

SU/BOS/Science/500

Date: 10/07/2023

To,

The Principal, All Concerned Affiliated Colleges/Institutions Shivaji University, Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science) Shivaji University, Kolhapur.
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Subject: Regarding syllabi of as per NEP-2020 under the Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of degree programme under the Faculty of Science and Technology.

1. B.Sc.-M.Sc. Part II Nanoscience and Technology	7. All Faculty Under Graduate Part II Environmental Studies
2. M.C.A. Part I (New NEP -2020)	8. P.G. Diploma in Data Science
3. B.C.A. Part II	9. P.G. Diploma in Environment Protection & Management
4. M.C.A. Part II	10. P.G. Diploma in Industrial Safety, Health & Environment
5. B.Sc. Part III Food Science	11. Diploma in Industrial Safety, Health & Environment
6. B.Sc. Part I Drug Chemistry	12. All Faculty UG & PG Value Added Course : Intellectual Property Rights

This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,



**Dy Registrar
Dr. S. M. Kubal**

Copy to:

1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education

**P. G. Diploma in
SAFETY, HEALTH AND ENVIRONMENT
(PGDISHE)
Syllabus from 2023-24**

- **Programme Outcomes (PO'S):**

The diploma students will be

PO-1) Aware and about the risks and hazards related to occupational health, safety and wellbeing.

PO-2) Get acquainted with the various causes and conducts responsible for unsafe environment, unsafe act and unsafe condition.

PO-3) Responsible for minimizing recurrence of accidents in work environment.

PO-4) Develop a positive attitude to solve the concerning principles of sustainable development.

Structure of Revised PGDISHE course :

There will be 6 theory papers, 1 one year project, 1 practical and 3 weeks in-plant training is compulsory. The total examination of 800 marks with annual pattern.

Sr. No	Paper No.	Paper Title	Theory Hours	Practical Hours	Marks		Total
					External	Internal	
1.	CC1101	Occupational Health and Environmental Safety Management	80	--	100	--	100
2.	CC1102	Safety at Workplace	80	--	100	--	100
3.	CC1103	Accident Prevention Techniques	80	--	100	--	100
4.	CC1104	Safety Management System and Legislation	80	--	100	--	100
5.	CC1105	Quality Control and Safety Management	80		100		100
6.	CC1106	Safety Engineering	80		100		100
7.	CC1107	In-plant Training and Visits	--	2 Weeks	--	50	50
		Practical	--	120	--	50	50
8.	CC1108	Project	--	One Year	50	50	100
Total marks							800

CC1101: Occupational Health and Environmental Safety Management

Upon completion of the course, students will be able to:

CO1: Realize the basics of Occupational Health and environmental safety Hazards.

CO2: Introduction to common occupational diseases and prevention.

CO3: Define industrial hygiene and principles.

CO4: Get acquainted with the principles of ergonomics.

CO5: Familiarise with Process Safety Management (PSM) as per OSHA

Syllabus

Unit I: Introduction and Scope (20)

- i. Definition of Occupational Health as per WHO/ILO.
- ii. Occupational Health and Environmental Safety Management - Principles practices.
- iii. Common Occupational diseases: Occupational Health Management Services at the work place. Pre-employment, periodic medical examination of workers, medical surveillance for control of occupational diseases and health records.

Unit II: Monitoring for Safety, Health and Environment (20)

- i. Occupational Health and Environment Safety Management System, ILO and EPA Standards.
- ii. Industrial Hygiene: Definition of Industrial Hygiene, Industrial Hygiene: Control Methods, Substitution, Changing the process, Local Exhaust Ventilation, Isolation, Wet method, Personal hygiene, housekeeping and maintenance, waste disposal, special control measures.
- iii. Chemical Hazard: Introduction to chemical hazards, dangerous properties of chemical, dust, gases, fumes, mist, Vapours, Smoke and aerosols. Route of entry to human system, recognition, evaluation and control of basic hazards, concepts of dose response relationship, bio-chemical action of toxic substances. Concept of threshold, limit values.

