gov
- www.osha.europa.eu

SUGGESTED DISTRIBUTION OF MARKS

TOPIC NO.	Time Allotted (Periods)	Marks Allotted (%)
1	12	5
2	30	30
3	18	15
4	18	15
5	18	15
6	18	15
7	6	5
TOTAL	120	100

9.4 APPRAISAL, ANALYSIS, INSPECTION AND CONTROL PROCEDURES

L T P
2 1 -

RATIONALE

Measurement, assessment and reporting system are the backbone of successful safety management. This paper covers application of general management system to industrial safety.

LEARNING OUTCOMES

On successful completion, Students will be able to

- Evaluate different plant & equipment safety appraisal & control techniques
- Appraise Hazard identification techniques
- Contribute for Accident investigation, reporting and analysis
- Assess measurement and control of safety performance

DETAILED CONTENTS

1. PLANT AND EQUIPMENT SAFETY APPRAISAL & CONTROL TECHNIQUES (30 Periods)

Objectives, Plant Safety observations, Plant Safety Inspections, Safety Sampling, Safety surveys, Job Safety Analysis, Safety Inventory System, Product Safety, Permit to Work systems, Safety tag systems, Accident/Incident Recall Technique, etc Loss Control : Damage control & system safety.

2. HAZARD IDENTIFICATION TECHNIQUES (30 Periods)

Hazard Identification techniques with examples such as FMEA, CMA, Fault Tree Analysis, ETA, Preliminary Hazard Analysis (PHA), Hazard and Operability (HAZOP), Safety Audit, Quantitative and Qualitative Risk Analysis- Out line of methodology, Consequences Analysis, etc

3. ACCIDENT INVESTIGATION, REPORTING AND ANALYSIS (30 Periods)

Purpose, Identifying the key factors and the causes, Writing reports and report forms, Corrective action, classification of accident as per Indian Standard, Method of collecting and tabulating data, Keeping the records.

4. MEASUREMENT AND CONTROL OF PERFORMANCE (30 Periods)

Lost time accident, Disabling injury, Accidents reportable under the factories Act and E.S.I. Act. Frequency rate. Severity rate, Incidence rate, man days lost, etc. Temporary disablement and permanent disablement. Partial and total disablement. Time charges scheduled in Workmen's Compensation Act and the Indian Standard.

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion and literatures review.

MEANS OF ASSESSMENT -

As per BTE, UP guidelines

RECOMMENDED BOOKS

Sl no	Title	Author
1	Industrial Accident Prevention	H E Heinrich, Dan Peterson, Nester Roos
2	Accident Prevention Manual (Vol 1 &2) (ISBN: 978-08-7-91235-8)	
3	Accident Prevention Manual for industrial operations (ISBN: 978-08-7-912024-5)	
4	Supervisor's Safety Manual (ISBN 978-08-7-912288-1)	
5	Loss Prevention in the Process Industries (Vol 1,2 & 3)	Frank P Lees
6	Chemical Process Quantitative Risk Analysis	Centre for Chemical Process Safety, AIChE, USA
7	Loss Control Management	Frank E Bird, Jr & Robert G Loftus
8	Management guide to Loss Control	Frank E Bird, Jr
9	Techniques of Safety Management	Dan Petersen
10	Industrial Safety and Environment	A K Gupta
11	A course of Industrial Safety	K U Mistry

Websites for Reference:

- www.dgfasli.gov.in
- www.ilo.org
- www.osha.gov
- www.osha.europa.eu

SUGGESTED DISTRIBUTION OF MARKS

NO.	TOPIC	Time Allotted (Periods)	Marks Allotted (%)
1		30	25
2		30	25
3		30	25
4		30	25
TOTAL		120	100

9.5 Safety Legislation & Standards

L T P
2 1 -

RATIONALE

The law of the land gives minimum level of safety, which all the occupiers of industrial units must achieve. A safety professional must have a thorough knowledge of the applicable safety statutes. Some of such provisions are covered in this paper.

