GSFC UNIVERSITY
EDUCATION RE-ENVISIONED

Post Graduate Diploma in Industrial Safety (PGDIS) – Full Time

July 2021

GSFC University,
Fertilizer Nagar,
Vadodara- 391750

COURSE MATRIX - PGDIS

Semester – I

Course Code	Course Title	Course Type	L	T	P	C
PGDIS101	Safety Management	Core	4	0	0	4
PGDIS102	Safety Engineering -I	Core	4	0	0	4
PGDIS103	Safety in Chemical Industries	Core	4	0	0	4
PGDIS104	Safety Engineering - II	Core	4	0	0	4
PGDIS105	Case Study & Seminar	AE	1	1	0	2
PGDIS106	Industrial Visit	AE	0	0	0	2
PGDIS107	Internship - I	AE	0	0	0	2

Semester – II

Course Code	Course Title	Course Type	L	T	P	C
PGDIS201	Hazard Identification, Risk Assessment & Determining Control Techniques	Core	4	0	0	4
PGDIS202	Industrial Health & Hygiene	Core	4	0	0	4
PGDIS203	HSE Legislations and Associated Statutory Provisions	Core	4	0	0	4
PGDIS204	Professional Elective	Core	4	0	0	4
PGDIS205	Safety Audit & Seminar	AE	1	1	0	2
PGDIS206	Industrial Visit	AE	0	0	0	2
PGDIS207	Internship - II	AE	0	0	0	2

AE – Ability Enhancement

DETAILED SYLLABUS - PGDIS

PGDIS101	Safety Management - I	L	T	P	C
		4	0	0	4
Total lecture hours & practical:		Total Marks: 100			
1	Course Pre-requisites: NIL				
2	Course Category: Core Course				
3	Course Revision/ Approval Date: 19-06-2021				
4	**Course Objectives**				

1. To learn the basic concepts of safety and its development process up to the modern concept of SHE i.e., Safety, Health and Environment.
2. To understand the basic concepts of safety, major concerns, important causation factors of industrial accidents.
3. To understand different aspect's philosophy, psychology, behaviour and principal technological attributes all of which have bearing on any given effective management system.
4. To understand the functions of planning, organizing, directing and controlling for industrial safety activities.
5. To learn safety techniques of imparting education and training, motivation and participation of employees in safety, costing of accidents and its relevance to safety budget and finally the Management Information System (MIS) on safety

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: The Important Conceptual attributes of Safety Need, Nature & its Significance-Focus on "Human Resource" i.e., Safety of the "Man" at the center. - An overview of perceptions vis-à-vis – facts pertaining to Safety; Appraisal on Various aspects of Accident prevention, Occupational Health & Environmental Preservation, Protection and	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

Conservation of nature-Modern concepts of HSE Management (as predominantly being identified and notified among different organizations) Various concerns attributable to Industrial Safety realization in terms of: Incidents and consequential Accidents resulting into Injuries, disabilities and loss of limbs/ lives-Occupational Health and Environmental Hazards-Nature and size of the problem. -Important Factors which could be detrimental to safety. -Logical inferences with reference to accident prevention. -Balancing of equation of between the inevitability factors that coexist in both Industrial development and Safety Historical evolution on the application of Scientific, Engineering and Technological Safety concepts in all Industrial establishments **PHILOSOPHY OF SAFETY:** Introduction to the philosophical outlook in any walk of life and its influence on creating a good safety management system -Explanatory review of various common definitions, phrases and terminologies like:-Unsafe Act/ Condition In attention, Oversight, Error, Casual approach, Mistake, Incapability, In competence, Error of judgment, Weakness, Stress related aberrations, Little forgetfulness, Negligence (Willful or otherwise), Hazard, Risk, Incident, Near miss, Accident (Minor/Major/Disastrous) etc.-Accident Causation Theories-H W Heinrich's Ten Axioms of industrial safety.-Heinrich's Domino Theory and his ratio". William Hadden's Energy Theory. Frank Bird theory of accident prevention. -Accident Prevention-Five Fundamentals of Accident Prevention – Organization, Fact Finding, Analyses of the facts, Selection of Remedies and Application of corrective actions. Five "E"s of Accident Prevention – Engineering control, Education and training, Enforcement, Enthusiasm and Example setting. **SAFETY PSYCHOLOGY:** Introduction to psychology and its linkage to safety at work areas,			

psychology and various examples depicting scope for improvement. Psychological factors affecting quality of work and Safety performance Perceptions, Myths, Attitudes, Aptitudes, Frustration, Conflict of interests, Team spirit, Morale, Fatigue, Boredom/ Monotony etc., (especially in case of round the clock shift duties and repetitive work schedule) Positive or adverse Impact of the above factors in the removal of accident causation factors and associated ill effects. Human Behavior: An introductory session covering various nuances of behavioral nature and their concerns related to Safety. Individual differences-Behavior as function of own personality and situation, different perceptions of good and poor behavioral patterns. Knowledge and responsibility vis-à-vis safety performance. Old concept of "Accident Proneness" and a health debate on its relevance or lack of it Motivation for Safety:-Significance, Need, Nature and Types of Motivational techniques.-Theories of motivation and their application to safety.-Role of Management, Supervisors and Safety Department in motivational upliftment at shop level.-launching session of Behavior based safety (BBS) Management Program: -Criteria for estimation and strategies.-Management techniques of accident control-Formulation of user friendly observation and survey formats for BBS-Scheduling of surveys by engaging all the staff without a single exception-Management review and action plan implementation on areas where either variances are observed or there could be further scope of improvement-Linking of BBS with employee recognition/ appreciation/ incentive schemes/ career growth and development .			
Unit 2: GENERAL MANAGEMENT: Origin and Evolution of Management Thoughts. -Definitions, Nature and Importance of Management.-Elements of Management Functions - planning, organizing, staffing, directing, controlling and	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

coordinating. -General Principles of Management. -Managerial Role, Their Powers, Execution of Authority and Responsibility matrix with regard to safety. Levels of Managerial hierarchy. -Delegation and decentralization of authority. **SHE MANAGEMENT & PLANNING FOR SAFETY** Planning: Definition, purpose, nature, scope and procedure- Range & variety of planning methods- Strategic planning and tools of implementation. - Management By Objectives (MBO) and its role in Safety, Health- and Environmental (SHE) functions. - Organizational Health & Safety Policy – Understanding its concept- Formulation and implementation along with review of its prevalent Statutory provisions			
Unit 3: **ORGANIZING FOR SAFETY:** Organizing: Definition, need, nature and principles- Organizational aspects associated with the setting up of Safety or SHE Department. - Types, structure, functions and responsibilities of SHE department- Line and Staff Functions for SHE as applicable to an organization vis-à-vis statutory compliance. - Role/ Duties/ Responsibilities of Supervisors, Workers and Trade Unions in facilitating the safety movement at the organization. **DIRECTING FOR SAFETY**- Direction: Definition, process, principles and techniques- Leadership- Role, functions and attributes of a leader who is empowered to offer directives- Model Leadership attributes on safety management. Communication- Definitions, Purpose, Categories, Methods, Processes, Types and Channel of communication- Essential rules of the game - Two-way system- Barriers being encountered - Essentials as applicable to maintain effectiveness and acceptability- Communication and group-dynamics. Team building - (role plays).	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

Unit 4: CONTROLLING FOR SAFETY : Controlling: Definition, need, benefits, types, areas, elements and listing of available control techniques. -Management by Exception (MBE) – Concepts and application strategy-Monitoring of management system through Safety Standards. -Application and use of Indian Standards on Safety and Health: IS:14489 – 2018 and ISO 9001, :14001, ISO - 45001series-A review on ILO and EPA Standards- SAFETY EDUCATION AND TRAINING:-Significance of sustainable training, notification and execution requirements-Elements of training cycle.-Assessment of training needs, Strategy planning and development-Objectives of various types of training activities.-Techniques of training.-Design, planning and development of training programs.-Training methodologies and strategies.- Types of safety training and execution methods.- Preview, Post evaluation and Assessment of participants' performance and gauging the efficacy of training programs.- Modern system, methodologies and practices of training- Thorough appraisal on all types of training aids and their general as well as selective applications- Integration of adult training programs to enhance performance standards of employees- Competence Building Technique (CBT)- Interlinking of for Safety and Job specific training- Role of Multimedia and their need base applicability- Coverage on effective use of computer aided training- An appraisal on World Trade Organization (WTO) initiatives to develop SHE training (especially E-Learning)	20%	9hrs	Presentation, Video presentation, Chalk board, Notes
UNIT 5: EMPLOYEE PARTICIPATION IN SAFETY Significant attributes of Employee Participation in Safety Management- Purpose, Areas and Methods of participation.-Workers' and Trade Union engagement in Safety developmental activities.-Safety Promotion, Popularization and Mass communication- Effective Application of: Suggestion schemes.-	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

