

**COURSES OF STUDY**  
**FOR**  
**POST DIPLOMA IN INDUSTRIAL SAFETY**  
**UNDER**  
**STATE COUNCIL OF TECHNICAL EDUCATION & VOCATIONAL TRAINING,**  
**ODISHA**  
**FOR ONE YEAR PDIS COURSE**

**TEACHING & EVALUATION SCHEME FOR FIRST SEMESTER COURSE OF POST DIPLOMA IN INDUSTRIAL SAFETY**

Sl No	Subject Code	Subject of study	Contact Periods/Week			Examination Scheme.						Full Marks
						Theory			Practical			
			Lecture	Tutorial	Practical	IA	End Exam.	Total	Sessio nal	End Exa m	Total Marks	
1	PDIS-101	SAFETY MANAGEMENT	04	01	-	30	70	100				<b>100</b>
2	PDIS-102	INDUSTRIAL SAFETY ENGINEERING-I	04	01	-	30	70	100				<b>100</b>
3	PDIS-103	HAZARD IDENTIFICATION & RISK CONTROL	04	01	-	30	70	100				<b>100</b>
4	PDIS-104	SAFETY IN CHEMICAL INDUSTRIES	04	01	-	30	70	100				<b>100</b>
5	PDIS-105	ELECTIVE(ANY ONE)	04	01	-	30	70	100				<b>100</b>
		E1 SAFETY IN ENGINEERING INDUSTRIES	-	-	-							
		E2 APPLIED ERGONOMICS	-	-	-							
		E3 SAFETY IN MINING INDUSTRIES	-	-	-							
6	PDIS-106	PROJECT WORK	-		14				150	100	250	<b>250</b>
<b>TOTAL</b>			<b>20</b>	<b>05</b>	<b>14</b>	<b>150</b>	<b>350</b>	<b>500</b>	<b>150</b>	<b>100</b>	<b>250</b>	<b>750</b>

**NOTE:**

1. Effective Teaching will be at least 15weeks per semester
2. Each period will be of minimum 55 minutes duration.

**Minimum pass Marks in Theory(End Examination)- 35%**

**Minimum pass Marks for Project/Practical – 50%**

**Minimum pass Marks in Aggregate – 40%**

**First Division- 60% and above**

**First Division with Honours – 70% and above**

DETAILED SYLLABI OF  
DIFFERENT THEORY & SESSIONAL SUBJECTS  
OF FIRST SEMESTER

## SAFETY MANAGEMENT

Subject Code	Course offered	Full Marks	End Exam	IA
PDIS 101	in First Semester	100	70	30

### **Chapter – 1 Management Practice:**

History of Safety Movement in India, USA, UK; Need for Safety ( Legal, human, economic & social considerations). General Principles of Management, Managerial role, Authority and span of Management, Delegation and decentralization of authority.

### **Chapter – 2 Safety Management Systems:**

#### i. Planning

Definition, purpose, nature, scope, and procedure. Range of planning, variety of plans, strategic planning and process of implementation. Management by objectives and its role in Safety, Policy formulation, On-site Emergency Plan, Off-site Emergency Plan, Implementation of OHSAS 18001.

#### ii. Organizing for Safety

Definition, need, nature and principles. , Organization structure and safety department, Structure and functions of Safety Committee, Line and Staff functions for safety.

### **Chapter – 3 Accident Prevention**

Role of management in Industrial safety management, principle and practices. Definition & concept of Incident, accident, injury, dangerous occurrence, unsafe act, unsafe condition, hazard. Theories & Principles of accident causation and its prevention. Cost of accident ( to victim and family, organization, society); Compilation procedure, utility and limitations of cost data. Budgeting for safety, accident investigation, accident reporting, learning from accidents.

### **Chapter – 4 Management Information System for Safety**

Source of Information on Safety, health and accidents, Compilation and collection of information. Analysis and use of modern methods of programming, storing and retrieval of MIS for safety, health and environment.

### **Chapter – 5 Behaviour Based Safety**

i Safety Education and Training

Element of training cycle, assessment of needs, Techniques of training, design and development of training programmes, Training methods and strategies. Types of training. Evaluation and review of training programmes. Infrastructure for training, developing training module with audio visual mode for SOP, SMP & induction training.