LEARNING OUTCOMES

On successful completion, Students will be able to

- **Understand various ILO convention and recommendations**
- **Know safety Legislation in India**
- **Learn and apply provisions made under the Factories Act 1948 And The Factories Rules and also Provisions Relating To Safety, Health And Environment in other important Legislations**

DETAILED CONTENTS

1. INTRODUCTION TO ILO : (12 Periods)
ILO convention and recommendations in providing safety, health and welfare to workers.
2. INTRODUCTION TO SAFETY LEGISLATIONS IN INDIA (12 Periods)
3. FACTORIES ACT 1948 AND THE FACTORIES RULES- (30 Periods)
Provision made under the Factories Act and the rules framed there under
4. EMPLOYEES WELFARE AND LEGISLATION: (12 Periods)
The Employee's compensation Act 1923 and rules. ESI Act and rules. Contract Labour Act and Rules. Public Liability Insurance Act and Rules framed there under,
5. PROVISION RELATING TO SAFETY, HEALTH AND ENVIRONMENT IN OTHER IMPORTANT LEGISLATIONS : (30 Periods)
Indian Boilers Act and Regulations. Indian Electricity Act and Rules. Indian Explosives Act and Rules. Petroleum Act and Rules. Gas Cylinders Rules. Radiation Protection Act and Regulations. Static and Mobile pressure vessels Rules. The Dock Workers (Safety, Health & Welfare) Act and Regulations. Building and other construction work Act & Rules. Provision regarding transportation of dangerous Cargo under Central Motor Vehicle Act and Rules. The insecticides Act and Rules.
Environmental Protection Act 1989-MSIHC Rules, CIMAH Rules. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act and Rules and Hazardous and other Wastes (Management and Trans boundary Movement) Rules 2016.
6. Standards (24 Periods)
National Standards like IS 9474, IS 14489, IS 5572, IS 2878, IS 9972, IS 15105, IS 6665, IS 3103, IS 2825, IS 4954, IS 3483, etc.
Orientation to International standards like NFPA, ISO, OSHA, OISD , NIOSH, etc.

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion and literatures review.

MEANS OF ASSESSMENT –
As per BTE, UP guidelines

RECOMMENDED BOOKS

Sl no	Title	Author
1	The Fatories Act, 1948 & Factories Rules	Bare Act
2	Environment (Protection) Act, 1986 & Rules	Bare Act
3	The BOCW Act, 1996 and Rules	Bare Act
4	Employees Compensation Act, 1923 & Rules	Bare Act
5	Indian Electricity Act, 2003 & Rules	Bare Act
6	Indian Explosives Act, 1984 & Rules	Bare Act
7	The Dock Workers (safety, Health & Welfare) Act, 1996 & Rules	Bare Act

Websites for Reference:

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- www.ilo.org
- www.osha.gov
- www.osha.europa.eu

SUGGESTED DISTRIBUTION OF MARKS

TOPIC NO.	Time Allotted (Periods)	Marks Allotted (%)
1	12	10
2	12	10
3	30	25
4	12	10
5	30	25
6.	24	20
TOTAL	120	100

9.6 INDUSTRIAL HYGIENE AND OCCUPATIONAL HEALTH

L T P
2 1 2

RATIONALE

Good health is a prerequisite of efficiency in an industrial worker. Providing hygienic working conditions and minimizing occupational health hazards (unavoidable due to nature of industry) is a must. A safety officer in the industry must be well aware to such situation to take preventive measures effectively.

LEARNING OUTCOMES

On successful completion, Students will be able to

- **Understand and apply concepts of Industrial Hygiene and work physiology**
- **Appraise** Application of ergonomics in safety and health management
- **Assess Occupational health status**
- **Evaluate selection criteria , use of personal protective equipment**

DETAILED CONTENTS

1. INDUSTRIAL HYGIENE (30 Periods)
 - 1.1. CHEMICAL HAZARDS :
 - 1.1.1 Acute and chronic health effects of substances liable to be entered through skin absorption, ingestion, injection and inhalation
 - 1.1.2 Assessment of airborne contaminants in the work environment including various methods of air sampling like dynamic or active sampling, passive sampling or dosimetry for area and personal sampling, relevant analytical methods, Biological monitoring and analysis
 - 1.1.3 Concepts of Exposure limits for airborne contaminants and chemicals - PEL, TLV, STEL, IDLH, REL, BEI, etc
 - 1.1.4 Control of airborne contaminants by substitution, isolation, enclosure, Wet methods, Industrial Ventilation - Dilution and local exhaust systems, Housekeeping, Personal Hygiene and Maintenance.
 - 1.2 PHYSICAL HAZARDS :
 - 1.2.1 Effect of occupational exposure, Methods of assessment, Permissible standards and prevention and control measures of physical Hazards- Thermal Stress- Physiology of Heat regulation, Heat disorders, Measurement of Thermal stress using different heat stress indices, Permissible limits of heat stress. Noise and its health effect, measurement and evaluation of noise, Permissible limits for noise. Hearing conservation programme. Vibration and its health effect. Illumination and its health effects. Ionizing and Non-ionizing radiations like X-rays, Radioactive radiations, Infrared, ultraviolet, Laser, Radio frequency, Microwave etc.

