

West Bengal State Council of Technical &
Vocational Education and Skill Development
(Technical Education Division)



Syllabus
of

Advanced Diploma in Industrial safety (ADIS)

**Course Duration: 1 Year (Full Time)
1 & ½ Year (Part Time)**

2023

ONE YEAR ADVANCED DIPLOMA IN INDUSTRIAL SAFETY

Eligibility for Admission:

A Degree from any recognized university in any branch of Engineering/Technology.

OR

A Degree in Science from any University recognized by UGC with Physics, Chemistry & Mathematics.

OR

A Diploma in any branch of Engineering or Technology recognized by the WBSCT&VE&SD.

Duration:

Two Semester Course: 1 Year.

Three Semester Course: 1&1/2 Years.

- Semester- 1 & 2 is of 17 weeks duration of which 15 weeks for Contact Classes and 2 weeks for Internal Assessment.
- Each week consists of 30 contact periods including tutorial and practical, Each period will be of one-hour duration.
- Marks distribution in

Semester – 1: 550 marks.

Semester – 2: 650 marks.

Total: 1200 marks.

- Hour of examination for semester examination is 3 hours.
- Classes will be held five days a week for the one-year course.

ONE & HALF YEAR COURSE (3 SEMESTERS)

SEMESTER-1

Sl. No.	Subject Code	Number of Hours	Full Marks
1	IS-101	4	100
2	IS-102	4	100
3	IS-104	4	100
4	IS-105	3	100

SEMESTER-2

Sl. No.	Subject Code	Number of Hours	Full Marks
1	IS-103	4	100
2	IS-201	4	100
3	IS-202	4	100
4	IS-106	3	50
5	IS-206	3	50

SEMESTER-3

Sl. No.	Subject Code	Number of Hours	Full Marks
1	IS-203	4	100
2	IS-204	4	100
3	IS-205	4	100
4	IS-207	3	100

**CURRICULAR STRUCTURE FOR FIRST SEMESTER OF THE ADVANCED
DIPLOMA COURSE IN INDUSTRIAL SAFETY**

Sl. No.	Subject Code	Subject of Study Theoretical Papers	Contact Periods/Week			Examination Scheme				Full Marks	
			Lec	Tut	Sess	Internal		External		Th	Sess.´
						Assessment	Attendance	Objective	Subjective		
1	IS-101	Safety, Health & Environmental Management	3	1	-	20	10	20	50	100	-
2	IS-102	Safety Engineering	4	-	-	20	10	20	50	100	-
3	IS-103	Appraisal, Analysis, Inspection & Quality Control Procedures	3	1	-	20	10	20	50	100	-
4	IS-104	Industrial Hygiene, Occupational Health & Applied Ergonomics	4	-	-	20	10	20	50	100	-
Sessional Papers											
5	IS-105	Industrial Hygiene & Occupational Health Lab.	-	-	3	Internal		External		Th	Sess.
						50		50		-	100
6	IS-106	Term Work	1	-	2	25		25		-	50
TOTAL						-		-		400	150

**CURRICULAR STRUCTURE FOR SECOND SEMESTER OF THE ADVANCED
DIPLOMA COURSE IN INDUSTRIAL SAFETY**

Sl. No.	Subject Code	Subject of Study Theoretical Papers	Contact Periods/Week			Examination Scheme				Full Marks	
			Lec	Tut	Sess	Internal		External		Th	Sess.´
						Assessment	Attendance	Objective	Subjective		
7	IS-201	Safety, Health & Environmental Legislation	4	-	-	20	10	20	50	100	-
8	IS-202	Environmental Management & Safety Philosophy	3	1	-	20	10	20	50	100	-
9	IS-203	Chemical & Process Safety in Industry	3	1	-	20	10	20	50	100	-
10	IS-204	Safety in Construction Industry	4	-	-	20	10	20	50	100	-
11	IS-205	Fire Safety Management	3	1	-	20	10	20	50	100	
Sessional Papers											
12	IS-206	Safety Engineering Laboratory	-	-	3	Internal		External		Th	Sess.
						25		25		-	50
13	IS-207	Project	-	-	3	50		50		-	100
TOTAL						-		-		500	150

**DETAILED SYLLABI OF THE
DIFFERENT THEORETICAL &
SESSIONAL SUBJECTS OFFERED IN
FIRST SEMESTER**

SAFETY, HEALTH & ENVIRONMENTAL MANAGEMENT

Subject Code	Course Offered in 1 st Semester	Full Marks	Written Test	Internal Assessment	Attendance
IS-101		100	70	20	10