Unit III: Occupational Health and Environmental Safety Education (20)

- i. Element of training cycle, Assessment of needs. Techniques of training, design and development of training programs. Training methods and strategies types of training. Evaluation and review of training programs.
- ii. Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety, Exposure Limit
- iii. Ergonomics-Introduction, Definition, Objectives, Advantages. Ergonomics Hazards. Musculoskeletal Disorders and Cumulative Trauma Disorders. 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 or fixation limits.

Unit IV: Occupational Safety, Health and Environment Management

(20)

- i. Bureau of Indian standards on safety and health 14489 - 1998 and 15001 – 2000, ISO 45001:2018, Process Safety Management (PSM) as per OSHA, PSM principles, ISO 45001:2018, EPA Standards, Performance measurements to determine effectiveness of PSM.
- ii. Importance of Industrial safety, role of safety department, Safety committee and function, Role and responsibilities of safety officer

Reference Books:

1. R. K. Jain and Sunil S. Rao , Industrial Safety , Health and Environment Management Systems, Khanna publishers, New Delhi (2006)
2. Slote. L, Handbook of Occupational Safety and Health, John Willey and Sons, New York .
3. Jeanne Mager Stellman, Encyclopedia of Occupational Health and Safety (ILO) Ms. Irma Jourdan publication

CC1102 : Safety at Workplace

Upon completion of the course, students will be able to:

CO1: Introduction to Safe use of machines and tools.

CO2: Recognise the different industrial hazards.

CO3: Identify the electrical and construction industry hazards.

CO4: Be acquainted with the use of personal protective equipments (PPE)

CO5: Monitor the fire and other hazards in industry.

Syllabus

Unit I: Safe use of machines and tools

(20)

- i. Safety in the use of Power Presses (all types), Shearing, Bending, Rolling, Drawing, Turning, Boring, Milling, Shaping, Planning broaching, planting, Grinding, CNCs.
- ii. Preventive maintenance, periodic checks for safe operation. Associated hazards and their prevention. Need for selection and care of cutting tools, Preventive maintenance and periodic checks for safe operation. Associate hazards and their prevention
- iii. Workplace Inspection, type of workplace inspection, Importance of consultation in safety.
- iv. Principles in machine guarding. Ergonomics of machine guarding. Indian standard and ergonomics of machine guarding. Type of guards, their design and selection. Guarding of different types of machinery including special precautions for machine, tools etc. Built-in-safety devices, maintenance and repairs of guards, incidental safety devices and tools.

Unit II: Industrial Hazards

(20)

- i. **Radiation:** Types and effects of radiation on human body, Measurement and detection of radiation intensity. Effects of radiation on human body, Measurement – Disposal of radioactive waste, Control of
- ii. **Noise and Vibration:** Sources, and its control, Effects of noise on the auditory system and health, adverse health effects of noise, Measurement of noise, Different air pollutants in industries, Effect of different gases and particulate matter ,acid fumes ,smoke, fog on human health, Vibration: effects, measurement and control measures
- iii. **Fire and other Hazards:** Factors contributing to fire, general causes and classification of fire, Detection of fire, extinguishing methods, fire fighting installations with and without water. Occupational Health Hazards

- iv. **Industrial Lighting and Illumination:** Purpose of lighting. Benefits of good illumination. Phenomenon of lighting and safety. Lighting and the work. Sources and types of artificial lighting. Principles of good illumination. Recommended optimum standards of illumination. Design of lighting installation and its Maintenance, Standards relating to lighting and colour

Unit III: Electrical Hazards and Hazards in Construction Industry (20)