2. WORK PHYSIOLOGY (30 Periods)

Classification of workload. Work capacity and man-job alignment. Fatigue and Rest allowances. Ergonomics, Anthropometry. Application of ergonomics in safety and health management. Fitness criteria for work. Diet and exercise for work Stress control and rehabilitation.

3. OCCUPATIONAL HEALTH

(30 Periods)

Common occupational diseases. Occupations involving risks of contracting these diseases. Mode of causation of the diseases and its effects. Different Diagnostic methods in Occupational Health, Physical tests in occupational health assessment, Bio monitoring. Methods of control & prevention for occupational diseases. Evaluation of injuries. First Aid and Occupational health Services in an industrial establishment and its functions.

Occupational diseases: Occupational lung Diseases. Occupational dermatosis. Occupational cancer, etc. Pre-employment and periodic medical examination of workers. Medical surveillance for control of occupational diseases. Health records management, Fundamentals of first- aid for Burns, fractures, suffocation, toxic ingestion- bleeding wounds, bandaging, Artificial respiratory techniques.

4. PERSONAL PROTECTIVE EQUIPMENTS

(30 Periods)

(a) Non respiratory personal protective devices :

Head protection. Ear protection. Face and eye protection. Hand protection. Feet protection. Body protection. Selection, use, care and maintenance of personal protective equipments as per statutes and standards.

(b) Respiratory personal protective devices :

Classification of hazards. Classification of respiratory personal protective devices. Selection of respirators. Instructions in the use of breathing apparatus. Selection, use, care and maintenance of breathing apparatus. Training in the use of respiratory personal protective device.

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion, practical and literatures review.

MEANS OF ASSESSMENT -

As per BTE, UP guidelines

RECOMMENDED BOOKS

Sl no	Title	Author
1	Encyclopaedia of Occupational Health & Safety	ILO
2	Hazardous Chemical Data Book	G Weiss
3	TLV Book	ACGIH
4	NIOSH Pocket Guide to Chemical Hazard	NIOSH
5	Lung Function Assessment & Application in Medicine	Cotes J E
6	Spiro metric Standards for male and female	Morries J P
7	Predictor equation for lung function in Indians	Kamaths S R
8	Proper Training , Techniques Vital to Pulmonary testing (Pg 23 – 27)	Horvath P E

9	Biological Effects and health implications of microwave radiation	S F Cleary
10	Biological and medical problems raised by the use of radar ultrasound waves	R P Delahaye

Websites for Reference:

- www.dgfasli.gov.in
- www.ilo.org
- www.osha.gov
- www.osha.europa.eu
- www.mohfw.gov.in
- www.atsdr.cdc.gov
- www.cdc.gov
- www.who.int
- www.acgih.org

SUGGESTED DISTRIBUTION OF MARKS

TOPIC NO.	Time Allotted (Periods)	Marks Allotted (%)
1	30	25
2	30	25
3	30	25
4	30	25
TOTAL	120	100

PRACTICAL

(80 Periods)

LIST OF PRACTICALS FOR INDUSTRIAL HYGIENE AND OCCUPATIONAL HEALTH

1. Calibration of Rotameter by Soap Bubble Meter.
2. Calibration of Rotameter by Wet Test Meter.
3. Detection of Carbon Monoxide, NO_x, Hydrogen Sulphide, Ammonia, Aromatic Hydrocarbons, SO₂ by Gas Detectors and other direct reading instruments.
4. Measurement of Concentration of Dust using Personal Sampler by Gravimetric Method.
5. Sampling and analysis of Ammonia.
6. Estimation of Hydrogen Sulphide in Air.
7. Estimation of Chlorine in Work Environment.
8. Estimation of Mercury concentration in working atmosphere.
9. Sampling and analysis of SO₂ using Colorimetric method.
10. Assessment of Heat Stress in Work Environment.
11. Plotting of an Audiogram by Audiometer.
12. Carrying out Lung Function Test by Spirometer.
13. Physical Fitness testing
14. Vision screening

