# SONA COLLEGE OF TECHNOLOGY, SALEM-5

**(An Autonomous Institution)**

## M.E- Industrial Safety Engineering

**(Dept of Mechanical Engineering)**

## CURRICULUM and SYLLABI

**[For students admitted in 2025-2026]**

## PG Regulations 2023

**Approved by BOS and Academic Council meetings**

ME-ISE I

**Sona College of Technology, Salem**
**(An Autonomous Institution)**
**Courses of Study for M.E/M.Tech. Semester I under Regulations 2023 (CBCS)**
**Branch: Industrial Safety Engineering**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Theory courses** | | | | | | | | | |
| 1 | P23ISE101 | Principles of Safety Management | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 2 | P23ISE102 | Occupational Health and Industrial Hygiene | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 3 | P23ISE103 | Environmental Safety | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 4 | P23ISE502 | **Elective:** Computer Aided Hazard Analysis | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 5 | P23ISE505 | **Elective:** Quality Engineering in Production Systems | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 6 | P23GE101 | Research Methodology and IPR | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 7 | P23GE701 | **Audit Course:** English for Research Paper writing | 2 | 0 | 0 | 0 | 0 | AC | 30 | T |
| | **Practical courses** | | | | | | | | | |
| 8 | P23ISE104 | Industrial Safety Laboratory | 0 | 0 | 4 | 0 | 2 | PC | 60 | L |
| 9 | P23ISE105 | Safety Audit | 0 | 0 | 0 | 2 | 1 | PC | 30 | P |
| | | | | | | **Total Credits** | 21 | | | |

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory,TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project

**Approved By**

| | | | |
|---|---|---|---|
| **Chairperson, Mechanical Engineering BoS** | **Member Secretary, Academic Council** | **Dean-Academics** | **Chairperson, Academic Council & Principal** |
| **Dr. D. Senthilkumar** | **Dr.R.Shivakumar** | **Dr.J.Akilandeswari** | **Dr.S.R.R.Senthil Kumar** |

Copy to:-
HOD/ Mechanical Engineering, First Semester M.E. ISE Students and Staff, COE

**Sona College of Technology, Salem**
**(An Autonomous Institution)**
**Courses of Study for M.E/M.Tech. Semester II under Regulations 2023 (CBCS)**
**Branch: Industrial Safety Engineering**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Theory courses** | | | | | | | | | |
| 1 | P23ISE201 | Industrial Safety, Health and Environment Acts | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 2 | P23ISE202 | Fire Engineering and Explosion Control | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 3 | P23ISE203 | Electrical Safety | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 4 | P23ISE204 | Safety in Process Industries | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 5 | P23ISE508 | **Elective:** Transport Safety | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 6 | P23ISE521 | **Elective:** Indoor Air Quality | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 7 | P23GE702 | **Audit course:** Stress Management by Yoga | 2 | 0 | 0 | 0 | 0 | AC | 30 | T |
| | **Practical courses** | | | | | | | | | |
| 8 | P23ISE205 | Mini Project -Hazard Assessment in Industry | 0 | 0 | 0 | 4 | 2 | PC | 60 | P |
| | | **Total Credits** | | | | | 20 | | | |

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**Approved By**

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|---|---|---|---|
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ME-ISE I

**Sona College of Technology, Salem**
**(An Autonomous Institution)**
**Courses of Study for M.E/M.Tech. Semester I under Regulations 2023 (CBCS)**
**Branch: Industrial Safety Engineering**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Theory courses** | | | | | | | | | |
| 1 | P23ISE101 | Principles of Safety Management | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 2 | P23ISE102 | Occupational Health and Industrial Hygiene | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 3 | P23ISE103 | Environmental Safety | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 4 | P23ISE502 | **Elective:** Computer Aided Hazard Analysis | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 5 | P23ISE505 | **Elective:** Quality Engineering in Production Systems | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 6 | P23GE101 | Research Methodology and IPR | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 7 | P23GE701 | **Audit Course:** English for Research Paper writing | 2 | 0 | 0 | 0 | 0 | AC | 30 | T |
| | **Practical courses** | | | | | | | | | |
| 8 | P23ISE104 | Industrial Safety Laboratory | 0 | 0 | 4 | 0 | 2 | PC | 60 | L |
| 9 | P23ISE105 | Safety Audit | 0 | 0 | 0 | 2 | 1 | PC | 30 | P |
| | | | | | | **Total Credits** | 21 | | | |

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory,TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project