Chapter	Content	Hours
1	<p>Introduction: Management and Management Principles and Types of Management. General principles of Management, Managerial Role, Authority, Responsibility and Power, Span of Management, Delegation and decentralization of authority. Safety, Health and Environment Management, (SHE), Occupational Safety, Health and Environmental Safety Management – Principles & practices. Role of Management in Industrial Safety</p>	8
2	<p>Planning for Safety: Planning: Definition, purpose, nature, scope and procedure. Range of planning, variety of plans. Strategic planning and tools of implementation. Management by objectives and its role in Safety, Health and Environment (SHE). Policy formulation and implementation</p>	6
3	<p>Organizing for Safety: Organising – Definition, Need, Nature, Principles. Organizing for Safety, Health & Environment. Organization structure, function and responsibilities. Co-ordination of 3-components of SHE. Line and Staff functions for Safety, Health & Environment.</p>	6
4	<p>Directing for Safety: Direction: Definition, process, principles and techniques, Leadership: Role, functions and attributes of a leader, Communication: Purpose, process, types and channels Essential rule in communication. Two ways communication. Barriers in communication, essentials of effective communication. Communication and group dynamics, Team building.</p>	5
5	<p>Monitoring for Safety, Health & Environment: Occupational Safety, Health and Environment Management System. Bureau of Indian Standards on Safety and Health : 14489 – 1998 and 15001 – 2000, ILO and EPA Standards Audit and inspection procedures associated with safety, health and environment. Relevance of WTO on SHE. SHE: Element of training cycle.</p>	6
6	<p>Principles of Accidents Prevention: Definition: incident accident, injury, dangerous occurrences, unsafe acts, unsafe conditions, hazards, error oversight, mistakes etc. Accident Prevention : Theories / Models of accident occurrences.</p>	8

	Principles of accident Prevention. Accident and Financial implication.	
7	Safety Organization: Objectives – Safety Policy – An Overview of various safety activities for discovering causes of accidents and controlling them – Division of responsibilities in the organization – Location of safety function - Organization of safety department – Qualification of safety specialist – Functional divisions within the safety department - Role, responsibility, authority and accountability of safety officers – Safety committee, their structures and functions.	6
8	Organisational Behaviour: Human factors contributing to accidents Human Behaviour: Individual differences, behaviour as function of self and situation, perception of danger and acceptance of risk, knowledge and responsibility vis-à-vis safety performance, theories of motivation and their application to safety, role of supervisors and safety departments in motivation. Conflict & Frustration: Identification of situations leading to conflict and frustration and techniques of management.	4
9	Behavioural Safety Culture & Motivation: Safety Culture of an organization and its components: unsafe human behaviour – safe performance – behavioural safety and risks assessment – Behavioural safety training - behavioural safety programmes.	5
10	Management Information System: Sources of information on Safety, Health and Environment Protection, Compilation and collation of information, Analysis & use of modern methods of programming, storing and retrieval of MIS for Safety, Health and Environment. QCC HS Computer Software Application and Limitations. Status and future goals of computer utilization in Safety, Health and Environment (SHE) Services in Industries.	6

SAFETY ENGINEERING

Subject Code	Course Offered in 1 st Semester	Full Marks	Written Test	Internal Assessment	Attendance
IS-102		100	70	20	10

Group/Chapter	Content	Hours
A. 1	SAFE GUARDING OF MACHINES Statutory provision related to principles in machine guarding. Type of guards, their design and selection. Guarding of different types of	6

	<p>machinery including special precautions of wood working, paper rubber and printing machinery, machine, tools, etc. Built-in-safety devices, maintenance and repairs of guards, incidental safety devices and tools.</p>	
2	<p>MANUAL HANDLING AND STORAGES OF MATERIALS</p> <p>Hazards in manual handling. Avoidance of excessive muscular effort. Kinetic methods of correct lifting and handling of materials. Maximum loads 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.</p>	6
3	<p>MECHANICAL HANDLING OF MATERIAS</p> <p>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.</p> <p>Lifting tackles: Chain slings, Rope slings, (fibre and wire) rings, hooks, Shackles, Swivels, Eye-bolts – salient safety features. Calculation of Safe Working Load.</p>	8
4	<p>HAND TOOLS AND PORTABLE POWER TOOLS</p> <p>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.</p>	8
B. 5	<p>ELECTRICAL HAZARDS</p> <p>Dangers from electricity – Safety limits of amperages – voltages – Safe distance from lines – Capacity and protection of conductors – joints and connection – Means of cutting off power – overload and short circuit protection – Earth fault protection.</p> <p>Earth., insulation and continuity tests – Protection against over voltage hazards arising out of “borrowed” neutrals - precautions – Portable electrical apparatus – Flame proof – Electrical equipment – Precautions in their selection, installation, maintenance and use – control of hazards to static electricity – Role of Electricians in controlling electrical accidents. Relevant provisions of the Indian Electricity Act and the Rules.</p>	6
6	<p>INDUSTRIAL LIGHTING</p> <p>Purpose of lighting. Advantage of good illumination. Lighting and Safety. Lighting and the work. Sources and types of artificial lighting. Principles of good illumination. Recommended minimum standards of illumination. Design of lighting installation, maintenance, lighting and</p>	2

	colour.	
C. 7	SAFETY OF PRESSURE VESSELS Fired and unfired – Statutory provisions – Testing requirements – Different kinds of testing – Design and construction aspects of safety. Safety in boilers, safety precautions & operation of boilers.	4
8	VENTILATION AND HEAT CONTROL Purpose of ventilation. Thermal environment and its measurement. Physiology of heat regulation. Thermal comfort. Indices of heat stress. Thermal limits for comfort, efficiency and freedom from health risk. Natural ventilation. Mechanical ventilation. Air conditioning. Process ventilation. Control of heat exposures, control at source, insulation, local exhaust ventilation. Control of radiant heat, dilution ventilation	5
9	MACHINE CONTROL & DISPLAYS <ul style="list-style-type: none"> - Location and sequence of operation - Natural expectation of control movement - Preventing accidental activation - Emergency control (creating accident scenarios) - Foot controls Displays – digital, analog, arrays, audio signals, coding, labeling, signs & symbols, warnings.	6
10	SAFETY IN INDUSTRIES – Engineering, Jute/Textiles, Agro, Forging & Foundry, Port & Dock.	10