9.7 SAFETY IN CHEMICAL INDUSTRY

L T P

2 1 -

RATIONALE

Though general principles of safety and health in industries are applicable to the chemical industries also, special features like large variations in the hazardous properties of chemicals, chemical operations and potential of chemicals to results enormous damage to life and property both inside and outside the work etc, render it necessary to include additional Safety considerations for chemical industries. Accordingly, the special feature for ensuring safety in chemical industries are being included in this paper.

LEARNING OUTCOMES

On successful completion, Students will be able to

- Evaluate hazards associated with chemical processes and their control
- Assess safety in transportation, storage and handling of hazardous chemicals
- Contribute for safety aspects during maintenance in chemical plants
- Apply major accident hazard control
- Understand industrial fire safety aspects

DETAILED CONTENTS

1. CHEMICAL PROCESS HAZARDS AND THEIR CONTROL :- (24 Periods)

- 1.1. Hazards of chemical reactions and possibilities of reactions going out of control.
- 1.2. Common hazards of important Unit Processes and their control.
- 1.3. Common hazards of important unit operations and their control.
- 1.4. Safety considerations in process control instrumentation.
- 1.5. Safety start up, shut down and emergency shutdown procedures.
- 1.6. Safety in sampling and gauging.
- 1.7. Safety aspects of plant modifications.
- 1.8. Hazardous Area Classification

2. SAFETY IN TRANSPORTATION, STORAGE AND HANDLING OF HAZARDOUS CHEMICALS:- (24 Periods)

- 2.1. Hazardous properties of chemicals and application of information provided in material safety data sheets.
- 2.2. Classification of dangerous materials with pictorial symbols, common hazard and common precautions for each class, Hazchem Code, TREM Card.
- 2.3. Safety in transportation of dangerous materials by road, rail, ships and pipelines.
- 2.4. Safety in bulk storage of hazardous substances.
- 2.5. Safety in shelf storage of hazardous substances.
- 2.6. Safety in handling of chemicals in the plant by pipelines.

3. SAFETY ASPECTS OF MAINTENANCE IN CHEMICAL PLANTS :- (18 Periods)

- 3.1 Piping & Instrumentation Diagram and Process Safety Management (PSM) & Risk Based Process Safety Management (RBPSM)
- 3.2 Maintenance of component failure history
- 3.3 Corrosion prevention for safety.

- 3.4 Preventive maintenance of vulnerable equipments.
- 3.5 Safe entry into confined spaces.
- 3.6 Permit to work system for safety in chemical plants.
- 3.7 Non Destructive Testing (NDT) in chemical plants

4. MAJOR ACCIDENT HAZARD CONTROL :- (18 Periods)

- 4.1 Major accident hazards and roles of management, local bodies and public.
- 4.2 Safety while site selection and lay out planning
- 4.3 Fire and explosion in chemical plants.
- 4.4 Quantitative risk analysis
- 4.5 Preparation of safety reports.
- 4.6 On site emergency planning and off site emergency planning.
- 4.7 Hazard and operability (HAZOP) studies.
- 4.8 Special precautionary measures for Fire and Explosion:
Special precautionary measures in handling/processing flammable liquids, gases, vapours, mists and dusts. BLEVE (Boiling liquid expanding vapour explosion). Vapour cloud explosion, Fire and Explosion Index and toxicity index, Determination of concentration of inflammable vapours.

5. SAFETY AND HEALTH IN SELECTED CHEMICAL INDUSTRIES :- (18 Periods)

- 5.1 Chlorine-caustic, soda-hydrochloric acid manufacturing plants (Mercury cell and Membrane cell process).
- 5.2 Ammonia-Urea manufacture.
- 5.3 Manufacture of Sulphuric acid by double conversion double absorption (DCDA) process.
- 5.4 LPG Storage and bottling plants.

6. INDUSTRIAL FIRE SAFETY: (18 Periods)

Statutory provisions regarding fire safety. Factors contributing towards fire. Chemistry of fire. Classification of fires. Common causes of industrial fires. Determination of fire load. Fire resistance of building materials. Design of building plant, exits, etc. for fire safety. Prevention of fire. Portable extinguishers. Water systems. Carbon-di-oxide systems. Foam extinguisher system. Dry chemical extinguishing system. Industrial fire detection and alarms. Sprinkle systems, Determination of Fire Load.