#### ii Employee Participation in Safety

Purpose, areas of participation, Safety committee meeting, methods. Role of trade union in safety and health, Safety suggestion schemes. Safety competitions. Safety incentive schemes, Audio visual publicity. Other promotional methods like safety week celebration etc.

#### iii Organizational Behaviour and Safety

Human factors contributing to accidents, Individual difference, behavior as function of self and situation, perception of danger and acceptance of risks, knowledge, and responsibility vis-à-vis safety performance, theories of motivation and their application to safety, role of management, supervisors and safety department in motivation, correcting behavior –the challenge.

## INDUSTRIAL SAFETY ENGINEERING – I

Subject Code	Course offered	Full Marks	End Exam	IA
PDIS 102	in First Semester	100	70	30

### **Chapter – 1 Safe Guarding of Machine.**

Concept of substantial machine guarding, Statutory provision related to principles in machine guarding. Type of guard, their design and selection. Guarding of different type of machinery including special precautions for wood working, paper, rubber and printing machinery, machine, tools, guarding end pulleys of conveyors, coupling guards, V- belts & pulleys of moving machinery, front and rear guards of hydras etc. Built-in-safety devices, maintenance and repair of guards, incidental safety devices and tools.

### **Chapter – 2 Manual Material Handling & Storage of Materials.**

Hazards in manual handling. Avoidance of excessive muscular effort. Kinetic methods of correct lifting and handling of material. Maximum load that may be carried. Lifting and carrying of object of different shapes, size and weight. Safe use of accessories for manual handling. Storage of materials.

### **Chapter – 3 Mechanical Handling of Materials.**

Lifting machinery (Cranes, Elevators, Conveyors, Dumpers, Pay loaders, etc) – Safety aspects considered during design, construction, and testing of Lifting Machinery - training of operator on safe operation, signaling, inspection and maintenance of Lifting Machinery.

Power trucks and tractors, safety features in design and construction, safe operation, inspection and maintenance.

Lifting tackles: Chain slings, Rope slings, (fiber and wire) rings, hooks, Shackles, Swivels, Eye-bolts – salient safety features. Calculation of Safe Working Load; testing of lifting tools and tackles with reference to relevant IS codes and provisions of Factories Act & Rules, work of competent persons.

### **Chapter – 4 Hand Tools & Portable Power Tools.**

Main causes of tool accidents – Control of tool accidents – Centralized tool control – Purchase, storage and supply of tools – inspection, maintenance and repair of tools. Detectable causes of tools failure – need for tempering, safe ending and dressing of certain tools – handles of tools

– safe use of various tools – types of hand tools used for metal cutting, wood cutting, miscellaneous cutting work – material handling and other hand tools such as Torsion Tools, Shock Tools, Non Sparking Tools – Portable power tools and their selection, inspection, maintenance and repair for safe use. Special precaution in selection and use of tools in high hazard installation like LPG & OIL installations, oxygen plants and explosive manufacturing factories etc.

## **Chapter – 5 Working at Height**

What is height work? Hazards associated & remedial measures required to be taken in height work, Safety features associated with design & construction of stair ways, ramps, working platforms, gang ways, ladders of different types, scaffolds of different types including boatswains chair and Safety harness. Hazards associated with working on roofs & measures required. Other safety requirements while working at height, Prevention of fall of persons at floor level – Potential tripping / slipping hazards, working on fragile roofs with reference to Rule 62-A of OFR 1950, screening of workers & work permit system for height work, precautions for working at height with special reference to construction of high rise building, chimney, painting of high rise structures, PPE and use of fall arrester and Safety net for height work.

## HAZARD IDENTIFICATION & RISK CONTROL

Subject Code	Course offered	Full Marks	End Exam	IA
PDIS 103	in First Semester	100	70	30

### **Chapter–1 Plant & Equipment Safety and Appraisal & Control Techniques**

Objective, Plant Safety observation, Plant Safety Inspection. Safety Sampling. Safety Survey. Job Safety Analysis. Safety Inventory System. Product Safety. Permit to Work system. Safety Tag system. Loss Control, Damage Control, System Safety. Interpretation of flow diagram and P & I drawing.