Contests and competitions.-Establishment of incentive benefits.-Setting up of Audio-visual publicity and other communication strategies.-Establishment of Recognition/ Appreciation/ Accreditation, Award distribution programs based on individual and group wise Safety Performance evaluation and rating.-Safety Committees, Conceptualization and need-Constitution, Inclusion of equal participation between worker and management groups, setting up of agenda to ensure effective participation and functioning, preparation/issue of Minutes of Meeting (MOM), and periodical review of compliance recommendations.-Statutory provisions (including the defined roles, duties and responsibilities of Chairperson, secretary all categories of committee members) -Legal Provisions available to members to seek redressal of pending execution recommendations as indicated in MOM **ECONOMICS OF SAFETY:** Cost of accidents- Direct and Indirect costs and their ratio.as being generally observed (indirect outweighing in number of cases)- Application of effective methodologies to convince both management workers about the types of losses incurred to people and productivity due to accidents-Listing and interpretation of financial implications affecting- Affected individuals, their families, organization, society and country at large. -Cost compilation procedure. -Utility of data costing including few of its limitations. -Budgeting for safety: -Purpose and procedure of safety budgeting -Company turnover vis-à-vis Safety-Consideration of Performance Rating against budget allocation			

MANAGEMENT INFORMATION SYSTEM (MIS): Sources of information on Safety, Health and Environment Protection System - Compilation and collation of information, its analysis and application. - "Benchmarking" on safety performance. -Modern methods of programming. -Storing and retrieval of MIS for HSE. -Computer Software Application and Limitations. Causes for MIS failures. Advantages and disadvantages of computerized information system. -Status and future goals of computer utilization in SHE services in industries. -Setting up of departmental functions to match against MIS			

Learning Resources

Textbooks:

Handbook of Industrial Safety by K.U. Mistry, Siddarth Prakashan, 108, Western Plaza, NearBhulka Bhavan School, Adajan Road, Surat – 395 009. (Gujarat).

Reference Books:

1. Accident Prevention Manual for Industrial Operations, National Safety Council,425, North Michigan Ave,Chicago, Illinois, USA.
2. Encyclopedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva.
3. Safety and Health for Engineers, by Roger L Brauer, Van Nostrain Reinhold, New York.
4. Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann.
5. Safety at Work by John Ridley.
6. Handbook of Industrial Safety by K.U. Mistry, Siddarth Prakashan, 108, Western Plaza, NearBhulka Bhavan School, Adajan Road, Surat – 395 009. (Gujarat).
7. Industrial Accident Prevention by H.W. Heinrich, McGraw Hill Book Co.
8. Techniques of Safety Management by Dan Pederson.
9. Effective Safety and Health Training by Hilyer.

<table>
<tr><td colspan="3">10. Occupational Health and Safety by Confer.
11. Environmental Health & Safety Management. Nicholas Cheunisinoff& Madelyn Graffia.OriginalPublishers: Noyes Publications. Indian Reprint: Jaico Publishing House.
12. Safety Management. John V Grimaldi& Rollin H Simonds Publication: All India Traveller Book Seller,Delhi. Industrial Safety and Health Management – II Edition. C. Ray Asfahl. Publication: Prentice Hall, Englewood Chliffs, New Jersey 07632.
13. Safety Thoughts by Loss Prevention Association of India Ltd.
14. Responsible Care – A Public Commitment by Indian Chemical Manufacturers Association.</td></tr>
<tr><td colspan="3">Journals & Periodicals: Nil</td></tr>
<tr><td colspan="3">Other Electronic Resources: Nil</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">Total Marks 100</td></tr>
<tr><td>Mid semester Marks</td><td colspan="2">30 marks</td></tr>
<tr><td>End Semester Marks</td><td colspan="2">50 marks</td></tr>
<tr><td rowspan="5">Continuous Evaluation</td><td>Category</td><td>Marks</td></tr>
<tr><td>Attendance</td><td>5 MARKS</td></tr>
<tr><td>Quiz</td><td>5 MARKS</td></tr>
<tr><td>Skill enhancement activities / case study</td><td>5 MARKS</td></tr>
<tr><td>Presentation/ miscellaneous activities</td><td>5 MARKS</td></tr>
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PGDIS102	SAFETY ENGINEERING -1	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100
1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. To learn main engineering aspects of industrial safety.
2. To learn various design aspects of layout, machine tools, guarding/ fencing / securing of machinery, Humidity control, air changes as well as ventilation, lighting and colour code, electrical safety.
3. Linkage of work area housekeeping, fire and explosion hazards, noise /vibration related concerns, material handling, hand and portable tools (manual as well as powered) and safety while working at different levels.
4. To practice exercise including a term work is also incorporated for the measurement of temperature, humidity, illumination level and noise level with practical experience of using specific instruments and equipment for this purpose.

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: **PLANT DESIGN AND LAYOUT:** Siting Criteria: -General and Environmental guidelines while locating and deciding on site selection including Meteorological aspects. -Ensuring of safe Separation/ segregation distances. -Need for Planning and follow-up at every stage of project implementation-Plant Layout and Design. General principles for factory buildings, -plants & equipment layout and fire protection. Relevant Statutory	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

provisions gauged against various Acts and Rules as applicable-Factories' Act and respective state level Rules- Petroleum Act and Rules- Explosives' Act & Rules. Including Static/ Mobile Pressure vessels Rules (SMPVR)-Environmental Protection Act & Rules including "Manufacturing, Storage and Handling of Hazardous Chemicals' Rules (MSIHC). - Boiler Act, Rules and Regulations-Other specific ones as applicable like Pesticide's act, Mines Act. Dock safety Act etc., and associated rules- Appraisal on Indian Standards. National Building Codes and other Codes of Practice. -Ergonomic considerations during the design stage of layout pertaining to plants, equipment and machinery. **HOUSEKEEPING:** -Housekeeping and its significant linkage with higher productivity and improved safety-Indicators of good housekeeping conformity as well as variances due to poor housekeeping. -Typical accident scenarios that arise out of bad housekeeping. -Various other Benefits of good housekeeping than accident prevention-Management of good house-keeping. -Safe and environment friendly disposal of scrap and other inevitable manufacturing process related. Methods of Prevention of spillages, leakages, emissions, water and soil contamination.-Clear marking of aisles, equipment bays, gantries, emergency exits, fire extinguisher locations etc., Explanations on standard signs, symbols, captions along with sizes and mounting locations to ensure easy visibility.-Nuances of Housekeeping campaigns, contests, rating etc., -Appraisal on effective use of color codes as an aid for good housekeeping.-Cleaning Methods.-Employee assignment			

for regular cleaning, upkeep and maintenance -Need to create regular Inspection programs with Checklists to enable manages, executives, supervisors, safety committee members for execution -Linkage of Preventive and Predictive Maintenance with Housekeeping.-Need for Conceptualization/ Implementation of proven and time-tested systems like Japanese "Five S" (5S). GHK initiative (1) Seri (Segregation) (2) Seiton (Arrangement) (3) Seiso (Cleaning) (4) Seiketsu (Maintenance of Standard) and (5) Shitsuke (Discpline).			
Unit 2. MACHINE GUARDING: -Fundamental Principles of machine guarding highlighting how it has been included in the statutory provisions from the very inception Factories' Acts of all countries. This must also encompass fencing, barricading, securing etc., of moving machinery -Ergonomics associated with modern designs of machine guards especially automatic -Types of guards-How to decide on appropriate Design and Selection of guards for a given machinery-Choice of right Material for guard construction based on durability, strength, corrosion resistance, ease for installation, removal and maintenance etc., Guarding of different types of machinery including special precautions-for wood working, rubber, centrifugal machines and paper mill machinery. through discussion on pinch and nip points, coverage of maximum sharp surface areas, plunger movements etc., -Built-in-safety devices like auto cut offs in case any hands, legs, other body parts come closer to the vicinity of machines when guards need to be raised or slides for certain operational work for material feeding. -Maintenance and repairs of guards. -Zero Mechanical State (ZMS).-Incidental safety devices and tools.-Lockout and Tagout.	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

MACHINE TOOLS: Definition and Classification of Machine tools. -Safety in the use of power presses, shearing, slitting, cutting, bending, rolling, drawing, turning, boring, drilling, milling, shaping, planning, broaching, slotting, grinding and CNC machines. -Total Predictive Maintenance (TPM) and Care. Periodic checks for safe-operation. **VENTILATION AND HEAT STRESS:** -Purpose of Ventilation and Heat Control. -Comparison among good. Poor or non -non - ventilated locations -Thermal Environment and Measurement of temperature, humidity-and velocity of air movement. Physiology of heat regulatory systems. -Heat stress measurements, thermo indices and associated regulations. Thermal comfort. Ranges of comfort as recommended for personal safety and work efficiency. -Control methods to ensure heat stress reduction. Types of Ventilation: -Natural.-Mechanized.-Processed – Dilution and/or Local Exhaust Ventilation (LEV).-Industrial Air Conditioning.-Testing and Maintenance methods to ensure the efficacy ventilation systems.-Worked Examples using sketches and calculation methods -Control of heat exposures - Methods and types of control equipment being used.-Recommended values for air changes required for various areas as per-Factories' Act, 1948 and Bureau of Indian Standards (BIS): Appraisal on IS:3103. "Code of practice for Industrial Ventilation, National Building Code Part VIII, Building Services".			
Unit 3: LIGHTING (ILLUMINATION) INCLUDING OTHER CONTRIBUTORY ASPECTS.-Purpose and benefits of good lighting vis-a-vis enhanced safety and higher productivity-Principles of illumination.-Adequacy.-Glare, shadow, contrast and impacts of colors.-Recommended standards of illumination.-Types of Lighting:-Natural,	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