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion and literatures review.

MEANS OF ASSESSMENT -

As per BTE, UP guidelines

RECOMMENDED BOOKS

Sl no	Title	Author
1	Risk based process safety by Centre for Chemical Process of Chemical Engineer (AIChE)	John Wiley & Sons Inc, Somerset, NJ (USA)
2	Accident Prevention Manual (Vol 1 & 2)	National Safety Council, USA
3	Accident Prevention Manual for Industrial Operation	National Safety Council, USA
4	Supervisor Safety Manual	-do-
5	Prevention of Major Industrial Accidents	ILO , Geneva
6	Loss Prevention in the Process Industries (Vol 1,2 & 3)	Frank P Lees
7	Chemical Process Quantitative Risk Analysis	Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York
8	Loss Control Management	Frank E Bird, Jr & Robert G Loftus
9	Management Guide to Loss Control	Frank E Bird, Jr
10	Techniques of Safety Management	Dan Peterson
11	Transport of Dangerous Goods – Recommendation of the Committee of Expert of Transportation of Dangerous Goods	United Nations, New York
12	Agrochemicals Handbook	Douglas Kartley & Hamish Kidd
13	The Merck Index –An Encyclopaedia of Chemicals	
14	Hazardous Chemical Data Book	G Weiss
15	TLV Book	ACGIH
16	NIOSH Pocket Guide to Chemical Hazard by NIOSH	
17	Major Hazard Control – A Practical Manual	ILO, Geneva

Websites for Reference:

- www.dgfasli.gov.in
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- www.osha.europa.eu
- www.epa.gov
- www.iitrindia.org

SUGGESTED DISTRIBUTION OF MARKS

TOPIC NO.	Time Allotted (Periods)	Marks Allotted (%)
1	24	20
2	24	20
3	18	15
4	18	15
5	18	15
6	18	15
TOTAL	120	100

9.8 Environment and Disaster Management

L T P
2 1 -

RATIONALE

This subject deals with Environment Management System, and disaster management system including National policy on Safety health and environment at workplace and relevant Laws which are very much essential from the point of views of today's environmental issues.

LEARNING OUTCOMES

On successful completion, Students will be able to

- Understand elements of Evaluate Environment Management system and ecosystem
- Evaluate factors contributing water, air, soil and noise pollution and their effects
 - Apply various techniques of Environmental monitoring
 - Implement various techniques of waste management
 - Addressed global warming issues and implement its control measure
 - Fulfil Sustainability reporting requirements
 - Identify effects of natural disaster leading to Major Hazards accidents
 - Develop system in line with National Disaster Management Framework

DETAILED CONTENTS

1. Environment Management System and ecosystem (18 Periods)
 - 1.1 National environment policy
 - 1.2 Aspects and impact of Environment Management, Environment Management Programmes,
 - 1.3 EMS – ISO 14001-2015
 - 1.4 Ecosystem and its components
 - 1.5 Bio-diversity
2. Pollution (9 Periods)
 - 2.1 factors contributing water pollution and their effects
 - 2.2 factors contributing air pollution and their effects
 - 2.3 factors contributing noise pollution and their effects
 - 2.4 factors contributing soil pollution and their effects
3. Environmental Monitoring (12 Periods)
 - 3.1 Principle and practices for monitoring of air pollution, water pollution
 - 3.2 Cleaner technology, Six -R
 - 3.3 Ambient air quality, Air pollution control devices, stack monitoring, scrubber
4. Effluent monitoring (ETP & STP) (12 Periods)
 - 4.1 Effluent treatment plant-key processes, sludge treatment
 - 4.2 Parameters of effluent monitoring
5. Solid Waste Management (12 Periods)
 - 5.1 E waste management
 - 5.2 Battery waste management
 - 5.3 Hazardous waste management