APPRAISAL, ANALYSIS, INSPECTION & QUALITY CONTROL PROCEDURES

Subject Code	Course Offered in 1 st Semester	Full Marks	Written Test	Internal Assessment	Attendance
IS-103		100	70	20	10

Rationale

For any planned activity there is always a need for appraisal of its effectiveness. It needs certain kind of inspection, analysis and also at time some control measures. This applies to industrial safety plans and programme too. Hence the paper.

Sl. No.	Units	Coverage		Marks
		L	T	
1	Plant and equipment safety appraisal and control techniques.	8	2	15
2	Hazards identification Techniques	8	2	15
3	Accident investigation & Reporting and analysis.	8	2	15
4	Measurement and control of performance	10	4	18

5	Major Accident Hazards Control	11	1	12
		45	1 5	75

PLANT AND EQUIPMENT SAFETY APPRAISAL & CONTROL TECHNIQUES

Objectives, Plant safety observation, Plant Safety Inspections. Safety Sampling. Safety Surveys. Job Safety Analysis. Safety Inventory System. Product Safety. Permit to work systems. Safety tag systems. Loss Control: Damage control & system safety.

HAZARD IDENTIFICATION TECHNIQUES

Hazard Analysis: Inductive, deductive. FMEA & CMA. Fault Tree Analysis. Examples of each. Risk Analysis Techniques: HAZAN, HAZOP, Safety Audit. Evaluating risks in chemical process.

ACCIDENT INVESTIGATION REPORTING AND ANALYSIS

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

MEASUREMENT AND CONTROL OF PERFORMANCE

Lost time accident. Disabling injury. Accidents imposable under the factories Act and E.S.I. Act. Frequency rate. Severity rate. Incidence rate per 1000 workers and man days lost. Temporary disablement 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.

Application of digital technology in monitoring safety compliance – usage of artificial intelligence, Robotics, Drones and other applications of Augmented Reality (AR) and Virtual Reality (VR).

Creation of Management Reports from Digital Tools, Dash Boards, Various follow-up mechanisms and enhances accountability through digital applications.

PLANT HOUSEKEEPING

Management responsibility – Safety Engineers stake in good housekeeping- Need for proper planning and follow-up – Need for overall cooperation – Typical accidents due to poor housekeeping – Typical items of unsafe housekeeping - 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 assignments – Inspection and Inspection check-list – Results of good housekeeping.

MAJOR ACCIDENT HAZARDS CONTROL

Introduction, types and consequences of major accident hazards. Role of management, local authorities and public.

Emergency preparedness, rehearsal and exercises.

INDUSTRIAL HYGIENE, OCCUPATIONAL HEALTH & APPLIED ERGONOMICS

Subject Code	Course Offered in 1 st Semester	Full Marks	Written Test	Internal Assessment	Attendance
IS-102		100	70	20	10

Group/Chapter	Content	Hours
A. 1	INDUSTRIAL HYGIENE: Concept, definition and importance of hygiene in industry. Difference between domestic hygiene and industrial hygiene. Physical Hazards – Heat Stress and its control, Ventilation, Noise, Vibration, Improper Illumination, Thermal Radiation – X-Rays – Ultra Violet Radiation – Ionizing and Non-ionizing Radiations – Permissible Industrial Exposure Limits – Effects of Exposure – Preventive and Control measures.	8
2	Air Sampling – The concept of Threshold Limits - Acute and Chronic exposure effect – Personal Monitoring – Biological Monitoring and Control Measures – Risk Management at work places – Emergency Control Measures. Awareness for ensuring ideal hygiene.	6
3	Noise and Vibration - The effect of noise on man, measurement and evaluation of noise, vibration damping, noise isolation, noise absorption – silencers, practical aspects of control of noise. Case studies on impact of noise from Compressors and Generators. Vibration: Effect, measurement and control.	6
B. 4	OCCUPATIONAL HEALTH: Meaning of Occupational Health and Occupational health Hazards. Awareness programme, types of occupational health hazards in industries – physical, chemical, biological, mechanical and psychological hazards- Common workrelated or Occupational Diseases – Occupations involving risk of contacting these diseases – Mode of causation of the diseases and its effect – Diagnostic methods – Methods of prevention – Notifiable occupational diseases – Compensation for Occupational Disease – Evaluation of injuries – Medical Services in an Industrial establishment and its functions – Occupational health service and its activity – Occupational Hazards in Hospital – Action programmes for work related diseases at the National Level – Major Accident Hazards Control – Medical provision - Occupational health audit & survey. Occupational diseases relating to construction work, emergency medical treatment of injuries and	8