artificial, direct and indirect.-Sources of illumination, Artificial lighting and types of fittings/ fixtures.-Design of lighting, installation of fixtures. Coefficients of Utilization, Day lighting and factors related to Light reduction or loss.-Effects of different Colors with reg. to lighting -Listing of codified colors being used in Hazard warning and safety guidelines system-Related Indian Standards.-Types of signs which can facilitate the efforts towards accident prevention-Psychological effects of color which could be observed among people-Maintenance/ upkeep of lighting and color factor integrity.- **ELECTRICAL SAFETY**: Hazards of electrical energy. -Physiology interpretation on shock occurrences. -Safe ranges of amperages & voltages. Guidelines on distance criteria from - high voltage sources -Electrical resistance factors of human body – gender/ duration/ current rating based.-Capacity ratings related to protection of conductors, joints and connection-Safety concerns associated with portable electrical apparatus and requirements -of protective devices like MCB, ELCB etc.-Standard features for power isolation including automatic cut offs & Protection against: -Overload and short circuit.-No load,-Earth fault.-Surges and voltage fluctuations-Hazards associated with "borrowed" neutral.-Earth insulation and continuity tests.-Earthing Standards. Lockout and Tag-out system, procedures and practices-Safeguards against the required application of electrical system and usage of appliances in Atmosphere having fire risk vulnerability-Hazardous area classification in relation to Electrical energy as vulnerable source of ignition- Restriction/prohibition on the use of ordinary electrical appliances in certain zones of area classification.- An appraisal on the characteristics of 'flame proof'			

electrical fittings, fixtures and accessories which are permitted for use in certain 'hazardous zones'-Criteria of selection, installation, maintenance and upkeep of electrical appliances to be used-Listing of latest types of flameproof fittings and equipment including intrinsically as well as increased safety rated appliances, pressurized enclosures etc. Philosophy of Lightning protection and a discussion on "Lightning arrestors"			
Unit 4: STATIC ELECTRICITY: Introduction. -Electrostatic charges and discharges and resultant spark generation.-An overview of the different Manufacturing cum allied operations, -Machines and equipment which are prone to generate static discharge -Introduction on static discharge detection, resultant risk identification and planning -of prevention/ control/mitigation strategies including listing of all probable -locations/ equipment/ piping/ valves/other equipment which could prove -vulnerable to static hazard.-Earthing and Bonding.-Recommended earthing resistance for control of electricity.-Static charge eliminators.-Dip pipes.-Increasing conductivity with additives/ humidity enhancement etc., -Handling solids with and without the emission of flammable vapors but producing fine dusts which can get easily ignited by static spark.-Control of flow liquid flow rates **FIRE & EXPLOSION**: Fire Phenomena-Chemistry of fire. -Stages of fire. -Factors contributing to fire. -Classification of fires. -Review of different Ignition sources and how to keep them at bay-Common causes of industrial fires. -Spread of fire. -Determination of fire load. -Design of building, plant, exits, etc. for fire safety and fire resistance-of building materials. -Prevention of fire. -Types of Portable Fire Extinguishers. Water	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

systems. Carbon-dioxide systems. Foam extinguisher system. Dry chemical extinguishing systems.-Halon Alternatives.-Hydrant and fixed installations.-Special industrial fire detectors and alarms-Sprinkler systems.-Automatic fire detection and extinguishing system.-Special safety precautions.-Control of fire and explosion in handling/processing flammable liquids, gases, vapors, mists, dusts etc.-The Pipelines and Informed Planning Alliance (PIPA) for automatic fire and gas detection and getting probable scenarios on DCS.-Specific concerns on firefighting involving pesticide vapors.-Handling strategies for fires involving Electrical Equipment – Panels. Cables, Fixtures, Fittings, Computer server rooms etc., -Effects of combustion products involving different materials -Explosion phenomena. -Deflagration. -Detonation. -Confined and unconfined Vapor Cloud Explosion (VCE). -Boiling Liquid Expanding Vapor Explosion (BLEVE). -Fire emergency action plan and drill. Control room. **NOISE AND VIBRATION:** Noise and Hearing Conservation-Generation, nature, types and effects. -Health hazards and controls. -Temporary and permanent loss of hearing capacity. -Ear protection. -Permissible exposure limits. -Audiometry and hearing conservation program. -Measurement and evaluation of noise. -Control methods. Control at source, substitution, isolation, absorption-techniques, sound proofing, silencers, antiphase system, etc. Practical aspects of control of noise. -Vibration. -Generation, nature, types and effects. -Vibrating Equipment-Health hazards and controls. White finger.			

Unit 5: MATERIAL HANDLING: Manual handling: -Kinetics of manual handling. -Maximum loads that could be lifted or carried. -Safe method and procedure for lifting and carrying of objects of different shapes, size and weight. -Safe use of accessories for manual handling. -Storage of materials. Safety in stacking and un-stacking, floor loading conditions. Layout condition for safety in storage.-Ergonomics of manual handling and storage.-Mechanical handling:-Lifting machinery, lifts and hoists.-Safety aspects in design and construction, testing, use and care, signaling, inspection and maintenance.-Safety in operation, inspection and maintenance of industrial trucks, cranes, lifting tackles, loose gears, conveyors etc.-Types of ropes including Nylon and PP ropes.-Hazards of remote operated lifting machines.-Training of operators.-Safe working load for all mechanical material handling equipment.-Competent Persons in relation to safety legislation–their duties and Responsibilities.-Worked examples HAND TOOLS AND POWER TOOLS: main causes of tool related accidents. Prevention and control of such accidents. -Centralized and personal tool issue system. Purchase, storage and supply-of tools. -Inspection, maintenance and repair of tools. Detectable causes of tool-failures. Tempering, safe ending and dressing of certain tools. -Safe use of various types of hand tools used for metal cutting,- wood cutting and miscellaneous cutting work. -Special hand tools such as torsion tools, shock tools, non-sparking tools. -safe use of hand tools in hazardous area. -Portable power tools and their selection, operation, inspection, maintenance, -repair and safe use. Double protection. Dead man control (operation till the button is pressed)	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

WORKING AT DIFFERENT LEVELS:-Working at Heights: Types and seriousness of fall accidents. -Safety features associated with design, construction and use-of stairways, ramps, working platforms, gangways, ladders of different types, scaffolds of different types including crawling board, Boatswain's chair and safety harness for working on roofs. Other safety requirements while working at heights. -Safety belts-their types, use and limitations. Whole body harness with double lifelines.-Fall arrestor devices.-Work permit system.-Working in a Confined spaces.-Definitions and detailed appraisal noting on Meaning of confined spaces-Salient features of confined spaces of different shapes, sizes, entry /exit limitations.-Types and nature of major accidents involving confined spaces – asphyxiation, unconsciousness, Physical injuries, drowning, trapping, injuries,-Specific Permit-To- Work system (PTWS) pertaining to confined spaces supervision-Working Underground- Deep excavations-Important Hazards, Causation factors and controls			
Practical 1. Practice Work on Ventilation: 2. Measurement of temperature. 3. Dry Bulb Temperature. 4. Wet Bulb Temperature. 5. Calculation of Heat Stress Indices. 6. Determination of relative humidity and effective corrective temperature. 7. Use of Aspirator, Hygrometer, Kata thermometer, Globe thermometer and			

pyrometer. 8. Practice Work on Illumination: 9. Measurement of illumination level by Luxmeter. 10. Practice Work of Noise Measurement: 11. Measurement of sound pressure level in dBA and dB linear. 12. Frequency analysis of noise. 13. Use of sound level meter and Octave filter test			

Learning Resources

Textbooks:

1. Hand Book of Industrial Safety and Health by Dr KU Mistry
2. Safety and Health for Engineers, by Roger L Brauer, Van Nostrain Reinhold, New York.
3. Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann.
4. Occupational Safety Management & Engineering by Willi Hammer.
5. Safety at Work by John Ridley.

Reference Books:

Journals & Periodicals: Nil

Other Electronic Resources: Nil

Evaluation Scheme	**Total Marks 100**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

PGDIS103	SAFETY IN CHEMICAL INDUSTRIES	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100
1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. To learn laws pertaining to hazardous chemical industries.
2. To understand the hazards and control measures for chemical industry are included as main aspects
3. To gain knowledge on the criteria for siting and safe layout of chemical plants, students will learn hazards and control measures with reg. storage, process, transfer, loading/unloading and transportation activities.
4. To Learn inspection, testing, maintenance and pollution control