- 5.4 Transportation of hazardous waste
- 6. Global warming (9 Periods)
 - 6.1 Green House Gases
 - 6.2 Acid rain
 - 6.3 Ozone depleting substances & its impact on the environment
 - 6.4 Mitigation measures of global warming
- 7. Sustainability reporting (12 Periods)
 - 7.1 Elements of SR
 - 7.2 Purpose and advantages of SR
 - 7.3 Global reporting initiatives(GRI4)
- 8. Disaster management (18 Periods)
 - 8.1 Natural & manmade,
 - 8.2 Types of disaster management – how disaster forms, destructive power, causes & hazards
 - 8.3 Case studies of following major accidents - Bhopal, Mexico, Flixborough, Seveso, Chernobyl and Feyzin disasters.
 - 8.4 National policy on Disaster Management & the Disaster Management Act, 2005
 - 8.5 Mitigation and vulnerability reduction – factor promoting vulnerability reduction and mitigation, emergency support function plan
- 9. National Disaster Management Framework (18 Periods)
 - 9.1 Main features and function of NDM
 - 9.2 Frame work, Disaster mitigation and prevention
 - 9.3 Legal policy frame work
 - 9.4 Early warning system
 - 9.5 Human resource development and function
 - 9.6 Information dissemination and communication

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion and literatures review.

MEANS OF ASSESSMENT -

As per BTE, UP guidelines

RECOMMENDED BOOKS

SI No	Title	Author
1	Environmental engineering	Venugopal Rao
2	Environmental Studies	N K Uberoi
3	Environment Management in India	R K Sapru
4	Environmental Studies	Daniel & Krishnaswamy
5	Environmental Health & Safety Management	Nicholas & Madelyn
6	Text book of Environmental Studies	Erach Bharucha
7	Environmental Studies	R Rajgopalan
8	Wastewater Engineering: Treatment, disposal, reuse	Metcalf & Eddy

Websites for Reference:

- www.dgfasli.gov.in
- www.ilo.org
- www.osha.gov
- www.osha.europa.eu
- www.ndma.gov.in

SUGGESTED DISTRIBUTION OF MARKS

TOPIC NO.	Time Allotted (Periods)	Marks Allotted (%)
1	18	20
2	9	5
3	12	10
4	12	10
5	12	10
6	9	5
7	12	10
8	18	15
9	18	15
TOTAL	120	100

9.9 PROJECT

Areas of Project Work (any one)

1. Safety audit
2. Hazard identification and Risk Assessment Techniques
3. Emergency Action plan
4. Management information system
5. Assessment of fire & explosion potential & their prevention
6. Safety inspection system
7. Documentation and report system of OSH
8. Occupational Safety and Health Management System.
9. Behavior Based Safety.
10. Any other topic as per the syllabus and approval of the faculty

9.10 TERM WORK

Areas of Term Work (Any One)

1. Design of need based training programme
2. Safety organization and management
3. Study of employees participation in safety
4. Safeguarding of machinery
5. Material handling
6. Working at height
7. Design of work place
8. House keeping
9. Lighting
10. Ventilation (for heat control)
11. Electrical hazards
12. Noise control
13. Job safety analysis
14. Fault tree analysis
15. Hazards identification
16. Accident investigation & reporting
17. Measuring safety performance
18. Study of cases under Factories Act
19. First aid facility in the industry.
20. Selection, use and care of PPE's (Personal protective equipments).
21. Use and up keep First aid Fire Fighting Extinguishers.
22. Any other topic as per the syllabus and approval of the faculty.

9.11 INDUSTRIAL VISITS

Industrial visits should be made Compulsory and it shall be followed by the submission of the Visit report.

10. RESOURCE REQUIREMENT

10.1 PHYSICAL RESOURCES

(A) Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

(B) Equipment requirement:

Following Laboratories are required for Post Diploma Programme in industrial safety