	rehabilitation at construction site.	
5	<p>PERSONAL PROTECTIVE EQUIPMENT Introduction and Requirements and assessment of PPE. Type of PPE.</p> <p>a) Non-Respiratory Personal Protective Devices: Head protection - Ear Protection – Face and eye protection – Hand protection – Feet protection – Body protection – supply. Use, care and maintenance of personal protective equipment – Requirements under Factories Acts and Rules.</p> <p>b) Respiratory Personal Protective Devices: Classification of hazards – Classification of respiratory personal protective devices – Selection of respirators – Instructions and hints in the use of Breathing Apparatus – supply. Use, Care and maintenance of Breathing Apparatus – Training in the use of Breathing Apparatus.</p>	5 5
C. 6	<p>APPLIED ERGONOMICS: Definition, Role & Science for considering Ergonomics as a component of SHE.</p> <p>Industrial Physiology:</p> <ul style="list-style-type: none"> - Classification of workload - Work capacity and man - Job alignment - Fatigue and rest allowances - Physiological list in occupational health assessment - Ergonomics - Man-machine differences - Man-machine interface - Fitting the man to the job - Prevention work related limb disorders & repetitive injury (RSI). 	6
7	<p>Load Carrying:</p> <ul style="list-style-type: none"> - Limits to load carrying - Physiological basis of work - Muscle system - Lever system in human body - Physiological problems measured with load carrying (injuries/fatigue etc.) - Possible solutions to these problems and general guidelines to avoid such problems 	4
8	<p>Hand Tools and their Use:</p> <ul style="list-style-type: none"> - 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. 	4
9	<p>Work Station Design:</p> <ul style="list-style-type: none"> - Introduction to Anthropometrics - Concepts of percentiles (5th, 50th, 95th), averages and how 	8

	<p>and where to apply these</p> <ul style="list-style-type: none"> - Working heights – standing, sitting, semi-standing (High stools) - Correct postures – Health problems related to wrong postures, back pain etc., fatigue due to sitting. 	
--	---	--

INDUSTRIAL HYGIENE & OCCUPATIONAL HEALTH LAB

Subject Code	Course Offered in 1 st Semester	Full Marks	Internal Assessment	External Assessment
IS-105	Semester	100	50	50

INDUSTRIAL HYGIENE:

Marks Allotted: 50.

Total Periods: 20

Sl. No.	Name of the Experiment	Equipment/Glassware to be Used
1	Demonstration and calibration of Air Sampling Equipment	Personal Sampler, High X Volume Sampler, Instantaneous Gas Detector. Midger Impinger Tubes, Rotameter, Wet Gas Flow Meter, Soap Bubble, Flow– rate Meter, Spectrophotometer, Atomic Absorption Spectrometer, Gas Liquid Chromatograph, Phase Contrast Microscope.
2		
a)	Oxides of Nitrogen	Personal Sampler, All Glass Bubbler, Rotameter, Spectrophotometer.
b)	Sulphur Dioxide	-do-
c)	Ammonia	-do-
d)	Chlorine	-do-
3	Sampling and Estimation of Solvent Vapours in Work Environment	
a)	Benzene Sampling by Activated Charcoal and Analysis by Gas Liquid Chromatograph.	Low–Flow Personal Sampler, Rotameter, Activated Charcoal Tube, Gas Liquid Chromatograph.

b)	Carbon di-sulphide Sampling by Aspirator Bottle and Analysis by Calorimetric Method	Aspirator Bottle, All Glass Impinger Tubes.
4	Sampling and Analysis of Mercury	Personal Sampler. All Glass Impinger Tubes. Rotameter Mercury Analyzer.
5	Sampling and Estimation of dust Gravimetric Method	Personal Sampler, Rotameter, Filter Holders, Electronic Balance.

OCCUPATIONAL HEALTH

Marks Allotted: 50.

Total Periods: 25

1. Lung Function Test on Medspirer.
2. Ear Testing on audiometer & demonstration of various methods of audiometer, Bakery Audiometer, BA-3 Arphi.
3. Study of notifiable diseases by use of models.
4. Study of various models of lungs (section of lungs)
5. Demonstration of Personal Protective Equipment such as Noise Mask, various types of Safety Goggles, etc.
6. Explanation on the charts of Industrial noise, Notifiable diseases, Physical health hazards, chemical health hazards, Industrial dermatitis, Prevention and Control.
7. Explanation of various notifiable occupational diseases with photographic models.
8. Explain of the charts of control of noise in industry, noise levels in some industries and permissible levels of exposure to noise in industry.