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: GENERAL: Overview on the Inevitable presence as well as the coveted status of Chemical Industry in society along with the special significance of safety concerns associated with it followed by a brief narrative on the Specific types and categories of chemical industries functioning in India. Process flow chart and its importance for safety inspection. Types of Chemical Hazards- Hazards due to material (property), Processing segments, Pipe line transfer, Loading. Unloading and transportation, Reactors, Vessels and other equipment. Unit operations, Utility functions etc., Hazards associated with pollution, fire, explosion, toxic release and	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

associated control measures. Interpretation use and training of material safety data sheets (MSDS). including the prevalent "Safety Data Sheets (SDS)" as per the Globally Harmonized System (GHS) OF Classification and Labelling of Chemicals (CLC) already in vogue among developed nations. Legality on the need for Supervision by qualified and specifically trained supervisors. Periodical examinations and preservation of medical case papers pertaining to all workers employed in Hazardous industrial installations followed by their review in case of any specific changes as well as signs/ symptoms of abnormal health conditions. -Hazard Communication System. -U.N., HAZCHEM, NFPA and other classification of chemicals along with their specific characteristics in relation transformation among solid, liquid and gaseous phases during manufacturing processes, in addition to the probable fire, explosive, reactive, toxic, radioactive, corrosive or other significant risks. -Safety and Risk Phrases. (Hazard and Precautionary statements) as per newly evolved -GHS on CLC (as already mentioned against Topic No. 1.4 above. -Criteria for siting and safe layout of chemical plants.-Environmental Impact Assessment (EIA) as well as Public hearing (review) meetings (as applicable) at the behest of civil administration with reg. the installation proposals for new Units of "high hazard" nature as well as their expansion project plans.-Statutory provisions: An Overview of Factories' Act, (their state level rules (as applicable), Other Acts like Explosives, Petroleum, Environmental Protection, Insecticides and/or other types along with corresponding rules in relation to Major Accident Hazard Units (MAH)-Establishment of Information sharing strategy (communication) among Workers, Directorate of Industrial Safety & Health (DISH), Local administration, Nearby Hospitals, Service departments like municipal fire brigades,			

Neighboring society etc.- Appraisal of automation in chemical processing/ storage/ handling units -Instrumentation for safe plant operations. Auto controls, trips, alarms, -interlocks, PLC, DCS etc.,			
Unit 2: STORAGE SPECIFIC HAZARDS AND CONTROLS: Receiving, Storing and Handling of Chemicals.-Safe receipt, unloading procedure to Bulk tanks, Stacking along Drum storage sheds or warehouses.-Purpose and design of dykes, their floors, Impervious lining, Sloping for gradient, Spill collection pits including split valve connection for draining water collection, -Prevention of overflow, pressure, temperature and process flow.-Types of gauges and valves (inlet/outlet).-Specific need of remote and automatically operable control valves for usage during exigencies or emergencies-Appraisal on the installation, operation and maintenance/upkeep of certain specific containment of materials like Oleum, Other Acids/ Alkalis, Liquefied or gaseous products such as Chlorine, Ammonia, LPG, Ethylene Oxide etc., as indicative examples of safer storage facilities for critically hazardous materials-Safety measures for storage of other items such as Petroleum Products (in general since specific ones are to be covered under Topic No. 8 of CC- 104 coming up next) -besides radioactive substances like isotopes being used for radiography examinations, automatic instrument action etc., Safety aspects associated with the storing and usage of gas cylinders, color coding,- marking and ensuring safe piping connections along with the design factors of storage sheds.-Design of storage shed or go-down, retention basin, catch pot or dump vessel etc. Safe placement of containers. Compatibility considerations.	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

Unit 3: PROCESS HAZARDS AND CONTROLS: Safe design of process vessels and their fittings duly covering the aspects of Material of construction and lining depending on type of chemicals and operational parameters.-Hazards and controls in Unit Processes and Unit Operations including-exothermic or runaway reactions, solvent distillation, toxic/ highly flammable materials, their mixing/ blending/ extraction reaction and other hazardous processes with probabilities of vapor/ dust emissions.-Safe operation of measuring vessels (also known as interim or day tanks) for during transfer/ charging operations.- Safe operation of vacuum system, scrubbing facilities as well as columns (towers), condensers, catch pots, venting etc., Use of appropriate gauges, valves, trips, alarms, interlocks, auto controls and other instrumentation. Safety features associated with Distributed Control System (DCS) and related facilities. -Safety aspects of Analytical (Chemical) Laboratories, Sampling (including handling aspects of glass wares, gas bombs etc.,), reuse, recycling and/or disposal of used up or left out samples-Monitoring and control of hazardous exposures. Comparison with permissible limits and inference. Implementation of control measures. **TRANSFER OF CHEMICALS:** -Pipeline Transfer. -Safe transfer of chemicals through pipelines within and outside installations, above and underground including deep sea-Safety of pipelines. -Permit-To-Work System (PTWS) associated with the opening or repairing pipelines of hazardous contents. -Color coding, earthing, bonding and testing of pipelines. -Information about the hazards associated with the use of pressurized air to transfer fluids. - Need for the safer methods of transfer including pumping of vacuum suction with appropriate controls and use of PPE's, -Safer methods of valves/pipe/pipe fitting connections.	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

Unit 4: TRANSPORTATION OF CHEMICALS:-Safety precautions for movement of hazardous / toxic / flammable /explosive / radioactive/other hazardous substances by all modes of transportation-Detailed appraisal on the safety concepts related to "Threshold quantities".-Guidelines as per MSIHC and associated Public Liability Insurance - Training to drivers, including the appraisal on content coverage as duly recognized by the central Transportation Ministry.-Safety checklists for vehicle inspection and distribution of-Transport Emergency (TREM) Cards by the suppliers of respective cargos	20%	9hrs	Presentation, Video presentation, Chalk board, Notes
Unit 5: **INSPECTION, TESTING & MAINTENANCE:** Inspection techniques for plants, storage and reaction vessels-Checklists for routine inspection, preventive and break down maintenance.-Testing, Certification of equipment and recording/ documentation in prescribed Forms. -Types of testing methods including different NDT & other methods like Liquid (Dye) Penetration, Magnetic Particle/Ultrasonic/ Radiographic Testing as well as Micro and Macroscopy, Hydraulic pressure testing- Fired and unfired pressure vessels, their design, construction, operation-and testing. Compliance of Codes and statutory provisions. Role of a Competent Person- Corrosion, erosion, location, causes, inspection and prevention. Cathodic protection. -Safe start up and shut down procedures Emergency shutdown. Detailed coverage on Permit- To-Work System (PTWS) guided through model checklist along with class room exercise on permit preparatory work. POLLUTION CONTROL: Principles and practices for prevention/ Control of water/air/land pollution & Hazardous Waste Management- Cleaner technologies. - Use of Eco-friendly processes and manufacturing of products-Carbon Credit & Ozon Depleting Substances-	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

Methods to reduce plastic consumption and reduction of non-biodegradable waste generation			

Learning Resources

Textbooks:

1. Accident Prevention Manual for Industrial Operations, National Safety Council,425, North Michigan Ave, Chicago, Illinois, USA.
2. Encyclopedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva.
3. Safety and Health for Engineers, by Roger L Brauer, Van Nostrain Reinhold, New York.
4. Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann.
5. Occupational Safety Management & Engineering by Willi Hammer.
6. Safety at Work by John Ridley.

Reference Books:

Journals & Periodicals: Nil

Other Electronic Resources: Nil

Evaluation Scheme	**Total Marks 100**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

PGDIS104	SAFETY ENGINEERING -1I	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100

1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. To learn main engineering aspects of industrial safety.
2. To understand the process involved in various types of industries
3. To learn about the safety management principles in different industries

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1 **METALLURGICAL INDUSTRY**: Manufacturing/ Extraction process of basic Metals from Natural resources (Ores) - Ferrous & Non-Ferrous: Listing of processes and basic operations involved in the manufacturing activities - Hazards associated with Steel working and corresponding safeguards - Conventional Metallurgical processes - Foundries - mixing of materials, mold and core making, Melting (furnaces), Casting, Knockout and dressing, forging etc, working on hot rolling and cold rolling mills, Hazards and safety measures of heat treatment operations, blasting, welding and cutting, brazing, soldering, polishing, buffing, cleaning. **TEXTILE INDUSTRY:** Introduction to Textile Industry. Flow chart of textile processes	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

including synthetic fiber and yarn, Machine guarding for Blow room, Spinning, Weaving and Processing machinery for cotton and synthetic fiber industry, Fire, explosion and health hazards and their control measures			
Unit 2 **CONSTRUCTION INDUSTRY:** Basic parameters governing the safety in construction such as site planning and layout, safe access, safety work permit and checklist, good housekeeping, Safety in the use of construction machineries like material, Handling & heavy earth moving equipment, Underground and above ground works. Hazards and Controls. Statutory safety requirements, Health and Welfare of construction workers – Dust, noise, vibration, heat, humidity and other hazards. First aid, medical examinations and health records, Work at height & safe construction & use of scaffolding, Excavation & shoring, Compliance of requirements 0f building construction under BOC Rules. **INFORMATION TECHNOLOGY:** Safety features of manufacture of electronic valves, tubes, other electromagnetic devices, semiconductors and superconductors, Safety features of Manufacture of Computers, Radio, Television and Communication equipment and apparatus, Hazards involved in testing of IT equipment and their safety measures.	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