EQUIPMENT REQUIRED FOR Post Diploma Programme in industrial safety

Sr. No.	Description	Qty	Rate	Total Price (Rs)
INDUSTRIAL SAFETY LABORATORY				
1	Models of safety guards such as fixed, automatic, interlock, photo-electric and two hand control device for demonstrating the principles of machines guarding.	1	25000	25000
2	Modeling of drilling, lathe, milling, shaper and grinding machines showing the various safety guards used on them.	1	50000	50000
3	A set of guards to be used on various wood working machines, such as circular saw, planer, spindle moulder, thickner, mortising chisel etc.	1	25000	25000
4	Tyre inflating device.	1	10000	10000
5	Pipe welding guard.	1	10000	10000
6	A set of common lifting tackles, used in materials handling with view to highlight their correct usage.	1	20000	20000
7	Samples of wire ropes, fibre ropes, chains etc. showing their construction.	1	15000	15000
8	A working model to show the load on sling legs due to variation of angle of lift.	1	30000	30000
9	Working model of conveyor belt safety device.	1	70000	70000
10	A model demonstrating the principles of manual handling	1	10000	10000
11	A set of anti-slip devices used for ladder safety.	1	10000	10000
12	A set of different types of extinguishers.	1	50000	50000
13	Panels depicting the various principles of safety in the use of electricity.	1	100000	100000
14	Electric safety devices- shock control leakage indicator etc.	1	50000	50000
15	Models demonstrating importance of earthing and time delay mechanism.	1	15000	15000
16	A set of models of various exhaust hoods.	1	100000	100000

17	Models of emergency safety shower.	1	20000	20000
18	A set of panels high lighting the recognition, evaluation and control of environmental hazards.	1	15000	15000
19	A set of panels and exhibits demonstrating the principles of lighting such as age and need for light, effect of contrasts, light & shape, speed & light, fundamental ways of lighting etc.	1	100000	100000
20	A set of panels on colour in industry.	1	25000	25000
21	A full range of personal protective equipment for head, eye, ear, hand, foot, leg, respiratory protection and safety belts.	1	200000	200000
EQUIPMENTS FOR INDUSTRIAL HYGIENE LABORATORY				
1	Sound Level Meter	1	25000	25000
2	Octave Band Analyser	1	30000	30000
3	Sound Survey Meter	1	15000	15000
4	Illumination Level Meter	1	20000	20000
5	Globe Thermometer	1	5000	5000
6	Kata Thermometer	1	7000	7000
7	Whirling Hygrometer	1	7000	7000
8	Aspirating Hygrometer	1	15000	15000
9	Anemo Thermo Air Meter/ Velometer	1	100000	100000
10	Detector tubes- Instruments for Assessment of Toxic Chemicals in Air Spot Testers For Various Gases.	1	50000	50000
11	Electrostatic Air Sampler	1	50000	50000
12	Standard Impinger	1	3000	3000
13	Light Weight Vacuum Pump	1	30000	30000
14	Rotameter	1	5000	5000
15	Filter Holder	10	1000	10000
16	Battery Operated Personal Sampler.	2	40000	80000
17	Explosive meter	1	80000	80000
18	Flammable Gas Detector	1	10000	10000
19	Thermal Precipitator Air	1	70000	70000
20	Spectrophotometer- Visible Range	1	300000	300000
21	PH Meter	1	15000	15000
22	Gas Chromatograph	1	1500000	1500000
23	Hot Plates and heating mantles	1	5000	5000
24	Magnetic stirrer	1	2000	2000
25	Muffle furnace	1	50000	50000
26	Hot air oven	1	15000	15000
27	Chemical balance	1	250000	250000
28	Glass wares and chemicals	1	100000	100000
29	Distilled water facility	1	10000	10000
30	Laboratory Microscope	1	500000	500000

31	WBGT Meter	1	300000	300000
AUDIO VISUAL EQUIPMENTS				
1	Multimedia Media Projector	1	50000	50000
2	Projector Screen	1	10000	10000
3	Computers	2	50000	100000
4	Sound System with recorded Facilities	1	100000	100000
5	LED Monitor/48 inches TV	2	20000	40000
MEDICAL/PHYSIOLOGICAL EQUIPMENTS :				
1	Eye Vision Tester	1	300000	300000
2	Hand Steadiness Teste	1	30000	30000
3	B. P. Equipment	2	5000	10000
4	Peak Flow Meter	2	1000	2000
5	Clinical Thermometer (Infrared)	2	2500	5000
6	Spirometer	1	150000	150000
7	Audiometer	1	150000	150000
8	Computer facility(Computer assisted learning system with software, printer, Mouse)	1	50000	50000

(C) Furniture Requirement

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

(D) STAFF REQUIREMENT OTHER THAN NON-TEACHNIG STAFF

1. Scientific Assistant – 02
2. Lab Assistant – 02
3. Lab Attendant – 02
4. Librarian – 01
5. Administrative Staff - 02
6. MTS – 04

Note: Guest lecturers by experts on Safety and other fields may be arranged as per-requirements.