TERM WORK

Subject Code	Course Offered in 1 st Semester	Full Marks	Total Periods	Internal Assessment	External Assessment
IS-106		50	45	25	25

Q. No. 1, 2 & 3 are compulsory and any two from the rest of works:

1. Hazard identification
2. Accident investigation and reporting
3. Measuring safety performance

4. Design of need based training programme to observe National Safety Day and Safety Awareness
5. Study of safety organisation and management
6. Study of employee's participation in safety
7. Safe guarding of machinery
8. Material handling – role and precaution to safety
9. Working at height – basic training to operator / worker in relation to safety
10. Design of work place having basic feature on safety
11. Ideal housekeeping observing all safety norms
12. Industrial lighting and illumination – concern of safety
13. Ventilation (for heat control) in industry
14. Electrical hazards
15. Noise control
16. Job safety analysis
17. Fault tree analysis
18. Study of cases under Factories Act

**DETAILED SYLLABI OF THE
DIFFERENT THEORETICAL &
SESSIONAL SUBJECTS OFFERED IN
SECOND SEMESTER**

SAFETY, HEALTH & ENVIRONMENTAL LEGISLATIONS

Subject Code	Course Offered in	Full Marks	Written Test	Internal Assessment	Attendance
IS-201	2 nd Semester	100	70	20	10

Chapter	Content	Hours																		
1	<ul style="list-style-type: none"> - ILO Convention and Recommendation concerning Occupational Health and Safety. - Relevant Conventions and Recommendation of ILO in the furtherance of Safety, Health and Environment (SHE). SHE a human right issue. Trade Policy affecting OHS. <table style="margin-left: auto; margin-right: auto; border: none;"> <thead> <tr> <th style="text-align: left;">Year</th> <th style="text-align: left;">Convention</th> <th style="text-align: left;">Recommendation</th> </tr> </thead> <tbody> <tr> <td>1981</td> <td>155-OHS</td> <td>164-OHS</td> </tr> <tr> <td>1985</td> <td>161-OHS</td> <td>171-OHS</td> </tr> <tr> <td>1988</td> <td>167-Safety & Health in construction</td> <td>175-Safety & Health in construction</td> </tr> <tr> <td>1990</td> <td>177-Chemicals</td> <td>177-Chemicals</td> </tr> <tr> <td>1993</td> <td>174-Prevention of major industrial accidents</td> <td>181-Prevention of major industrial accidents</td> </tr> </tbody> </table>	Year	Convention	Recommendation	1981	155-OHS	164-OHS	1985	161-OHS	171-OHS	1988	167-Safety & Health in construction	175-Safety & Health in construction	1990	177-Chemicals	177-Chemicals	1993	174-Prevention of major industrial accidents	181-Prevention of major industrial accidents	12
Year	Convention	Recommendation																		
1981	155-OHS	164-OHS																		
1985	161-OHS	171-OHS																		
1988	167-Safety & Health in construction	175-Safety & Health in construction																		
1990	177-Chemicals	177-Chemicals																		
1993	174-Prevention of major industrial accidents	181-Prevention of major industrial accidents																		
2	Overview of the Occupational Safety, Health & Working Conditions Code, 2020.	10																		
3	The Factories Act, 1948 (Amended) and Rules: Factories Act. Provisions under the Act and Rules made there-under with Amendments Case Laws under the Factories Act.	12																		
4	Social Security Legislations: <ul style="list-style-type: none"> - Workmen's Compensation Act and Rules. - ESI Act and Rules. Contract Labour (Abolition and Regulation) Act. - Public Liability Insurance Act. - Social Accountability 8000 SA-8000. 	8																		
5	Safety, Health and Environment (SHE) related Important Legislation: Salient Features:	10																		

	<ul style="list-style-type: none"> - Sections pertaining to SHE. - Indian Boilers Act. 1923 with allied Regulations. Indian Electricity Act, 2000 and Rules, Indian Explosives Act, 1984 and Rule. Petroleum Act and Rules. Gas Cylinder Rules. Calcium Carbide Rules. The Insecticides act and Rules - Radiation Protection Rules, Hazardous Material Transportation Rules. - Static and Mobile (Unfired) Pressure Vessel Rules, 1981 as amended in 2000. - The Dock Workers (Safety, Health & Welfare) Act. 1996 and Rules and Regulations. - The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act. 1996. - Central Building and other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 1998. - The Building and other Construction Worker's Welfare Cess Act. 1996 Cess Rules, 1998. - Local building & development laws. - West Bengal Building & other Construction Workers (Regulation of Employment and Conditions of Services) Rules, 2004. 	
6	<p>Environmental Protection Legislations</p> <ul style="list-style-type: none"> - Water (Prevention & Control of Pollution) Act. 1974 and Rules, Air (Prevention & Control of Pollution) Act. 1981 and 1982 and Rules. Motor Vehicles Act. 1988 as amended in 2000. The Central Motor Vehicles Rules, 1989 as amended in 2000. Transport of Hazardous Goods Rules. - Environmental Protection Act. 1986 and Rules. Noise Pollution Act. 1998. Bio-Medical Waste, Hazardous Waste Management Rules. - Chemical accidents (Emergency Preparedness, Planning and Response) Rules, 1986. - Manufacture, storage and import of Hazardous chemicals Rules, 1989. 	8

ENVIRONMENTAL MANAGEMENT & SAFETY PHILOSOPHY

Subject Code	Course Offered in	Full Marks	Written Test	Internal Assessment	Attendance
IS-202	2 nd Semester	100	70	20	10