### **Chapter – 2 Hazard Identification Techniques**

Hazard Analysis: Inductive, deductive. FMEA & CMA. Fault Tree Analysis. Examples of each. Risk Analysis Techniques: HAZOP, HAZAN, Safety Audit, Safety Report, Evaluating risks in chemical process. Concept of reaction vessels in fertilizer plants, pesticide industry, and other complex process plants.

### **Chapter – 3 Accident Reporting, Investigation and Analysis**

Purpose. Identifying the key factors and causes, root causes and contributing causes. Writing reports and report forms. Corrective action. Standard classification of factors associated with accident. Method of collecting and tabulating data. Recording and investigating near miss, first aid and reportable accidents. Importance of accident statistics.

### **Chapter – 4 Measurement and Control of Performance**

Lost time accident. Disabling injury. Accidents reportable under the Factories Act and E.S.I. Act. Frequency rate. Severity rate. Incidence rate per 1000 workers and man-days lost. Temporary and Permanent disablement. Partial and Total disablement. Time charges scheduled in Workmen's Compensation Act and the Indian Standard. Study of appraisal report of the Department of Labour, Government of West Bengal.



## **Chapter – 5 Major Accident Hazard Control**

### **i Major Accident Hazards:**

Introduction, type and consequence of major accident hazards. Role of management, local authorities and public, Role of Safety Officer.

### **ii On-Site and Off-Site Emergency Planning:**

Definition, scope and objectives. Statutory back ground, Identification and assessment of hazards. Risk Analysis. Implementation of control procedures and systems. Emergency preparedness, Emergency Control Room, rehearsal and exercises, mock drills. Check list for inspecting MAH factories dealing with chlorine, ammonia, LPG/ propane gas, Coke oven gas, mixed gas, BF Gas, Oil installations; basic concept for preparation of On-Site Emergency Plan and Off-Site Emergency Plan and their approval, Importance of training and sensitization for emergency management.

## SAFETY IN CHEMICAL INDUSTRIES

Subject Code	Course offered	Full Marks	End Exam	IA
PDIS 104	in First Semester	100	70	30

### **Chapter – 1 Introduction**

Different types of hazards in chemical industries and their precautions - UN and other classification for Chemicals – Use of Material Safety Data Sheet – safety in receiving, storing, handling and transportation of chemicals – Compatibility and Considerations — Fulfillment of Statutory requirements for transporting Hazardous / Toxic / Flammable / Explosives by all modes - Safety in Chemical Industry :- Batch Process and Continuous process - Criteria for the plants to be under MAH category. Chemical hazards: toxic chemicals, dust, gases, fumes, mists, vapour & smokes – exposure, evaluation.

### **Chapter – 2 Storage & Transportation of Chemicals**

#### i Bulk/Isolated Storages

General consideration – types of storages - atmospheric and pressurized storage vessels – double and single integrated vessels – layout of storages of LPG, Chlorines, Ammonia, reaction vessels etc. - specific reference to bunds, flooring, catch pit, alarms, safety valves etc. - safe entry procedures to confined spaces – Inspection techniques of isolated storages (checklist method)

#### ii Pipeline Safety

Transfer of chemicals by pipelines – different components and safety devices of pipelines – Pipeline and Instrumentation (P&I) diagram – colour coding – Identification of contents – precautions in breaking pipelines (probable causes of pipeline failure) – integrating of pipelines (pipeline integrity) – maintenance of pipelines - preparation of maintenance schedule - safe operations, precaution during transport of hazardous substances with special reference to transport of LPG bullets, compressed gas cylinders, chlorine tonners, Ammonia tankers etc.

### **Chapter – 3 Planning for Safe Plant Operations**

Start up and shut down procedures - work permit application –vapour cloud formation hazards and combating such chemical spillage control procedures.

Runway reactions - its control, precaution and prevention. Introduction to specific safety measures in certain Chemical Plants using chemicals, resulting in health disorders which are notified like Fertilizer, Insecticide, Pesticides – Chloro-alkali Explosives. Polymer plants, Toxic releases in them and their engineering controls.

#### **Chapter – 4 Inspection & Risk Assessment**

Concept of inspection of risk assessment, DOW index - Risk analysis – Dispersion modeling – Probability Criteria (HAZOP, HAZAN). Inspection techniques for chemical process plants, Reaction vessels, Distillation Towers, etc. Checklist for routine inspections - Checklist for specific maintenance and breakdown activities - Checklist for inspection of loading / unloading bay - Checklist Inspections of Compressor, Pumps etc. Assessing reliability of vessels - test checks. Corrosion location - causes – preventive inspection. Crushing Coring – locations and causes – prevention and inspection.