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HOD/ Mechanical Engineering, First Semester M.E. ISE Students and Staff, COE

| P23ISE101 | PRINCIPLES OF SAFETY MANAGEMENT | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| **CO1:** | Identify the functions and activities of safety engineering department. |
| **CO2:** | Carry out a safety audit and prepare a report for the audit. |
| **CO3:** | Prepare an accident investigation report. |
| **CO4:** | Estimate the accident cost using supervisors report and data., |
| **CO5:** | Evaluate the safety performance of an organization from accident records |

**CO/PO, PSO Mapping**

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 1 | 2 | - | - |
| CO2 | 1 | 2 | 3 | - | - |
| CO3 | - | 3 | - | 1 | - |
| CO4 | - | 2 | - | 2 | - |
| CO5 | 1 | 2 | - | 1 | - |

| Course Assessment methods | | |
|---|---|---|
| Direct | | Indirect |
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

**Unit 01: CONCEPTS AND TECHNIQUES** — **9 Hours**

History of Safety movement –Evolution of modern safety concept- general concepts of management– planning for safety for optimization of productivity -productivity, quality and safety-line and staff functions for safety-budgeting for safety-safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety.

| Unit 02: | SAFETY AUDIT | 9 Hours |
|---|---|---|
| Components of safety audit, types of audit, audit methodology, non-conformity reporting (NCR), audit checklist and report – review of inspection, remarks by government agencies, consultants, experts – perusal of accident and safety records, formats – implementation of audit indication - liaison with departments to ensure co-ordination – check list – identification of unsafe acts of workers and unsafe conditions in the shop floor. | | |
| **Unit 03:** | **ACCIDENT INVESTIGATION AND REPORTING** | **9 Hours** |
| Concept of an accident, reportable and non-reportable accidents, reporting to statutory authorities – principles of accident prevention – accident investigation and analysis – records for accidents, departmental accident reports, documentation of accidents – unsafe act and condition – domino sequence – supervisory role – role of safety committee –cost of accident. | | |
| **Unit 04:** | **SAFETY PERFORMANCE MONITORING** | **9 Hours** |
| ANSI (Z16.1) 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 05:** | **SAFETY EDUCATION AND TRAINING** | **9 Hours** |
| Importance of training-identification of training needs-training methods – programmes, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training. | | |

| Theory: 45 Hrs | Tutorial: | Practical: | Project: | Total Hours: 45 Hrs |
|---|---|---|---|---|

**REFERENCES**


| | |
|---|---|
| 1. | "Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 13th Edition 2009. |
| 2. | Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey,. 3rd Edition 2000. |
| 3. | Dan Petersen, "Techniques of Safety Management", McGraw-Hill Company, Tokyo, 1981. |
| 4. | Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York. 1980 |
| 5. | John Ridley, "Safety at Work", Butterworth and Co., London, 1983 |
| 6. | Lees, F.P., Loss Prevention in Process Industries" Butterworth publications, London, 2nd edition, 1990. |
| 7. | Relevant Indian Standards and Specifications, BIS, New Delhi. |
| 8. | "Safety and Good House Keeping", N.P.C., New Delhi, 1985. |


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| P23ISE102 | OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| **CO1:** | Identify the various physiological functions of our body and the test methods for periodical monitoring of health. |
| **CO2:** | Recognize the functions and activities of Occupational health services. |
| **CO3:** | Classify various types of hazards arising out of physical, chemical and biological agents in a process. |
| **CO4:** | Identify notifiable occupational diseases arising out of Occupation and suggest methods for the prevention of such diseases |
| **CO5:** | Analyze the various physiological functions of our body and the test methods for periodical monitoring of health. |

**CO/PO, PSO Mapping**

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 1 | 2 | 2 | 1 |
| CO2 | - | - | 3 | - | 2 |
| CO3 | - | - | - | - | - |
| CO4 | - | - | - | 2 | 2 |
| CO5 | 1 | 1 | 2 | - | 2 |

| Course Assessment methods | | |
|---|---|---|
| Direct | | Indirect |
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

| Unit 01 | PHYSICAL HAZARDS | 9 Hours |
|---|---|---|

Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometry, hearing conservation programs- vibration, types, effects, instruments, surveying procedure, permissible exposure limit.

Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard- non- ionizing radiations, effects, types, radar hazards, microwaves and radio-waves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control

| Unit 02 | CHEMICAL HAZARDS | 9 Hours |
|---|---|---|

Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard.

Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling

Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education

| Unit 03: | BIOLOGICAL AND ERGONOMICAL HAZARDS | 9 Hours |
|---|---|---|

Classification of Biohazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases – Covid SARS - Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design.