Chapter	Content	Hours
1	ENVIRONMENT MANAGEMENT SYSTEM Aspects and Impact of Environment Management. Environmental Policy. Environment Impact Assessment. Process & Methodologies. Administrative Procedure for Environmental Clearance. EMS Audit ISO 14001:015. Guidelines related to Industrial Siting.	8
2	ENVIRONMENT MONITORING Principles and practices for monitoring of air pollution, water pollution, environmental noise pollution. Effluent treatment plant – key process. Parameters of Effluent monitored.	6
3	WASTE MANAGEMENT Principles and concept of hazardous waste management. Six-R Concept: Rethink, Refuse, Reduce, Recycle, Reuse & reprocessing/co-processing of waste.	5
4	GLOBAL WARMING Carbon Emission, Atmospheric gases, Greenhouse gases, Kyoto Protocol, Ozone depleting substances and its impact on environment. Restrictions for development in Coastal Zone as per CRZ Regulations	5
5	ENERGY CONSERVATION Key elements of energy management system ISO 50001. Use of clean technologies. Different energy conservation measures	5
6	SUSTAINABILITY REPORTING Elements of Sustainability Reports. Purpose and advantages of Sustainability Reporting	6
7	VISION ZERO: PHILOSOPHY & PRINCIPLES 7 Golden rules & Guidelines Role of Leadership. Global case Studies.	6
8	EMPLOYEE PARTICIPATION IN SAFETY Purpose. Areas of participation. Methods. Role of Trade Union in Safety Health and Environment Protection. Safety Promotion and Safety Awards and Suggestion Schemes. Safety Competitions. Safety Incentives. Publicity Schemes – Audio-visual publicity and other promotional methods.	6
9	ECONOMICS OF SAFETY Cost of Accidents: Direct and Indirect cost. Financial costs to individual and family, Organization and society. Cost compilation procedures. Utility and Limitation of Cost Data. Budgeting for Safety.	4
10	SAFETY EDUCATION & TRAINING Training for Safety: Assessment of training needs – Design and development of Training Programmes – Training methods and strategies – Training of Managers, Supervisors and Workers –	6

	Evaluation and Review of Training Programmes. Communication with Senior and Line Management. Ensuring top-level involvement and commitment to safety training. Safety training promotional activities: In plant training programmes, external training programmes, seminars, conferences and workshops, induction programmes for new entrants. CBT, concept for training. Safety as online function. Use of audio-visual multimedia and information technology in organizing the training on safety	
11	DISASTER MANAGEMENT Disaster from natural calamities affecting Industrial activities. Fire, Flood, Earthquakes and other emergency accident scenarios. Guidelines for meeting Emergencies	4

CHEMICAL & PROCESS SAFETY IN INDUSTRY

Subject Code	Course Offered in	Full Marks	Written Test	Internal Assessment	Attendance
IS-203	2 nd Semester	100	70	20	10

Chapter	Content	Hours
1	INTRODUCTION: Different types of hazards in chemical industries and their precautions - U. N. 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 Cargo, by all modes - Safety in Chemical Industry :- Batch Process and Continuous process - Criteria for the plant to be under MAH unit. Chemical hazards: toxic chemicals, dust, gases, fumes, mists, vapour & smokes – exposure, evaluation.	10
2	BULK/ISOLATED STORAGEES 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)	8
3	PIPELINE SAFETY Transfer of chemicals by pipelines – different components and safety devises of pipelines – Pipeline and Instrumentation (P&I) diagram – colour coding – Identification of contents – precautions in breaking pipelines (probable causes of pipeline failure) – integrating of	8

	pipelines (pipeline integrity) – maintenance of pipelines - preparation of maintenance schedule - safe operations.	
4	<p>PLANNING FOR SAFE PLANT OPERATIONS</p> <p>Start up and shut down procedures - work permit application –vapour cloud formation hazards and combating such chemical spillage control procedures.</p> <p>Runway reactions - its control, precaution and prevention.</p> <p>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.</p>	12
5	<p>RISK ASSESSMENT</p> <p>Assessment of DOW index - Risk analysis – Dispersion modeling – Probability</p> <p>Criteria (HAZOP, HAZAN).</p>	4
6	<p>EMERGENCY PLANNING & PREPAREDNESS</p> <p>Emergency Planning – On site & off Site Emergency Plans for toxic releases, fire and explosions. Emergency Preparedness, rehearsal and exercises.</p>	4
7	<p>INSPECTION</p> <p>Inspection techniques for chemical processes plants, Reaction vessels, Distillation Towers, etc. Checklist for routine checks - Checklist for specific maintenance and breakdown - Checklist for inspection of loading / unloading bay - Checklist Inspections of Compressor, Pumps etc. Asserting reliability of vessels - test checks. Corrosion location - causes – prevention inspection. Crushing Coring – locations and causes – prevention and inspection.</p>	6
8	<p>PRINCIPLES OF RELIABILITY ENGINEERING</p> <p>Principles of Reliability Engineering – Application of Reliability – Engineering, Concepts of critical equipment and devices.</p>	3
9	<p>CASE STUDIES</p> <p>Case of studies of some major accidents, viz. Fluxborough disaster, Seveso disaster, Bhopal Gas tragedy etc. Safety Audit – evaluating risks in chemical Processes</p> <p>– Engineering control of Chemical Contaminants.</p>	4

SAFETY IN CONSTRUCTION INDUSTRY

Subject	Course	Full Marks	Written Test	Internal	Attendance
---------	--------	------------	--------------	----------	------------