#### **Chapter – 5 Disaster Management Plan**

Assessment of DOW index - Risk analysis – Dispersion modeling – Probability Criteria (HAZOP, HAZAN). Case studies of some major accidents, viz. Fluxborough disaster, Seveso disaster, Bhopal Gas tragedy etc.

## SAFETY IN ENGINEERING INDUSTRIES (ELECTIVE)

Subject Code	Course offered	Full Marks	End Exam	IA
PDIS 105(E1)	in First Semester	100	70	30

### **Chapter – 1 Hot Working Process**

#### i Hot Work

Basic concept of hot work with examples ,Foundry Operation : Flow sheet for foundry operation including use of different types of furnaces. Health hazards and safe methods of operation in Die casting. Fettling operations, Shot blasting, sand blasting etc.

Forging Operation : Hazards in forging operation, Preventive maintenance of forging machines. Safe work practices in forging operations. Safety in use, handling and storage of dies. Safety on die changing.

Hot Rolling Mills Operation : Hazards in hot rolling operations and their control measures, safety in hot rolling mills, Selection and use of PPE for hot work

ii Furnaces: Hazards associated with DRI Kilns and their remedial measures, concept of safety accretion cutting, DSC cleaning etc, Induction Furnaces, Ladle Refining Furnaces, Electric Arc Furnaces, Submerged Arc Furnaces, Blast Furnaces, Basic Oxygen Furnaces etc. SOP/SMP, use of PPE & effective supervision in hot work.

### **Chapter – 2 Cold Working Process.**

Safety in the use of 1) power press (all types), 2) shearing, 3) bending, 4) rolling, drawing, 6) turning, 7) drilling, 8) boring, 9) milling / shaping, 10) planning / broaching, 11) Grinding, 12) Computerized Numerically Controlled Systems. Need for selection and care of cutting tools. Preventive maintenance, periodic checks for safe operation. Associated hazards and their prevention. Safety in use of the machine tools.

### **Chapter – 3 Other Operations**

Safety precautions in 1) Welding, 2) Cutting, 3) Brazing, 4) Soldering, 5) Metalising, 6) Chiseling, and 7) Blasting Operations. Safety in selection, use and maintenance of the associated equipment and instruments. Safety in finishing operation like a) cleaning, b) polishing and c) buffing and their related hazards. Safety during maintenance and use of these machines.

## **Chapter – 4 Heat Treatment**

Concept of heat treatment, safety during stress relieving activities in power plants and steam pipe lines, Hazards in various heat treatment operations. Assessment, Control and Preventive measures. Selection & use of PPEs.

## **Chapter – 5 Safety in Power Generating Industry**

Introduction –basic concept of power generation, concept of LP, MP & High Pressure boilers, description of the processes with their flow charts – safety aspects of mechanical and electrical equipment viz. boiler, turbine, pump, compressor, motor, transformer – safety manuals, safety during erection and commissioning and operation of power stations.

## APPLIED ERGONOMICS (ELECTIVE)

Subject Code	Course offered	Full Marks	End Exam	IA
PDIS 105(E2)	in First Semester	100	70	30

### **Chapter – 1 Definition, role and science for considering ergonomics as a Component of SHE, Notified occupational diseases due to poor ergonomics practices.**

#### **Load Carrying**

- Limits of load carrying
- Physiological basis of work
- Muscle System
- Lever systems in human body
- Physiological problems measured with load carrying (injuries/fatigue)
- Possible solutions to these problems and general guidelines to avoid such problems.

### **Chapter – 2 Use of Hand Tools & Work Station Design**

- Design of tools in relation to body postures
- Hand tools / power tools /specialized tools. Body supports /tool supports.
- Safety while using tools
- Tool boxes / Kits
- Tool maintenance / Training in usage
- Introduction to Anthropometrics.
- Concepts of percentiles (5th, 50th, 95th), averages & how and where to apply these
- Working heights-standing, sitting, semi standing (High stools)
- Correct postures – Health problems related to wrong postures, back pain etc. fatigue due to sitting.
- Good Chair.
- Precision tasks vs. gross tasks.
- Inspection tasks

- Key board work station

### **Chapter - 3 Machine Controls and Displays**

- Location & Sequence of operation.
- Natural expectation of control movement
- Preventing accidental activation
- Emergency controls (creating accident scenarios)
- Foot controls
- Displays – digital, analog, arrays, audio signals, coding, labeling, signs, & symbols, warnings

### **Chapter -4 Management of Human Comfort**

#### i Lighting

- Direct / indirect lighting, shadows, Local vs. general lighting, Glare Measurement of light & acceptable / recommended values for lighting.