Work Related Musculoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of the neck-back injuries

| Unit 04: | OCCUPATIONAL HEALTH AND TOXICOLOGY | 9 Hours |
|---|---|---|

Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests

Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems.

| Unit 05: | OCCUPATIONAL PHYSIOLOGY | 9 Hours |
|---|---|---|

Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness – work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene.

| Theory: 45 Hrs | Tutorial: | Practical: | Project: | Total Hours: 45 Hrs |
|---|---|---|---|---|
| | | | | |

| REFERENCES | |
|---|---|
| 1. | Benjamin O.Alli, Fundamental Principles of Occupational Health and Safety ILO 2008. |
| 2. | Danuta Koradecka, Handbook of Occupational Health and Safety, CRC, 2010. |
| 3. | E.J. McCormick, and M. S Sanders, "Human Factors in Engineering and Design," Tata McGraw-Hill, 1992. |
| 4. | Encyclopedia of "Occupational Health and Safety", Vol.I and II, published by International Labour Office, Geneva, 1985 |
| 5. | Handbook of "Occupational Safety and Health", National Safety Council, Chicago, 2002. |
| 6. | Lawrence Slote, "Handbook of occupational safety and health", Wiley, 2001. |
| 7. | Louis J. Di Berardinis," Handbook of occupational safety and health " Wiley, 1999. |
| 8. | Interim guidance "COVID-19: Occupational health and safety for health workers", WHO & ILO,2021 |

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| P23ISE103 | ENVIRONMENTAL SAFETY | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

| Course Outcomes | |
|---|---|
| At the end of the course, the student will be able to | |
| CO1: | Illustrate and familiarize the basic concepts scope of environmental safety. |
| CO2: | Identify the standards of professional conduct that are published by professional safety organizations and/or certification bodies. |
| CO3: | Explain the ways in which environmental health problems have arisen due to air and water pollution. |
| CO4: | Illustrate the role of hazardous waste management and use of critical thinking to identify and assess environmental health risks. |
| CO5: | Discuss concepts of measurement of emissions and design emission measurement devices. |

| CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | |
|---|---|---|---|---|---|
| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | - | 2 | - | 1 |
| CO2 | 2 | - | 3 | - | - |
| CO3 | 1 | - | - | 1 | 1 |
| CO4 | 2 | - | 1 | - | 2 |
| CO5 | - | 1 | - | 3 | |

| Course Assessment methods | | |
|---|---|---|
| Direct | | Indirect |
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

| Unit 01 | AIR POLLUTION | 9 Hours |
|---|---|---|
| Classification and properties of air pollutants – Pollution sources – Effects of air pollutants on human beings, Animals, Plants and Materials - automobile pollution-hazards of air pollution-concept of clean coal combustion technology - ultraviolet radiation, infrared radiation, radiation from sun-hazards due to depletion of ozone - deforestation-ozone holes-automobile exhausts-chemical factory stack emissions-CFC. | | |
| **Unit 02** | **WATER POLLUTION** | **9 Hours** |
| Classification of water pollutants-health hazards-sampling and analysis of water-water treatment - different industrial effluents and their treatment and disposal -advanced wastewater treatment - effluent quality standards and laws- chemical industries, tannery, textile effluents-common treatment | | |
| **Unit 03:** | **HAZARDOUS WASTE MANAGEMENT** | **9 Hours** |
| Hazardous waste management in India-waste identification, characterization and classification-technological options for collection, treatment and disposal of hazardous waste-selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic and radioactive wastes-incineration and verification - hazards due to bio-process- dilution-standards and restrictions – recycling and reuse. | | |
| **Unit 04:** | **ENVIRONMENTAL MEASUREMENT AND CONTROL** | **9 Hours** |
| Sampling and analysis – dust monitor – gas analyzer, particle size analyzer – lux meter-pH meter – gas chromatograph – atomic absorption spectrometer.<br>Gravitational settling chambers-cyclone separators-scrubbers-electrostatic precipitator - bag filter – maintenance - control of gaseous emission by adsorption, absorption and combustion methods- Pollution Control Board-laws. | | |
| **Unit 05:** | **POLLUTION CONTROL IN PROCESS INDUSTRIES** | **9 Hours** |
| Pollution control in process industries - cement, paper, petroleum-petroleum products-textile- tanneries-thermal power plants – dying and pigment industries - eco-friendly energy. | | |

| Theory: 45 Hrs | Tutorial: | Practical: | Project | Total Hours: 45 Hrs |
|---|---|---|---|---|