Unit 3 **CEMENT INDUSTRY**: Types of cement and manufacturing processes, Hazards due to bulk storages of raw materials, conveyers and machineries, rotary kiln, mixers and driers, loading, unloading and packing etc. Control measures for dust collection, noise, vibrations, heat exposure etc, Cement pneumoconiosis. **FERTILIZER INDUSTRY:** Types of Fertilizers and manufacturing processes including associated hazards & their mitigating measures, Probable causes of major accidents/emergency & their mitigating measures, Hazards due to bulk storages, processes, transfer and transportation of chemicals, dust, noise etc. and their control measures, Various other safety challenges of fertilizer industries. **PESTICIDES INDUSTRY:** Types of pesticides and their lethal dosages, Marking, labeling and safe disposal of containers, Manipulation processes, their hazards and controls, Medical treatment in case of exposure.	20%	9hrs	Presentation, Video presentation, Chalk board, Notes
Unit 4 **PETROLEUM REFINING & PETROCHEMICAL INDUSTRY:** Petroleum classification and hazards due to petroleum products, Hazards of bulk storages, Crude Oil/Natural Gas Exploration. drilling/rigging extraction/ collection, storage, basic purification and transfer to Refineries for further processing, Storage/ Loading/ Unloading/ Transportation of various petroleum products commencing Crude oil, Petrol, Diesel, Aviation fuel, Kerosene, Other solvents. Naphtha, Heavier bottoms, LPG, Hydrogen, Ethylene, Propylene, Butadiene and related hazards as well as control systems, Appraisal other hazardous by product formation in refineries	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

like H_2S, Methane, Carbon Monoxide, Sulfur dioxide, Pyroforic sulfides etc. **POTTERY AND CERAMIC INDUSTRY:** Products of Pottery and Ceramic Industries, Raw materials and Process flow chart, Hazards of Raw material mixing and manufacturing processes, Machine guarding, Control measures for dust, heat, noise, vibration and other, hazards. Temperature control near kilns and glaze driers. Local exhaust ventilation. Medical examinations of workers, Washing facilities, Statutory provisions.			
Unit 5 **GLASS AND QUARTZ INDUSTRY:** Products of Glass Industries, Raw materials and Process flow chart, Hazards of Raw material mixing and manufacturing processes, Hazards of quartz grinding and handling, Machine guarding, Control measures against dust, heat, noise, vibration, glass breaking and flying, fuel and exhaust gases. Other hazards. Temperature control near furnaces and heaters. Local exhaust ventilation. LEV for Quartz, and Diamond grinding and polishing, Medical examinations of workers, Washing facilities, Statutory provisions. **PAPER INDUSTRY:** Products of Paper Industries. Pulp, paper and containers, Raw materials and Process flow chart, Hazards of Raw material mixing and manufacturing processes, Machine guarding. Nip Guards near moving rollers. Trips and interlocks. Guards near straw cutters and paper cutting blades. Fencing or Conveyer feeding to Pulper for preventing fall accidents, Medical examinations of workers, Washing facilities, Statutory provisions. **SUGAR INDUSTRY:** Process flow chart commencing with sugar canes unloading and storage go downs and molasses tanks, Hazards of moving machineries like crushers, juice makers and other operations like, boiling, evaporating, centrifuging, sugar grading and packing, Machine	20%	9hrs	Presentation, Video presentation, Chalk board, Notes

guarding for v-belt drives, gear wheels, fly wheels, rollers etc, Control of dusting from baggase, coal, SO2, noise and vibration, Control of hazards associated with Juice Heaters, Evaporators, Boiling Pans, Syrup and Molasses storage inside Tanks etc, Medical examinations of workers, Washing facilities, Statutory provisions			

Learning Resources

Textbooks:

1. Accident Prevention Manual for Industrial Operations, National Safety Council,425, North Michigan Ave, Chicago, Illinois, USA.
2. Encyclopaedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva.
3. Vibration and Noise for Engineers by Pujara, Dhanpatrai & Co. Pvt. Ltd., Delhi.
4. Safety and Good housekeeping by NPC, New Delhi.
5. Material Handling Equipments by Alexandrov.
6. Safety in the use of Press Brakes by HMSO, London.
7. Site Safety by JC Landey.
8. Industrial Ventilation, ACGIH, Cincinnati., Ohio, USA.
9. Handbook of Industrial Lighting, Stanley L. Lyons, ECIBS, Butterworths.

Reference Books:

Journals & Periodicals: Nil

Other Electronic Resources: Nil

Evaluation Scheme	**Total Marks 100**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

PGDIS201	Hazard Identification, Risk Assessment & Determining Control Techniques	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100

1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. To learn the techniques of Hazard Identification, Risk Assessment and Determining Control Techniques (HIRAC).
2. To provide sufficient knowledge to sharpen their skill/competence in this segment.
3. The course provides adequate knowledge about types of accidents and probable consequences, safety performance rates, accident reporting, analysis and investigation methods, various safety appraisal and control techniques, the concept of major accident hazard (MAH), criteria for classification of MAH units
4. To do assessment of fire, explosion and toxicity index, failure rates and reliability data, gas dispersion and computer modeling, probability and consequence analysis, risk contours, F-N curves, study as well as preparation of safety audit and risk assessment reports, on-site and off-site emergency response plans and codes of practice for major accident hazard controls.
5. To enable the students to deal with safety related issues of industries in general and modern units with complex and highly automated processes as well larger capacity utilization and production rates

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: Incidents. Accidents, Narrow misses/Narrow hits, Mishaps, Dangerous occurrences, Disasters, Injuries, - (Minor, Non-Reportable, Reportable, Disabling), Fatalities, Property damage etc., Accidents	20%	9hrs	Presentation, Video

reportable under the Factories Act, ESI Act, IBR, and Electricity Act.-Safety Performance Rates-Frequency Rate, Severity Rate, Incidence Rate, Frequency/ Severity Index, -Safe-T Score.-Worked examples.-Types of Disablement-Temporary and Permanent Disablement.-Partial and Total Disablement.-Time Charges scheduled in Workmen's Compensation Act 1923.-National and International Standards. Worked examples-			presentation, Chalk board Notes
Unit 2: ACCIDENT AND INCIDENT INVESTIGATION, REPORTING AND ANALYSIS- Accident and Incident Investigation-Philosophy, purpose, process and types of investigations. - Identifying the key factors and the immediate and basic causes. Corrective Action-Agencies investigating accident-Accident investigation Form.-Methods of writing of accident investigation report-Accident reporting-Reporting to authorities in statutory forms-Essential elements to be covered in accident reports-Prescribed time limits for reporting of accidents-Reporting of dangerous occurrences.-Accident and Incident Analysis-Standard Classification of factors (conforming to BIS) associated with accident-Methods of collating and tabulating data.-Record keeping.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 3: SAFETY APPRAISAL & CONTROL TECHNIQUES Plant Safety Rules and Procedures-Safe operating procedures (SOP). - Safety Checklists-Safety work permits-Plant safety inspections-Safety Sampling-Safety Survey-Job safety analysis (JSA)- Safety inventory system-Product Safety-Safety tag system-Total Loss Control and Prevention.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 4: HAZARD IDENTIFICATION, RISK ASSESSMENT& DETERMINING CONTROL TECHNIQUES Hazards and Risks-Definitions & Terminology for hazard and risk assessment-Difference between Hazard and Risk and their co-relation-Prioritization of hazards and risks.- Hazard and Risk Progression Chart-Hazard identification.-Hazard analysis-Risk analysis.-Risk assessment.-Risk management.-	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Hazard and Risk Analysis: (With examples)-Quantitative and Qualitative Risk analysis.-Failure Mode and Effect Analysis (FMEA).-Failure Mode, Effect and Criticality Analysis (FMECA)-Maximum Credible Accident Analysis. -Preliminary Hazard Analysis (PHA) & Hazard Analysis (HAZAN).-Hazard and Operability study (HAZOP).-Management Oversight Review Technique (MORT).-Incident Recall Technique.-Critical Incident Review Technique etc.-Use of Safety Audit and checklists for Hazard Analysis.-Risk Assessment: -Comparing analyzed risks with Acceptable criteria (permissible limits) and giving Judgment for further Safety measures if necessary.-Types of risks and assessment methods including FTA, ETA etc.-Use of Computer Models			
Unit 5: **MAJOR ACCIDENT HAZARD (MAH) CONTROLS** Concept of MAH-Definition of "Major Accident Hazard". -Identification and assessment of MAH units. Criteria and Classification of Threshold Quantities of hazardous materials. -Applicability of respective rules (MSIHC Rules or Rule 68-J, GFR). -Compliance of statutory provisions. -Assessment of fire, explosion and toxicity by Dow & Mond index. -Assessment of Reliability of vessels and safety fittings. Data of Failure rates-and its utility. -Gas dispersion, Fire and Explosion Events-Assessment of probability (frequency) and consequence (effect)-of such hazardous events. Scenario identification and Consequence Analysis. -Computer modeling. -Population density, Vulnerable zones, Probit equation & percentage fatality, Types of damage and damage distances. Risk counter. -F-N curves. -Criteria for acceptable risks, Assessment and Areas of Evacuation. -Safety Audit, Safety Report and Risk Assessment Report. -Preparation of Safety audit as per IS:14489.-Preparation of Risk Assessment Report and its compliance. -Preparation of Safety Report. -Use of identified risks and scenarios from Safety Audit, Safety Report and Risk Assessment Report for emergency -planning. Compliance. -	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Emergency Planning (Disaster Management Plans): -Preparation and Rehearsal of On-site and Off-site Emergency Plans. -Execution of Chemical Accidents (EPPR) Rules. Role of Govt., Role of Management, Local Authorities and Public. -Standards and Codes: -ILO Code of Practice for Major Accident Hazard Control			

Learning Resources

1. Handbook of Industrial Safety by K.U. Mistry, SiddarthPrakashan, 108, Western Plaza, Adajan Road, Surat – 395 009. (Gujarat).
2. Chemical Process Safety Fundamentals with Applications by Daniel A Crawl & Joseph F Louvar,Prentice Hall, New Jersey.