#### ii Heat

- Protection from heat, protective suits/shoes/masks, ventilation & exhausts.
- Good practices, insulation

#### materials iii Noise

- Protection from noise, reducing noise levels, Engineering Control measures, good practices, insulation. Sound proof arrangement, PPES

#### iv Emergencies

- Fire, Flood, Earthquakes / Emergency Accident Scenarios
- Guideline for prevention, escape routes, exits etc

#### v General upkeep

- Create hassle free / injury free work environment, proper aisles for men & material movements, stairs, ramps, hand rails, signage.

### **Chapter– 5 Welfare Measures**

- Bathrooms, toilets, drinking water & washing facilities (minimum facilities and their upkeep)
- Recreations & relaxation / facilities Special needs exchange, easy communication.
- Self-improvement, rewards & motivation.

## **SAFETY IN MINING INDUSTRIES (ELECTIVE)**

Subject Code	Course offered	Full Marks	End Exam	IA
PDIS 105(E3)	in First Semester	100	70	30

### **Chapter – 1 Benching**

Study of bench Parameters – height, width & Slope, Study of Length of bench for overburden and ore.

### **Chapter – 2 Explosive**

Study of ANFO, LOX, slurry explosives, emulsion explosives, permitted explosives, Study of preparation of charge, Procedure of firing shots, direct and inverse initiation, stemming materials, water ampoules, cushion firing. Work permit for blasting operations.

### **Chapter – 3 Mine Gases & Fires**

Define atmospheric air and mine air mines.

Study of different gases found in their properties and physiological effect. Study of various sources of CO, Firedamp, black damp and after damp in mines. Study of gradual exudation, blower and outbursts of fire damp in under ground workings.

Study of causes and factors affecting spontaneous heating.

### **Chapter – 4 Explosion & Associated Hazards**

Study of causes of fire damp and coal dust explosion.

Study of various sources of water in mines & it's danger.

Study of various types of mine dusts, their sources, physical properties. Study of various types of mine dusts, their sources, physical properties. Study of diseases like Pneumoconiosis, silicosis, asbestosis, Nystagm epidermophytosis, ankylostomiasis and radiation hazard, Various sources of noises & vibrations.



## **Chapter – 5 Mining Safety & Law**

### **i Legislation**

Study of various aspects of Mine Rescue Rules 1955 (CMR), Study of Indian Explosive Rules – 2008.

### **ii Mines Accident and Safety.**

Discuss their classification causes & prevention.

Concept for accident report, procedure for conducting an enquiry to ascertain the causes of accidents.

Role of supervision in accident prevention, accident due to open cast mining.

Basic concepts of Safety, Safety consciousness & Safety Campaign, Safety organization, safety Committee, Duties of Safety Officer.

## **PROJECT WORK**

Subject Code	Course offered	Full Marks	Sessional	End Exam
PDIS 106	in First Semester	250	150	100

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Safety Engineering and Management Practices in real life situations, so as to participate and manage a large projects in future.

### **OBJECTIVES**

After undergoing the Project Work, the student will be able to:

1. Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real life working environment, preferably in an industrial environment.
2. Develop working models or applications and implement these for the actual needs of the community/industry.
3. Explain the working of industrial environment and its work ethics.
4. Explain what entrepreneurship is and how to become an entrepreneur.
5. Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.

### **General Guidelines**

The project assignment can be individual assignment or a group assignment. Preferably there should not be more than 5 students, if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl.No	Performance Criteria
1	Selection of project assignment
2	Planning and execution of considerations
3	Quality of performance
4	Providing solution of the problems or production of final product
5	Sense of responsibility
6	Self expression/ communication/ Presentation skills
7	Interpersonal skills/human relations
8	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work. It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations to such an exhibition.