**REFERENCES**


| | |
|---|---|
| 1. | E. C Wolfe, Race to Save to Save Planet, Wadsworth Publishing Co., Belmont, CA 2006. |
| 2. | G. T Miller, Environmental Science: Working with the Earth, 11th Edition, Wadsworth Publishing Co., Belmont, CA, 2006 |
| 3. | M.J Hammer, and M.J Hammer,., Jr., Water and Wastewater Technology, Pearson Prentice Hall, 2006 |
| 4. | Rao, CS, "Environmental pollution engineering, Wiley Eastern Limited, New Delhi, 1st January 2018. |
| 5. | S. P. Mahajan, "Pollution control in process industries", Tata McGraw Hill Publishing Company, New Delhi, 2006. |
| 6. | Varma and Braner, "Air pollution equipment", Springer Publishers, Second Edition. |




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| P23ISE502 | COMPUTER AIDED HAZARD ANALYSIS | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

| Course Outcomes | |
|---|---|
| At the end of the course, the student will be able to | |
| CO1: | Explain the basic concepts in risk and hazard |
| CO2: | Identify the various instruments to bring safety in Industries |
| CO3: | Provide solution for risk assessment studies using software |
| CO4: | Quantify the risk by applying risk assessment technique. |
| CO5: | Employ hazard analysis techniques in Industry and helpful to prevent the accidents in Industry |

| CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | |
|---|---|---|---|---|---|
| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | - | 3 | 1 | - | - |
| CO2 | 1 | - | - | 2 | - |
| CO3 | 1 | - | 1 | 3 | 1 |
| CO4 | - | 1 | - | 2 | 3 |
| CO5 | - | 1 | 2 | 2 | - |

| Course Assessment methods | | |
|---|---|---|
| Direct | | Indirect |
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving /Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

| Unit 01 | HAZARD, RISK ISSUES AND HAZARD ASSESSMENT | 9 Hours |
|---|---|---|
| Introduction, hazard, hazard monitoring-risk issue, group or societal risk, individual risk, voluntary and involuntary risk, social benefits Vs technological risk, approaches for establishing risk acceptance levels, Risk estimation. Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis (PHA), human error analysis, hazard operability studies (HAZOP), safety warning systems. | | |

| Unit 02 | COMPUTER AIDED INSTRUMENTS | 9 Hours |
|---|---|---|
| Applications of Advanced Equipment and Instruments, Thermo Calorimetry, Differential Scanning Calorimeter (DSC), Thermo Gravimetric Analyser(TGA), Accelerated Rate Calorimeter(ARC), Reactive Calorimeter(RC), Reaction System Screening Tool(RSST) - Principles of operations, Controlling parameters, Applications, advantages.<br>Explosive Testing, Deflagration Test, Detonation Test, Ignition Test, Minimum ignition energy Test, Sensitiveness Test, Impact Sensitiveness Test(BAM) and Friction Sensitiveness Test (BAM), Shock Sensitiveness Test, Card Gap Test. | | |
| **Unit 03:** | **RISK ANALYSIS QUANTIFICATION AND SOFTWARES** | **9 Hours** |
| Introduction to Discrete and Continuous Systems Simulation- Fault Tree Analysis and Event Tree Analysis, Logic symbols, methodology, minimal cut set ranking - fire explosion and toxicity index (FETI), various indices - Hazard analysis(HAZAN)- Failure Mode and Effect Analysis(FMEA)- Basic concepts of Reliability- Software on Risk analysis, CISCON, FETI, HAMGARS modules on Heat radiation, Pool fire, Jet, Explosion. Reliability software on FMEA for mechanical and electrical systems. | | |
| **Unit 04:** | **CONSEQUENCES ANALYSIS** | **9 Hours** |
| Logics of consequences analysis- Estimation- Hazard identification based on the properties of chemicals- Chemical inventory analysis- identification of hazardous processes- Estimation of source term, Gas or vapour release, liquid release, two phase release- Heat radiation effects, BLEVE, Pool fires and Jet fire- Gas/vapour dispersion- Explosion, UVCE and Flash fire, Explosion effects and confined explosion- Toxic effects- Plotting the damage distances on plot plant/layout. | | |
| **Unit 05:** | **CREDIBILITY OF RISK ASSESSMENT TECHNIQUES** | **9 Hours** |
| Past accident analysis as information sources for Hazard analysis and consequences analysis of chemical accident, Mexico disaster, Flixborough, Bhopal, Seveso, Pasadena, Feyzin disaster(1966), Port Hudson disaster- convey report, hazard assessment of non-nuclear installation- Rijnmond report, risk analysis of size potentially Hazardous Industrial objects- Rasmussen masses report, Reactor safety study of Nuclear power plant | | |

| Theory: 45 Hrs | Tutorial: | Practical: | Project: | Total Hours: 45 Hrs |
|---|---|---|---|---|