Reference Books:

1. Accident Prevention Manual for Industrial Operations, National Safety Council,425, North Michigan Ave,Chicago, Illinois, USA.
2. Encyclopedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva.
3. Safety and Health for Engineers, by Roger L Brauer, Van Nostrain Reinhold, New York.
4. Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann.
5. Occupational Safety Management & Engineering by Willi Hammer.
6. Safety at Work by John Ridley.
7. Major Hazard Control – A Practical Manual, ILO, Geneva.
8. Gas Dispersion Modeling, Engineers India Ltd., Central Labour Institute, Mumbai.
9. Methodologies for Risk & Safety Assessment in Chemical Process Industries,
10. Raghvan K.V., Khan A.K., Commonwealth Science Council, London.
11. Hazard Factories/Installations by Central Labour Institute, Sion, Bombay.
12. Technical Guidance on Hazard Analysis by National Safety Council.
13. Emergency Preparedness by MOEF through ICMA publication.

Journals & Periodicals: Nil

Other Electronic Resources: Nil

Evaluation Scheme	**Total Marks 100**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

PGDIS 202	Industrial Health and Hygiene	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100

1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date:19-06-2021
4	**Course Objectives**

1. To acquaint the students with adverse health effects arising out of industrial hazards, associated risks and consequential occupational diseases.
2. To provide adequate job knowledge on both engineering and medical controls.
3. The important aspects of Industrial Hygiene, Ergonomics, Occupational Health, Physiology and Personal Protective Equipment are included.
4. To sharpen their knowledge about different aspects of Occupational Health and preventive measures including hygiene habits expected out of the working force.
5. Deployment of Industrial Hygienists and their effective functioning in industry is still under developmental stage in our country. Accordingly, knowledge of this area will facilitate the efforts to enhance better liaison among the work of Safety Officer, Industrial Hygienist and Occupational Health Specialist or Factory Medical Officer.

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: INDUSTRIAL HYGIENE: Co-relation between Industrial Hygiene & Health-Definition of Industrial Hygiene (IH).-Difference between Industrial Hygiene & Occupational Health.-Work co-ordination between Industrial Hygienist, Safety Officer and Factory Medical Officer to enhance overall development of health and safety among employees-Occupational Health Hazards.-Introduction & Classification of Occupational Health Hazards.-Dangerous properties of chemicals, dusts, gases, fumes, mists, vapors, smoke and aerosols and their health effects.-Routes of Entry & Toxic Effects -Routes of entry to human system.-Recognition, evaluation and control of basic hazards.-Concepts of dose response relationship and bio-chemical action of toxic substances.-Toxicity and Toxicology.-Types and Degrees of toxic effects.-Threshold Limits of Exposure – PEL, TLV- TWA, STEL-TWA, IDLH, LD/LC etc.-Air Sampling Methods and Strategies, instruments and analysis.-Types of Monitoring:-Workplace or Area monitoring.-Air quality and Stack monitoring.-Personal exposure monitoring.-Biological monitoring.-Methods of Sampling & Analysis.-Control Methods:-Substitution, Changing the process, isolation, wet method, local exhaust ventilation.-Personal hygiene.-Housekeeping and maintenance. Waste disposal. -Special control measures.	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Unit 2: ERGONOMICS: Introduction: -Introduction to Ergonomics and its constituents. -Application of Ergonomics for Safety & Health. -Load Carrying:-Limits of load carrying. -Physiological basis of work. Static and dynamic work. Occupational work capacity. -Muscle System and Muscular work. -Lever systems in human body. -Physiological problems associated with load carrying- (injuries / fatigue/ occupational disease etc.). -possible solutions to these problems and general guidelines to avoid such problems. -Hand Tools and their use: Design of tools in relation to body postures. -Hand tools, Power tools, Specialized tools, Body supports and Tool supports. -Safety while using tools. Training for usage. -Tool boxes / Kits. -Tool maintenance. -Work Station Design: -Introduction to anthropometry. -Concepts of percentiles (5^{th}, 50^{th}, 95^{th}), averages and how and where to apply these. -Working heights – Standing, sitting, semi standing (high stools). -Correct postures – Static and functional reach. Health problems related to wrong postures, back pain etc. Fatigue due to sitting.-Ergonomic office furniture and utility tools.-Precision tasks vs Gross tasks-Inspection tasks.-Key board work station, Musculo-skeletal -disorders, Cumulative trauma disorders and Carpal Tunnel Syndrome.-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.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
UNIT 3: PERSONAL PROTECTIVE EQUIPMENT: Introduction: Need for personal protective equipment (PPE)-Selection and applicable standards-Appraisal of Indian Standards pertaining to PPE. -Procurement, stocking, issue of PPE; s, Classification and limitations of few of the respiratory and non-respiratory PPE. -Non-respiratory PPE: -Head protection. -Ear protection. -Face and Eye protection. -Hand protection. -Foot	20%	9hrs	Presentation, Video presentation, Chalk board Notes

protection. -Full Body Protection-Fall protection – Safety belts, harnesses and fall arrestor mechanism. -Respiratory). - of hazards. -Classification and Selection of respiratory PPE. -Instructions and training-Instructions and training for the use, maintenance and care of non-respiratory PPE. -Instructions and training for the use, maintenance and care of respiratory PPE. -Testing Procedures and Standards. **OCCUPATIONAL HEALTH HAZARDS:** Adverse health effects of noise, vibration, cold, heat stress, improper-illumination, thermal radiation, X-rays, UV rays, ionizing and non-ionizing radiations. -Effects of Threshold Limits: -Short term and long-term effects of exposures. -Preventive and control measures.			
Unit 4: **OCCUPATIONAL HEALTH**-Definition as per World Health Organization. -Occupational Diseases: -Common occupational diseases. -Notifiable diseases under Schedule III of the Factories Act 1948.-Occupations involving risk of contracting these diseases. -Mode of causation of the diseases and their effects. - Diagnostic methods. -Biological monitoring. Methods of detection and prevention.-Evaluation of injuries.-Occupational Health Services at the work place:-occupational Health Center.-Ambulance van.-Factory Medical Officer, Staff and Equipment.-Medical Examinations:-Pre-employment and periodical medical examinations of the workers.-Medical surveillance for control of occupational diseases and health records.-Different Statutory Forms for filing medical reports-First-Aid-First Aid for Burns, Fractures, Suffocation, Toxic Ingestion, Bleeding, Wounds and Bandaging. Artificial Respiratory techniques. -First aid and Antidotes for poisoning of different types-	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Unit 5: PHYSIOLOGY: Physiology of respiration:-Cardiac cycle, Muscle contraction, Nerve conduction system, etc.-Assessment of Workload based on Human physiological reactions.-Permissible limits of load for Manual lifting and carrying.-Criteria for fixation of limits.-Aerobic work capacity (physical work capacity):-Methods of determination (use of bicycle, ergometer, treadmill, step-stool ergometer).-Factors affecting Aerobic capacity and Work performance.-Working posture: Effect on Cardio-vascular and Musculo-skeletal system.-Implications on health.-Assessment of Work Capacity:-Fatigue and Rest Allowances.-Physiological test for assessment of occupational health.-Good Nutrition related requirements; intermittent dieting, types of appropriate workout exercises to remain physically fit.	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Textbooks:

1. TLVs & BEIs by ACGIH 2021
2. The Indian Factories Act, 1948
3. The Occupational Environment — Its Evaluation, Control, and Management 3rd Edition by AIHA
4. Fundamental of Industrial Safety & Health BY Dr. K U Mistry
5. Toxicology Principles by William
6. Fundamentals of Industrial Hygiene by Barabara Plog
7. Recognition of Health Hazards in Industry by William A
8. OSHA 1910.132 PPE
9. Occupational Disease by NIOSH Instructional Module

Reference Books:

Journals & Periodicals: Nil

Other Electronic Resources: Nil

Evaluation Scheme	**Total Marks 100**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

PGDIS203	HSE LEGISLATIONS AND ASSOCIATED STATUTORY PROVISIONS	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100

1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. Imparting knowledge about various legislations related to safety, health and environment.
2. To know statutory provisions for adequate compliance and to keep necessary records in this regard.
3. The knowledge about reportable accidents, dangerous occurrences, notifiable diseases and many statutory provisions will help the students and the managements for successful execution of all legal requirements the law of the land and methods of its implementation.
4. Other contents deal with Factories' Act and Rules, other legislations pertaining to boiler safety, electricity, flammable and toxic chemicals, atomic energy, dock safety, construction safety, environmental protection and social well-being