- i. Safe limits of amperages, voltages, distance from lines, etc., Hazards of electrical energy, Joints and connections, Overload and Short circuit protection, Earthing standards and earth fault protection , safe limits of amperages, voltages, safe distance from lines, etc., Protection against voltage fluctuations, Effects of shock on human body Hazards from Borrowed neutrals, Electrical equipment in hazardous atmosphere, Criteria in their selection, installation, maintenance and use, Control of hazards due to static electricity,
- ii. Introduction of Construction industry, safety in the use of construction machinery. Scaffolding and Working plat form, Welding and Cutting, Excavation Work, Concreting and Cementing work, Transportation of men and material , safety in prevention and protection at work site. Handling and Storage of compressed gas.
- iii. Construction Industry hazard: Working at Heights: Incidence of accidents. Safety features associated with design, construction and use of stairways, ramps, working platforms, gangway, ladders of different types, scaffolds of different types including Boatswain's chair and safety harness working on roofs. Other safety requirements while working at heights. Working in Confined Spaces, Working underground.

Unit IV: Personal protective equipments (PPE) (20)

- i. Working at Heights: Incidence of accidents. Safety features associated with design, construction and use of stairways, ramps, working platforms, gangway, ladders of different types, scaffolds of different types including Boatswain's chair and safety harness working on roofs. Other safety requirements while working at heights. Working in Confined Spaces, Working underground. Need for personal protection equipment, selection, applicable standards, supply, use, care and maintenance respiratory and non-respiratory personal protective equipment. PPE testing methodology and their standards
- ii. Need for personal protection equipment, selection, applicable standards, and supply, use, care and maintenance respiratory and non-respiratory personal protective equipment. Respiratory personal Protective devices: Classification of hazards. Classification of respiratory personal protective devices, selection of respiratory personal protective devices. Non-respiratory personal protective devices: Head protection, Ear protection. Face and eye protection, hand protection, foot protection, body protection.

- iii. Respiratory personal Protective devices: Classification of hazards. Classification of respiratory personal protective devices. Selection of respiratory personal protective devices. Non-respiratory personal protective devices: Head protection, Ear protection. Face and Eye protection. Hand protection, Foot protection, body protection. Instructions and training in the use, Maintenance and care of self-contained breathing apparatus. Use of breathing apparatus. Testing Procedure and Standards.
- iv. Instructions and training in the use, Maintenance and care of self-contained breathing apparatus. Training in the use of breathing apparatus

Reference Books :

- 1. Frank P Lees - Loss of prevention in Process Industries, Vol. 1 and 2, Butterworth-Heinemann Ltd., London (1991).
- 2. Industrial Safety - National Safety Council of India.

CC 1103 Accident Prevention Techniques

Upon completion of the course, students will be able to:

CO1: Introduce the theories and principles of accident causation.

CO2: Recognise principles of accidents prevention.

CO3: Identify major accident control in industry.

CO4: Be acquainted with the use of plant layout for safety

CO5: Monitor legislation and safety management systems

Syllabus

Unit I: Principles of accidents prevention

(20)

- i. Definition: Incident, accident, injury, dangerous occurrences, unsafe acts, unsafe conditions, hazards, error, oversight, mistakes, etc.
- ii. Accident Prevention : Theories / Models of accident occurrences, Principles of accident prevention, Accident and Financial implications, Hazard identification and analysis, fault tree analysis, Event tree analysis, failure modes and effects analysis, Hazop studies, Job safety analysis - examples , Plant safety inspection - objectives and types check procedure inspection report.
- iii. Causes of accidents, Types of accidents, accident statistics, Cost of accident, Direct and indirect cost of an accident, accident/ incident reporting, accident Investigation report.

Unit II: Theories and principles of accident causation

(20)

- i. The effect of accident, unsafe act, unsafe condition, unpredictable performance,
Human factors contributing to accidents - causes for unsafe acts.
- ii. Safety and psychology -Theories of motivation and their application to safety. Consequences of accident, accident prevention programmers, Role of safety
- iii. **Plant and Equipment: Safety Appraisal and Control Techniques.**
Plant Safety Rules and Procedure, Safe Operating Systems, Safety Check List, Plant Safety Inspection. Safety Surveys. Jobs Safety Analysis. Product Safety. Safety tag system Major Accident Hazards (MAH) Control System.