10.2 Human Resources Development:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

11. EVALUATION STRATEGY

11.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavour 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 (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.

11.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work (Laboratory, Workshop, Field Exercises)
- Project Work
- Student centric activity

A. 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 multiple choice objective type items. Total weightage to Section-1 should be of the order of 15 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 very short answer items. The weightage to this section should be of the order of 30 percent of the total marks. Again, no choice should be given in section-II.

Section-III

It should contain short answer items. The weightage to this section should be of the order of 20 percent of the total marks. Again, no choice should be given in section-III.

Section-IV

It should contain Descriptive and Narrative type questions. Total weightage to this section should be of the order of 35 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section.

Table I : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

B. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practical/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.

Table II : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge about principles and procedures	10-30 percent
Manipulative skills	40-60 percent
Ability to observe and record	20-30 percent
Ability to interpret and draw conclusions & work related attitudes	Upto 10 percent

C. 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.

Table III : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
learnt knowledge and skills in solving real life problems	10-30 percent
Manipulative skills	40-60 percent
Ability to observe and record	20-30 percent
creativity and communication skills	Upto 10 percent

12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

This curriculum document is a Plan of Action 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 polytechnics 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 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. An academic plan needs to be prepared and made available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.
3. HOD of every Programme Department along with HODs and incharges of other departments are required to prepare academic plan at department level referring to 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.

Polytechnic 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 of time. It is essential for them to use the given time 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 and courses to be taught.
2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes 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 assignments and seminars can be thought of as terminal outcome of library experiences.
5. Concept and content based field visits may be planned and executed for such content of course which 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 feed back to every student
8. The student centred activities 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. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.
11. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

12. 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 employment.
13. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

REFERANCE BOOK

1. Douglas Mcgregor - The human side of enterprise Mc Grow Hill
2. H. W. Henrich - Industrial Accident prevention & Engineering Mc Graw Hill
3. Willi Hammer - Occupational Safety Management & Engineering Prentice Hall
4. Simonds &Gribaldi - Safety Management Richard D. Irwin
5. Handley - Industrial Safety handbook Mc Graw Hill
6. Brid - Management Guide to loss Control International Institute of Loss Control
7. Willi Hammer - Handbook of system & Product safety Prentice Hall
8. National safety Council - Accident Prevention Manual Chicago for Industrial Operation
9. Singleton - Introduction to ergonomics World Health Organisation
10. ACGIH - Industrial Noise Control Manual
11. Hopkinson - Lighting, HMSO London
12. HMSO - Principles of Exhaust Ventilation.
13. ACGIH - Industrial Ventilation- Manual of Recommended Practice
14. D. Hunter - Diseases of occupation English University Press
15. SAX IRWIN - Dangerous Properties of Industrial Materials Van Nostrand Reinbold
16. Schilling - Occupational Health Practice Buttre Worth
17. ACGIH, USA - Encyclopedia of Industrial Hygeine Instrument
18. Redgrave - Health & Safety in factories Butterworth

19. Srivastava K.D. - Commentaries of Factories Act Eastern Book Company
20. Illuminating Engineering Society of North America - IES Lighting Handbook
21. Frank P. Lees Butterworths - Loss Prevention in Process Industries Vol I & II
22. National Fire Protection Association USA - Industrial Fire Hazards Handbook
23. I.L.O. Geneva - Encyclopedia of Occupational Health and safety
24. Barbara A Plog Chicago - Fundamentals of Industrial Hygiene
25. Dan Petersan - Industrial Safety Mgt.

NOTE:

Revision of curriculum does not create any new need for running the course. Existing Staff, space and other resources- Building, Lab equipments, books, staff etc. as mentioned here are already existing with the institute. So no additional facility wanted for running the course .only)

13 LIST OF PARTICIPANTS

Sl. No.	Name and Designation	Organisation	Remarks
1	Dr. Arkaprabha Sau, Deputy Director (Industrial Medicine) & Head of Office	Regional Labour Institute, Kanpur	Member
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8	Prof. Devendra Kumar Verma, Professor	Institute of Research Development and Training, Kanpur	Chairman
9	Shri Monit Kumar, Research Assistant/Technical Assistant	Institute of Research Development and Training, Kanpur	Member
10	Smt. Shruti Dwivedi, Library Information Assistant)	Regional Labour Institute, Kanpur	Member