Code	Offered in			Assessment	
IS-204	2 nd Semester	100	70	20	10

Chapter	Content	Hours
1	<p>Meaning and Scope of Safety in Construction</p> <p>Basic philosophy peculiarities and parameters governing the safety in construction such as site planning and layout, safe access, good housekeeping.</p> <p>Accident and hazards – their causes and effects to be changed as Potential construction hazards (physical, chemical, biological, ergonomic). Major causes of accidents. Accident and hazards their causes and effects.</p>	4
2	<p>Safety in Construction Operations</p> <p>a)Underground Works : Excavation, drilling and blasting prematic, trenching, shorting porklain type of shorting, strutting, tunnelling, piling and safety in using and operating machinery and equipment relating to the above works. Foundations: Plant & Machinery and Structure.</p> <p>b)Above Ground Works : Scaffolding, shuttering / form work, ladders, concrete. Safety in use and portion of related machinery and equipment. Safety on working on fragile roof. Working at Heights.</p> <p>c)Underwater portions: Well sinking, caissons underwater concreting, cofferdams and special operations connected with irrigation work. Safety in use of machinery and equipment related to underwater portions.</p> <p>d)Movements of Construction Machinery & Materials : Heavy /Long Items, Earth Movers equipment Railway wagons, motor trucks. Materials Vehicles etc. Hazardous Materials, Material handling equipment.</p> <p>e)Special Works : High rise buildings, bridges and tunnels, roads, railways, asphaltting, pneumatic caissons, electrical installations and bills.</p> <p>f)Safety in Prevention and Protection at Work. Site including the collapsing of the structure.</p> <p>g)Blasting Operation Related Safety (including Handling, Storing of Explosives Related Safety): Hazards involved and Safety Precautions. Safety in Demolition Operations – Planning and Permit; precautions prior to demolition, protection of the public, precautions during demolition, sequence of demolition operations from safety point of view. Temporary installation and structures.</p>	20
3	<p>Safety in Stacking, Storage and Transport of Construction Materials</p>	10

	<ul style="list-style-type: none"> • Reinforcements • Cement • Sand • Aggregates • Chemicals • Organic binders • Gas Cylinders • Others. <p>General considerations for stacking and storage – Planning for Storage Layout, protection against atmospheric agencies, protection against fire and other hazards.</p>	
4	<p>Safety in Use of Construction Machineries & Equipment:</p> <p>Hazards involved, safety devices and precautions to be taken for:</p> <ul style="list-style-type: none"> • Batching plant • Mixers • Earth Moving equipment • Cranes • Pile driving equipment • Excavators • Drilling equipment • Welding equipment • Gas cutting equipment • Grinding equipment • Derricks • Compressors • Crushers • Layers. <p>Hot Mix Asphalt Plant Operation: Asphalt cement (compost)/mastic asphalt. Asphalt melting equipment; Rolled asphalt concrete; Mobile asphalt layers and finishes asphalt pavers (wheel type); Asphalt plant compactor; Asphalt recycler equipment.</p> <p>Hand Tools, Portable and Hydraulic Tools: Common causes of accidents, safe practices; Inspection, maintenance and repair of tools; detectable causes of tool failures. Redressing of tools.</p> <p>Hand Tools: Safe use of hammers, hand saw, chisel, axe and hatchets, punches & pins, snips, screw drivers, hand planes, plumb bob, crow bar.</p> <p>Cutting Hand Tools: Rod and Bar cutters, Bolt cutters, Manual Rebar shears, Wrenches, Pliers, Pipes, Clamps, Vice etc.</p> <p>Power Tools: Type of injuries; Earthing, Use of RCCB, ELCB, Double insulated tools, Electric cords and plugs, Safe use of electric drill, Drill presses, Power saw, Portable grinder, Electric/Hydraulic shear and cutter, Electric/hydraulic benders etc.</p>	14
5	<p>Special Construction Operations</p> <p>Special Operations</p> <ul style="list-style-type: none"> • Transmission Towers • Railways • Power Plants • Transformer Installations 	6
6	<p>Working at Heights and Prevention of Falls of Persons</p>	8

	<p>High incidence of serious accidents in working at heights – Types of operations – Planning operations – Safety features associated with Construction, Design and use of gangways, floors, ladders of different types, scaffolds of different types including Boatwain’s Chain and Safety belts – other safety requirements while working at height – Prevention of falls of persons at floor level – Potential tripping slipping hazards.</p> <p>Prevention from falling of materials; Safety on working on fragile roof; Mobile elevated working platforms.</p>	
--	---	--

FIRE SAFETY MANAGEMENT

Subject Code	Course Offered in	Full Marks	Written Test	Internal Assessment	Attendance
IS-205	2 nd Semester	100	70	20	10