Unit III: Major Accident Control

(20)

- i. Definition, Major Accident, Hazards, Identification and Assessment of MAH Units. Role of Govt., Role of Management, Local Authorities and Public. Energy Management System. Safety and Environmental Assessment.
- ii. **First aid:** Body structure and Functions, Position of causality, the unconscious casualty, fracture and dislocation, Injuries in muscles and joints, Bleeding, Burns, Scalds and accidents caused by electricity, Respiratory problems, Rescue and Transport of Casualty. Cardiac massage, poisoning, wounds.

- iii. Personal Protective Equipments: Need, selection, supply, use, care and maintenance, Personal protective devices for head, ear, face, eye, foot, knee and body protection, Respiratory personal protective devices.

Unit IV: Plant layout for safety

(20)

- i. Design and location, distance between hazardous units, colour coding , Lighting, ventilation, Flow charts, pilot plant applications and machine guarding and its types, Housekeeping.
- ii. Accidents related with maintenance of machines, maintenance of machines- advantages. Work permits systems - Significance of documentation.
- iii. Plant layout, design and safe distance. Safety and good housekeeping. Typical accidents due to poor house-keeping. Disposal of scrap and other trade wastes. Prevention of spillage. Marking of aisles space and other locations. Use of colour as an aid for good housekeeping. Housekeeping contest. Cleaning methods. Employee assignment. Inspections and checklists. Benefits of good housekeeping. Role of preventive maintenance in safety and health. Importance of standards and codes of practice for plant and equipment.

Reference Books :

1. Frank P Lees – Loss of prevention in Process Industries , Vol. 1 and 2, Butterworth- Heinemann Ltd., London (1991).
2. R. K. Jain and Sunil S. Rao, Industrial Safety , Health and Environment Management Systems, Khanna publishers, New Delhi (2006).

CC 1104 Legislation and Safety Management Systems

CO1: Recognise the legislative measures in industrial safety.

CO2: Be familiar with Environment Protection Legislations

CO3: Identify safety management and management principles.

CO4: Be acquainted management information system (MIS)

CO5: Know computer utilization in Safety, Health and Environment (SHE) Services in Industries

Syllabus

Unit I : Legislative measures in industrial safety (20)

Factories Act, 1948, Workman's Compensation Act, 1943, Employees State Insurance Act, 1948.
Mines Act , Air (Prevention and control) Pollution Act, 1981, Water (Prevention and Control) Pollution Act, 1974,Boiler Vessels Act. Child Labor and Women Employee Act.
The factories rules, History, Provisions under the factories Act and rules made there under with amendments, Functions of safety management.
ILO Convention and Recommendations in the furtherance of safety, health and welfare. Public Liability Insurance Act.

Unit II: Environment Protection Legislations (20)

- i. Water (Prevention and Control of Pollution) Act 1974and Rules. Air (Prevention and Control of Pollution) Act 1981 and1982 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.
- ii. Environment Protection Act 1986 and Rules. MSIHC Rules after 1989 and amended time to time Noise Pollution Act, Bio-Medical Waste, Hazardous Waste Management Rules.
- iii. Chemical accidents (Emergency preparedness, planning and response) Rule 1986

Unit III: Safety Management and Management Principles (20)

- i. Types of Management, General principles of Management. Managerial Role, Authority, Responsibility and Power. Span of Management, Delegation and decentralization of authority.
- ii. Safety, Role of management in industrial safety, Safety Principles, Health safety model concept.
- iii. Planning, organizing, staffing, directing, controlling, motivating safety strategies.

- iv. The competent person in relation to safety legislation - duties and responsibilities.

Competence Building Technique (CBT), Concept for training, application of computer, multimedia, communication. Relevance of WTO regarding safety, Health and environment.