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: LEGISLATIVE PROCESS: Meaning of legislation, legislative process and other legal terminology such as Statement of objects and reasons, Bill, Act, Rules, Amendment, Section, Rule, Schedule and Form, Preamble, Penal section, Prosecution, Judicial process, Judgment, Citation etc. ILO CONVENTION AND RECOMMENDATIONS: Role of ILO for Safety, Health & Environment Conventions and Recommendations in the furtherance of Safety, Health and Environment. Some examples: 1981-155-OHS/164-OHS; 1985-161-OHS/171-OHS;1988 – 167-safety & health in construction 175- safety & health in construction; 1990 – 170 – safety in the use of chemicals at work 177- chemicals; 1993 – 174- prevention of major industrial accidents & 181 – prevention of major industrial accidents.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 2: THE FACTORIES' ACT, 1948 AND THE GUJARAT FACTORIES RULES 1963: History of the Safety Movement in the World and India, including the Factories Acts and their Amendments. Provisions of the Factories Act 1948 and Gujarat Factories' Rules made there under, with special reference to definitions u/s 2, Chapter 3, 4, 4-A, 5, 6, 9 & 10 and Schedules and Forms pertaining to dangerous operations and hazardous processes. Case Laws under the Factories Act and Rules.	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Unit 3: OTHER LEGISLATIONS: Sections pertaining to Safety, Health & Environment from the following statutes (latest with last amendment):-The Gujarat Lifts & Escalators Act 2000 and Rules 2001.-Boilers Act 1923, Gujarat Boiler Rules 1966 and Indian Boiler Regulations 1950 (IBR).-Electricity Act 2000 and Rules 2000.-Petroleum Act 1934 and Rules 1976.-Explosives Act 1884 and Rules 1983.-Static and Mobile (Unfired) Pressure Vessels Rules 1981.-Gas Cylinders Rules 1981.-Insecticides Act 1968 and Rules 1971.-Atomic Energy Act 1962 and Radiation Protection Rules 1971.-Rules for Transportation of Hazardous Goods from the Motor Vehicles Rules 2000.-The Dock Workers (Safety, Health & Welfare) Act 1986, Rules and Regulations 1990.-The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act1996 and the Central Rules 1998.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 4: LEGISLATIONS ON ENVIRONMENTAL PROTECTION: Water (Prevention and Control of Pollution) Act 1974 & Rules 1975.Air (Prevention and Control of Pollution) Act 1981 & Rules 1982.-Environment (Protection) Act 1986 & Rules 1986.-Hazardous Wastes (Management & Handling) Rules 1989.-Manufacture, Storage & Import of Hazardous Chemicals Rules 1989.-Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms, Genetically Engineered Organisms or Cells.-Chemical Accident (Emergency Planning, Preparedness and Response) Rules 1996.-Bio-Medical Waste (Management & Handling) Rules 1998.-Re-cycled Plastics Manufacture & Usage Rules 1999.-Noise Pollution (Regulation & Control) Rules 2000.-Ozone Depleting Substances Rules 2000.-Batteries (Management & Handling) Rules 2001.	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Unit 5: LEGISLATIONS ON SOCIAL SECURITY: -Workmen's Compensation Act 1923 and Rules 1924.-Compensation for death, injuries and occupational diseases. Worked examples. -Employees' State Insurance Act 1948 and Rules 1950.-Gujarat Physically Handicapped Persons (Employment in Factories) Act 1982 & Rules 1982.-Gujarat Payment of Unemployment Allowance to Workmen in Factories, Act 1981.-Public Liability Insurance Act 1991 and Rules 1991.-Social Accountability.	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Learning Resources		
1. ILO Conventions and Recommendations on Safety, Health & Environment. 2. The Factories Act 1948 and the Gujarat Factories Rules 1963. 3. Books of bare Acts & Rules mentioned in 'Topics & Subtopics (Para 4 to 6)'. 4. Handbook of Industrial Safety by K.U. Mistry, Siddarth Prakashan, 108, Western Plaza, Near Bhulka Bhavan School, Adajan Road, Surat – 395 009. (Gujarat).		
Reference Books:		
Journals & Periodicals: Nil		
Other Electronic Resources: Nil		
Evaluation Scheme	**Total Marks 100**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

LIST OF ELECTIVES PROFESSIONAL ELECTIVES - PGDIS204

PGDIS204(A)	SAFETY IN CONSTRUCTION INDUSTRY	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100

1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. To become familiar with different stages of building construction, and activities involved.
2. To understand the hazards associated with specific activities associated with building construction and control procedures and safety practices currently employed.
3. To become aware of safety and welfare legislation for construction workers and its implementation on sites.
4. To appreciate the hazards involved in working at height and at depth, and become familiar with correct procedures, PPE and tools andtackles required for such rescue operations involving building construction sites
5. To learn various occupational health and safety of the workers at construction sites

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: SAFETY IN CONSTRUCTION OPERATIONS Basic philosophy peculiarities and parameters governing the safety requisites: in the use of construction machinery. - Seismic structural soundness, structural safety, accident and hazards their causes and effects	20%	12hrs	Presentation, Video presentation, Chalk board Notes

Underground Works. -Excavation, drilling and blasting prematic- Trenching, Shorting, Porklain type of Shoring. - Strutting, Tunneling, Piling. -safety in using and operating machinery and equipment relating to the above works. -Foundation: Plant, Machinery and Structure. -Above Ground Works. -Scaffolding, Shuttering form work. - Ladders, Concrete, Cofferdams and special operation connected with irrigation work. -Safety in use and portion of related machinery and equipments.-4 Safety on working on fragile roof-Working at Heights -Under Water Portions- Well sinking-Caissons under water concreting-Cofferdams and special operations connected with irrigation work.- Safety in use of machinery and equipments related to under water portions-Movement of Construction Machinery-Heavy/Long Items.-Earth Movers Equipments-Railway wagons- Motor Trucks- Material Vehicles-Hazardous Material-Material handling equipments-Special Works- High rise buildings- Bridges and Tunnels- Roads, Railway-Asphalting, Pneumatic caissons.-Electrical installation and Lifts.-Safety in Prevention and Protection at work site including the collapsing of the structure-Safety In use of explosives- Open cost machinery, Quarrying- Project Management and Constructions in safety- Introduction- Manpower utilization.- Utilization of material- Equipment and Tools.-			
Unit 2: SAFETY IN DEMOLITION OPERATIONS Planning and Permit. -Planning the sequence of demolition. -Safety Precaution to be taken for and during demolition carrying out repairs, addition and alterations.	20%	6hrs	Presentation, Video presentation, Chalk board Notes

Unit 3: SAFETY WITH REGARD TO STORAGE, STOCKING AND HANDLING OF MATERIALS OF CONSTRUCTION Health Hazards while handling construction material and chemicals-Safety Measures with respect to handling of material used in Construction (a) Cement (b) limes (c) aggregates (d) fly ash (e) timber steel (f) glass (g) paints (h) varnishes (i) petroleum Products (j) Chemicals (k) Plastic and PVC materials	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 4: ACCIDENT PREVENTION. Occupational Health Hazards- Occupational diseases relating to construction work. -- Safety in the use and maintenance of personal protective equipment specific to construction industry. -Health and Welfare measures at construction site. - Emergency Medical treatment of injuries and rehabilitation at construction site.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 5: STATUTORY OBLIGATIONS. Regulation of Employment and condition of work in construction- Construction Safety Laws. -IS AND NB Codes- Local Building and Development Laws- Accident Investigation and Reporting. - Structure stability and precautions to be taken. **SPECIAL PRECAUTION FOR WORKS OF ENGINEERING CONSTRUCTION**. Special precaution for works of Engineering Construction like (a) Distilling (b) Fractionating columns (c) Chimney (d) Silos-Oil and Gas (e) Installation of Transmission/Communication Lines (f) Cable Installation (g) Air Fields	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Learning Resources			
Textbooks 1. Accident Prevention Manual for Industrial Operations, National Safety Council, 2. 425, North Michigan Ave, Chicago, Illinois, USA. 3. Encyclopaedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva. 4. Safety and Health for Engineers, by Roger L Brauer, Van Nostrain Reinhold, New York.			

<table>
<tr><td colspan="3">5. Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann.
6. Occupational Safety Management & Engineering by Willi Hammer.
7. Safety at Work by John Ridley.
8. Handbook of Industrial Safety by K.U. Mistry, Siddharth Prakashan, 108, Western
9. Plaza, Near Bhola Bhavan School, Adajan Road, Surat – 395 009. (Gujarat).
10. Building Construction by Jha and Sinha, Khanna Publishers, Delhi.</td></tr>
<tr><td colspan="3">Reference Books:</td></tr>
<tr><td colspan="3">Journals & Periodicals: Nil</td></tr>
<tr><td colspan="3">Other Electronic Resources: Nil</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">Total Marks 100</td></tr>
<tr><td>Mid semester Marks</td><td colspan="2">30 marks</td></tr>
<tr><td>End Semester Marks</td><td colspan="2">50 marks</td></tr>
<tr><td rowspan="4">Continuous Evaluation</td><td>Category</td><td>Marks</td></tr>
<tr><td>Attendance</td><td>5 MARKS</td></tr>
<tr><td>Quiz</td><td>5 MARKS</td></tr>
<tr><td>Skill enhancement activities / case study</td><td>5 MARKS</td></tr>
<tr><td>Presentation/ miscellaneous activities</td><td>5 MARKS</td></tr>
</table>

PGDIS204(B)	SAFETY IN ENGINEERING INDUSTRY	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100
1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. To gain knowledge about the process involved in various engineering industries
2. To understand the hazards and risks involved in engineering industries
3. To design suitable safety management plans for various engineering industries

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: Safety in Metal Working Machinery and Wood Working Machines General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes-saws, types, hazards.	20%	6hrs	Presentation, Video presentation, Chalk board Notes
Unit 2: Principles of Machine Guarding Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard	20%	9hrs	Presentation, Video presentation, Chalk board Notes

construction- guard opening. Selection and suitability: lathe drilling- boring-milling-grinding-shaping-sawing-shearing presses-forge hammer-flywheels shafts- couplings-gears-sprockets wheels and chain pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.			
Unit 3: Safety in Welding and Gas Cutting Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.	20%	8hrs	Presentation, Video presentation, Chalk board Notes
Unit 4: Safety in Cold Forming and Hot Working of Metals Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.	20%	12hrs	Presentation, Video presentation, Chalk board Notes
Unit 5: Safety in Finishing, Inspection and Testing Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering	20%	10hrs	Presentation, Video presentation, Chalk board Notes

and administrative controls, Indian Boilers Regulation. Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal.			