Group	Content	Hours
A	<p>BASIC PHYSICS & CHEMISTRY OF FIRE</p> <p>Definition of Fire, Fire Triangle, Fire Tetrahedron, Chain Reaction, Classes of Fire Essential Prerequisites of Fire; Basic Elements of Fire and their Properties. Spread of Fire, Stages of Fire, Source of Ignition, Common Causes of Fire, Methods of extinguishing Fire; Smoke and its Effect, Fire Load.</p> <p>ANATOMY OF FIRE</p> <p>Combustion, Elements & Factors involved in Combustion, Combustion Toxicology; Flame, Smoke, Heat, Toxic gases; Flash point, Fire point, Ignition temperature; Techniques of Fire Extinction – Smothering, Cooling, Starvation and Chain Breaking Mechanism (CBM).</p> <p>FIRE RISK IN FLAMMABLE LIQUIDS, GASES & DUST</p> <p>Flammable Liquids:- Name, Physical properties; Classification of Flammable & Combustible Liquids; Hazard classification of Flammable Liquids; Extinguishing Media and Methods of application; Vapour Density; Classification of Gases by Chemical properties, Physical properties; Dust & dust Explosion.</p>	12
B	<p>ELECTRICITY AND FIRE RISKS</p> <p>Common causes of Electrical Fire & its remedial measures, Electrical</p>	20

	<p>Hazards including Static Electricity; Electrical Circuits, Electrocutation & Protective measures; Electrical safety and use of Electrical equipment in hazardous areas.</p> <p>BUILDING CONSTRUCTION & FIRE</p> <p>Importance of Fire Safety in buildings, Building materials and their behavior under fire conditions; Classification of Buildings as per NBC part IV (Fire & Life Safety), 2016; Symptoms of Building Collapse; Smoke movement in building; Fire safety requirement in different groups of buildings; Means of Escape.</p> <p>FIRE FIGHTING AGENTS & APPLIANCES</p> <p>Water: Physical properties, Extinguishing properties. Foam: Types of Foam, Properties of Foams and Techniques of Extinguishment by Foam; High Expansion & Low Expansion Foam; Foam making equipment. Carbon Dioxide: Properties, Extinguishing mechanism. Dry Chemical Powder: types & Uses. Fire Fighting Equipment: Portable Fire Extinguisher: Importance, Types of Extinguishers, Methods of operation of different types fire extinguishers Fire Tender: Various types of Fire Tenders. Fire Service Equipment: Pumps & Primers; Hose & Hose Fittings: Classification, Types; Cooling System, Working Principles, Methods of Operation; Care & Maintenance; Small & Special Gears. Ladders, Ropes & Lines: Types of Ladder: Operational use; Care & Maintenance; Types & Uses of Lines; Methods of Inspection & Testing; Care & Maintenance of Ropes & Lines.</p>	
C	<p>FIRE PROTECTION AND CONTROL TECHNIQUES</p> <p>Fire Hydrant Systems and Water Supply: Types & Components of Hydrant, Operational functions; Wet Riser, Dry Riser, Down Comer, Flow Gauging. Hydraulics and Water Relay: Pressure & Head; Pressure & flow; Nozzle's Discharge; Types of Water Relay. Automatic Fire Detection Systems: Types of Detectors – Smoke, Heat, Flame/Gas Detectors; Operating Principles; Automatic Fire Alarm Systems; Fire Detection Alarm Systems; types of Sprinklers and their operating principles; Fire Suppression System. Breathing Apparatus: Types of B.A. Sets in use; Working Principles and Care & Maintenance; Fire Proximity and Approach Suits.</p>	14
D	<p>FIRE AND LIFE SAFETY EDUCATION & TRAINING</p> <p>Human behaviour in fire situation; On Site Emergency Plan; Public Fire & Life Safety Education & Training Methods. Medical First Aid: Definition of First Aid; Duties of First Aider; First Aid tools; Fire Incidents; Burn & Scalds - Symptoms & Management; Wounds & Haemorrhage; Bleeding & Infection; Causes & Types of Fractures; Sprain & Dislocation; Artificial Respiration; CPR;</p>	14

	Injuries – Classification, Symptoms & Management; Snake Bite & its Management. Principles of Disaster Management: Objectives; Classification – Natural & Man-made Disaster; Elements; National Policy on Disaster Management.	
E	Visit to Fire Station for First-hand Training: Fire tender and its Operation. Practical fire fighting demo using extinguishers. BA Set & Rescue Operation. Emergency Methods & Rescue.	10

SAFETY ENGINEERING LABORATORY

Subject Code	Course Offered in	Full Marks	Internal Assessment	External Assessment	Period
IS-206	2 nd Semester	50	25	25	45

Experiments:-

1. Measurement of illumination level by Photo Meter.
2. Assessment of Heat Stress in Work Environment.
3. Measurement of number of air changes in a room by Velometer.
4. Measurement of Sound Levels.
5. Plotting of an Audiogram by Audiometer.
6. Determination of concentration of inflammable vapours.
7. Measurement of Static Charge / Electricity with the help of Static Charge Meter.
8. Determination of Fire Load in a given work place.
9. Measurement of Vibrations of Machines and equipment.
10. Measurement of Insulation Resistance.
11. Continuity test for Electrical circuits.
12. Earthing continuity test.

INDUSTRIAL PROJECT

Subject Code	Course Offered in	Full Marks	Internal Assessment	External Assessment	Period
IS-207	2 nd Semester	100	50	50	45

Any one of the following has to be performed:

1. Safety audit
2. HAZOP study
3. Preparation of emergency plan
4. Design of management information system
5. Assessment of fire & explosion potential and their prevention
6. In-plant safety inspection
7. Preparation of safety report