Unit-IV Management information System (MIS) (20)

- i. Sources of information on Safety, Health and Environment Protection. Compilation and collation of information, Analysis and use of modern methods of programming, storing and retrieval of MIS for Safety, Health and Environment.
- ii. SQA Computer Software Application and Limitations.
- iii. Status and future goals of computer utilization in Safety, Health and Environment (SHE) Services in Industries.

Reference Books :

- 1. The Factories Act with amendments 1987, Govt. of India Publications DGFASLI, Mumbai
- 2. Grimaldi and Simonds, Safety Management, AITBS Publishers , New Delhi (2001).
- 3. Industrial Safety - National Safety Council of India.

CC 1105 Quality control and safety management Systems

CO1: Recognise Quality Control and Safety Standards.

CO2: Be familiar with Structure and features of OSHAS 18001 .

CO3: Understand the preparation and assessment of safety audit

CO4: Be acquainted Environment Impact Assessment (EIA).

CO5: Analyse the Hazards and Risk Identification Techniques

Syllabus

Unit I: Quality Control and Safety Standards (20)

- i. Quality objectives – Quality control – Quality Assurance – Process variability
- ii. ISO 9000 and TQM concepts - Quality circles, tools – Zero defect management, 6 sigma – Quality Function Deployment(QFD).
- iii. Components and benefits of safety management system.

Unit II: OHSAS standard (20)

- i. Introduction – Development of OHSAS standard and transition to ISO 45001:2018 – Structure and features of ISO 45001:2018
- ii. Benefits of certification-certification procedure – OH and S management system element, specification and scope - correspondence between ISO 45001:2018, ISO 14001:2015 and ISO 9001:1994 – Guidelines for implementing ISO 45001:2018.
- iii. Developing OH and S policy– Guidelines – Developments - procedure - Content of OH and S policy – General principle, strategy and planning, specific goals, compliance – methodology
- iv. Planning – Guidelines, methodology steps developing action plan – Analysis and identify the priorities, objective and Targets, short term action plan, benefits and cost of each option, Development of action plan.

Unit III: Environment Impact Assessment (20)

ISO 14040(LCA), General principles of LCA, Stages of LCA, Report and Review. ISO 14020 (Eco labeling) – History, 14021, 14024, Type I labels, Type II labels, ISO 14024, principles, rules for eco labeling before company attempts for it. Advantages. EIA in EMS, Types of EIA, EIA methodology EIS, Scope, Benefits. Audit-methodology, Auditors Audit results management review-Continual improvement.

- Unit IV: Hazard and Risk Identification Techniques. (20)**
- i. Hazard and Risk Analysis: Quantitative and Qualitative: Failure, Mode and Effect Analysis (FMEA) and Maximum Credible Accident Analysis(MCAA). Fault Tree Analysis, event tree Analysis. Example of each. HAZAN, HAZOP, Managerial Technique etc.
 - ii. Preparation and Assessment of Safety Audit.
 - iii. Report as BIS 14489: 1998, Safety Report Standards. Environmental Assessment as per Environment Act. Energy Management System.

Referance Books :

1. Albert R. Wilson Environmental Risk: Identification and Management, CRC
2. Kletz Hazop and Hazan-Ref to cheme, Macmillan Education Australia

CC 1106: Safety Engineering

CO1: Know the Safe use of machines and tools.

CO2: Be acquainted with the use of plant layout for safety

CO3: Hazard and Risk Identification Techniques

CO4: Environment Impact Assessment

Syllabus

Unit I: Introduction

(20)

- i. Introduction and need of Safety engineering.
- ii. Man, Material and Machine Safety
- iii. Safety plans and engineering.
- iv. Safety engineering and Construction safety

Unit II: Safe use of machines and tools

(20)

- i. Ergonomics of machine guarding guards, Guarding of different types of machinery including special precautions for paper, rubber and printing machinery, wood working.
- ii. Working in different areas: Working in confined spaces, Working Underground, Working at heights - use of stairways, clamps, working platforms, ladders of different types, Boatswain's chair and safety harness Working on roofs, Lifting machinery lifts and hoists,
- iii. Operation, inspection and maintenance of industrial trucks, loose gears conveyors, Safe working load for mechanical material handling equipments.