Learning Resources

Text Books:

1. Accident Prevention Manual" – NSC, Chicago, 1982.
2. Occupational safety Manual" BHEL, Trichy, 1988.
3. Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers
4. Book seller, New Delhi, 1989.
5. Safety in Industry" N.V. Krishnan Jaico Publishery House, 1996.
6. Safety in the use of wood working machines, HMSO, UK 1992.
7. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.
8. Safety and Health for Engineers - Roger L. Brauer, Ph.D & CSP (USA)

Reference Books:

Journals & Periodicals: Nil

Other Electronic Resources: Nil

Evaluation Scheme	**Total Marks 100**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

PGDIS204(C)	SAFETY IN TEXTILE INDUSTRY	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100
1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. To become familiar with different stages of textile process and activities involved.
2. To understand the hazards associated in textile industries, control procedures and safety practices currently employed.
3. To become aware of safety and welfare legislation for textile workers and its implementation on industries.
4. To learn various occupational health and safety of the workers in textile industries

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: Process flow charts of i) short staple spinning, ii) long staple spinning, iii) viscose rayon and synthetic fibre, manufacturer, iv) spun and filament yarn to fabric manufacture, v) jute spinning and jute fabric manufacture-accident hazard, guarding of machinery and safety precautions in opening, carding, combing, drawing, flyer frames and ring frames, doubles, rotor spinning, winding, warping, softening/spinning specific to jute.	20%	12hrs	Presentation, Video presentation, Chalk board Notes
Unit 2: Accident hazards i) sizing processes- cooking vessels, transports of size, hazards due to steam ii) Loom shed – shuttle looms and shuttles looms iii) knitting machines iv) nonwovens.	20%	8hrs	Presentation, Video presentation, Chalk board Notes

Unit 3: Scouring, bleaching, dyeing, punting, mechanical finishing operations and effluents in textile processes.	20%	8hrs	Presentation, Video presentation, Chalk board Notes
Unit 4: Health hazards in textile industry related to dust, fly and noise generated-control measures-relevant occupational diseases, protective equipment-health and welfare measures specific to textile industry, Special precautions for specific hazardous work environments.	20%	8hrs	Presentation, Video presentation, Chalk board Notes
Unit 5: Relevant provision of factories act and rules and other statues applicable to textile industry – effluent treatment and waste disposal in textile industry.	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Learning Resources

Text Books:

1. "Safety in Textile Industry", Thane Belapur Industries Association, Mumbai.
2. Shenai, V.A. "A technology of textile processing", Vol. I, Evak Pub-lications, 1980.
3. Little, A.H. ,"Water supplies and the treatment and disposal of effluent" the textile institute, Manchester, 1975.

Reference Books:

Journals & Periodicals: Nil

Other Electronic Resources: Nil

Evaluation Scheme	**Total Marks 100**
Mid semester Marks	30 marks
End Semester Marks	50 marks

Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

PGDIS204(D)	**SAFETY IN DOCKS**	**L**	**T**	**P**	**C**
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100

1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. To gain the knowledge on dock safety status
2. To understand the emergency action plan in docks
3. To gain knowledge on dock safety workers regulations

Course Content	**Weightage**	**Contact Hours**	**Pedagogy**
Unit 1: History of dock safety status in India-background of present dock safety statues- dock workers (safety, health and welfare) act 1986 and the rules and regulations framed there under, other statues like marking of heavy packages act 1951 and the rules framed there under - manufacture, storage and import	20%	9hrs	Presentation, Video presentation, Chalk board Notes

of hazardous chemicals. Rules 1989 framed under the environment (protection) act, 1989 – few cases laws to interpret the terms used in the dock safety statues. Responsibility of different agencies for safety, health and welfare involved in dock work			
Unit 2: Types of cargo ships – working on board ships – Safety in handling of hatch beams – hatch covers including its marking, Mechanical operated hatch covers of different types and its safety features – safety in chipping and painting operations on board ships – safe means of accesses – safety in storage etc. – illumination of decks and in holds – hazards in working inside the hold of the ship and on decks – safety precautions needed – safety in use of transport equipment - internal combustible engines like fort-lift truck spay loaders etc. Working with electricity and electrical management – Storage – types, hazardous cargo – Oil, Chemicals and Flammable Liquids Tankers – Man Entry, Dock Entry & Hot work of hazardous cargo ships**.**	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 3: Different types of lifting appliances – construction, maintenance and use, various methods of rigging of derricks, safety in the use of container handling/lifting appliances like portainers, transtainer, top lift trucks and other containers – testing and examination of lifting appliances – portainers – transtainers – toplift trucks – derricks in different rigging etc. Use and care of synthetic and natural fiber ropes – wire rope chains, different types of slings and loose gears.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 4: The different types of equipment for transporting containers and safety in their use safety in the use of self-loading container vehicles, container side lifter, fork lift truck, dock railways, conveyors and cranes. Safe use of special lift trucks inside containers – Testing, examination and inspection of containers – carriage of dangerous goods in containers and maintenance and certification of containers for safe operation Handling of different types of cargo – stacking and unstacking both on	20%	9hrs	Presentation, Video presentation, Chalk board Notes

board the ship and ashore			
Unit 5: Emergency action Plans for fire and explosions - collapse of lifting appliances and buildings, sheds etc., - gas leakages and precautions concerning spillage of dangerous goods etc., - Preparation of on-site emergency plan and safety report. Dock workers (SHW) rules and regulations 1990-related to lifting appliances, Container handling, loading and unloading, handling of hatch coverings and beams, Cargo handling, conveyors, dock railways, forklift.	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Learning Resources		
Text Books: 1. International Labour Organization, "Safety and Health in Dock work", 2nd ed. 1997. 2. Indian Dock Labourers Act 1934 with rules 1948", Law Publishers (India) Pvt. Ltd., Allahabad. 3. Srinivasan "Harbour, Dock and Tunnel Engineering", Charotar Publishing House Pvt. Limited, 2011.		
Reference Books:		
Journals & Periodicals: Nil		
Other Electronic Resources: Nil		
Evaluation Scheme	**Total Marks 100**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

PGDIS204(E)	APPLIED ERGONOMICS	L	T	P	C
		4	0	0	4

Total lecture hours & practical:	Total Marks: 100
1	Course Pre-requisites: NIL
2	Course Category: Core Course
3	Course Revision/ Approval Date: 19-06-2021
4	**Course Objectives**

1. To ensure that safety in ergonomics of conveying and hoisting mechanisms and handling of heavy equipment
2. To provide comprehensive knowledge on application of ergonomics in a work system

Course Content	Weightage	Contact Hours	Pedagogy
Unit 1: Man-machine system Concept – Human factors Engineering and its Applications - Man as Information processor, Sensor, Controller.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 2: Human Behaviour – Individual difference –Motivation –Frustration and Conflicts – Attitudes - Learning concepts.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 3: Ergonomic Principles – ergonomics Application in a work system – motion economy Principle – environmental effects.	20%	9hrs	Presentation, Video presentation, Chalk board

			Notes
Unit 4: Impending safety factors – Technological factor –Physiological factor –Legal factor – Administrative factors.	20%	9hrs	Presentation, Video presentation, Chalk board Notes
Unit 5: Personal protective equipments (different types, specifications, standards, testing procedures, and maintenance).	20%	9hrs	Presentation, Video presentation, Chalk board Notes

Learning Resources

Text Books:

1. McCornick, E.J., Human Factors in Engineering and Design, Tata McGraw-Hill, 1982.
2. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 1982.
3. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 1982.
4. Alexandrov, M.P., Material Handling Equipment, Mir Publishers, Moscow, 1981.

Reference Books:

Journals & Periodicals: Nil

Other Electronic Resources: Nil

Evaluation Scheme	**Total Marks 100**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation	**Category**	**Marks**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

TOPICS OF PROJECT FOR SELECTION

1) Types of Industrial accidents & their analysis of Fertilizer plant of last five years
2) To prepare HAZOP study report of any one hazardous chemical manufacturing process
3) To prepared Emergency Action Plan for any MAH industry
4) To prepare fire protection system of any MAH Industry
5) HSE laws applicable to Petrochemical Industry
6) List of hazards & their mitigating measures of Textile Industries
7) List of hazards & their mitigating measures of steel plant
8) List of hazards & their mitigating measures of Pesticides Industry
9) To prepare safety management plan of any MAH industry
10) List out hazards & their mitigating measures of Foundry

GSFC University may also decide upon about the provision of offering few other options related to "Elective topics". This would depend upon the main resource of faculties with good experience in those fields besides additional facilities organizing study tours of those industries around the state of Gujarat or outside.

Suggested topics are:

a) Safety in Engineering industry.
b) Disaster Risk management
c) Textile Manufacturing
d) Construction.
e) Docks
f) Applied ergonomics
g) IT Industry
h) Pottery & Ceramics
i) Waste treatment Plants – Involving Liquid effluents, Gas emissions, Solid waste disposal etc.,
j) Hospital Safety