Unit III: Plant design and Housekeeping

(20)

- i. Plant layout, design and safe distance, Ventilation and heat stress, Significance of ventilation, Natural ventilation, Mechanical ventilation Air conditioning
- ii. National Building code part VIII and Building service, Thermal comfort Indices of heat stress, Physiology of heat regulation,
- iii. Safety and good housekeeping, Disposal of scrap and other trade wastes Spillage prevention, Use of colour as an aid of housekeeping, Cleaning methods, Inspection and Checklists, Advantages of good housekeeping.
- iv. Safety performance monitoring and its techniques, Recommended practices for compiling and measuring work injury experience – permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate –problems

Unit IV: Industrial Safety Engineering

(20)

- i. **Industrial Lighting: Purpose** of lighting, Uses of good illumination, Recommended optimum standards of illumination, Design of lighting installation, Standards for lighting and colour.
- ii. **Vibration and Noise:** Activities related to vibrations, its impact on human health, abatement Sources, effects of noise on man, Measurement and evaluation of noise, Silencers, Practical aspects of control of noise.
- iii. **Safety at various Industries:** Agro-Industry, Sugar Industry, Textile Industry etc.
- iv. Construction safety.

Reference Books:

1. Heinrich H.W Safety code for Scaffolds and Ladders Ladders IS : 3696
2. Ghiselli, F.E The Myth of Accident Proneness The British Journal of Industrial Safety, Vol. 6, No. 71, 1963
3. Accident Prevention Manual for Industrial Operations”, N.S.C.Chicago, 1982
4. Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York, 1980.
5. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay, 1997.
6. John Ridley, “Safety at Work”, Butterworth and Co., London, 1983.
7. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey, 1973
8. Heinrich H.W Safety code for Scaffolds and Ladders Ladders IS : 3696
9. Ghiselli, F.E The Myth of Accident Proneness The British Journal of Industrial Safety, Vol. 6, No. 71, 1963.

CC 1107: In-plant Training and Industrial Visits:

- i. In-plant training of 2 weeks is compulsory and a Report to be submitted to the Department with due Certification of the industry where training is sought.
 - ii. Minimum 5 Industrial Visits are compulsory.
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CC 1108: Project

One year compulsory Project on Industrial Safety to be completed before Theory examination and a Report to be submitted to the Department.

Equivalence for the old syllabus papers :

The students of the old syllabus can appear for the following papers as equivalent papers.

Sr. No.	Paper No.	Title of Old paper	Paper No.	Title of New paper
1	I (ISHE 1)	Occupational Health and Hazards	I (ISHE 1)	Occupational Health and Environmental Safety Management
2	II (ISHE 2)	Safety at Workplace	II (ISHE 2)	Safety at Workplace
3	III (ISHE 3)	Accident Prevention Techniques	III (ISHE 3)	Accident Prevention Techniques
4	IV (ISHE 4)	Safety Management System and Law	IV (ISHE 4)	Safety Management System and Legislation

Format of question paper with marking scheme

**PG Diploma in Industrial Safety, Health and
Environment (Revised) Examination,
ENVIRONMENTAL SCIENCE (Paper-) (New)**

Paper name:

Sub. Code:

Day and Date:

Total Marks: 100

Time:

Instructions: 1. Question No. 1 is compulsory.

2. Solve any four questions from Question No. 2 to 7.

3. All questions carry equal marks.

Q. 1. (20)

Q. 2. (20)

Q. 3. (20)

Q. 4. (20)

Q. 5. Write Short Notes (Any Two) (20)

a)

b)

c)

Q. 6. Write Short Notes (Any Two) (20)

a)

b)

c)

Q. 7. Write Short Notes (Any Four) (20)

a)

b)

c)

d)

e)

- Standard of Passing : 40 M