**REFERENCES**


| | |
|---|---|
| 1 | Brown, D.B. System analysis and Design for safety, Prentice Hall, 1976. |
| 2 | Course Material Intensive Training Programme on Consequence Analysis, by Process Safety Centre, Indian Institute of Chemical Technology, Tarnaka and CLRI, Chennai. |
| 3 | Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process safety, AICHE 1992 |
| 4 | Hazop and Hazom, by Trevor A Klett, Institute of Chemical Engineering, |
| 5 | ILO- Major Hazard control- A practical Manual, ILO, Geneva, 1988. |
| 6 | Loss Prevention in Process Industries-Frank P. Less Butterworth-Hein UK 1990 (Vol.I, II and III) |
| 7. | Methodologies for Risk and Safety Assessment in Chemical Process Industries, Common wealth Science Council, UK |
| 8. | Quantitative Risk assessment in Chemical Industries, Institute of Chemical Industries, Centre for Chemical process safety. |




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| P23ISE505 | QUALITY ENGINEERING IN PRODUCTION SYSTEMS | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| **CO1:** | Identify the loss function derivation and quality engineering in product design and development processes. |
| **CO2:** | Develop online quality control systems and process control parameters. |
| **CO3:** | Improve the production and process diagnosis and production process. |
| **CO4:** | Asses the ISO quality management systems. |
| **CO5:** | List the roles and responsibilities of leaders. |

**CO/PO, PSO Mapping**

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | - | 2 | 1 | - |
| CO2 | 2 | - | 3 | - | 3 |
| CO3 | 1 | 3 | - | - | - |
| CO4 | - | 2 | - | - | 1 |
| CO5 | - | - | - | 2 | - |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

| Unit 01 | INTRODUCTION TO QUALITY ENGINEERING AND LOSS FUNCTION | 9 Hours |
|---|---|---|
| Quality value and engineering- overall quality system-quality engineering in product design - quality engineering in design of production processes - quality engineering in production - quality engineering in service. Loss function Derivation – use-loss function for products/system- justification of improvements-loss function and inspection- quality evaluations and tolerances-N type, S type. L type. | | |
| **Unit 02** | **ON-LINE QUALITY CONTROL** | **9 Hours** |
| On-line feedback quality control variable characteristics-control with measurement interval- one unit, multiple units-control systems for lot and batch production. On-line process parameter control variable characteristics- process parameter tolerances- feedback control systems-measurement error and process control parameters. | | |
| **Unit 03:** | **ON-LINE QUALITY CONTROL ATTRIBUTES AND METHODS FOR PROCESS IMPROVEMENTS** | **9 Hours** |
| Checking intervals- frequency of process diagnosis. Production process improvement method- process diagnosis improvement method- process adjustment and recovery improvement methods. | | |
| **Unit 04:** | **QUALITY ENGINEERING AND TPM** | **9 Hours** |
| Preventive maintenance schedules- PM schedules for functional characteristics- PM schedules for large scale systems. Quality tools-fault tree analysis, event tree analysis, failure mode and effect analysis. ISO quality systems. | | |
| **Unit 05:** | **SIX SIGMA AND ITS IMPLEMENTATION** | **9 Hours** |
| Introduction- definition-methodology- impact of implementation of six sigma-DMAIC method-roles and responsibilities –leaders, champion, black belt, green belts. Do's and dont's - readiness of organization – planning-management role- six sigma tools – sustaining six sigma. | | |

| Theory: 45 Hrs | Tutorial: | Practical: | Project: | Total Hours: 45 Hrs |
|---|---|---|---|---|

**REFERENCES**


| | |
|---|---|
| 1. | Brue G, "Six Sigma for Managers", Tata-McGraw Hill, New Delhi, Second reprint, 2002. |
| 2. | De Feo J A and Barnard W W, "Six Sigma: Breaktrough and Beyond", Tata McGraw-Hill, New Delhi, 2005. |
| 3. | Pyzdek T and Berger R W,"Quality Engineering Handbook", Tata-McGraw Hill, New Delhi, 1996 |
| 4. | Taguchi G, Elsayed E A and Hsiang, T.C.,"Quality Engineering in Production Systems", Mc-Graw- Hill Book company, Singapore, International Edition, 1989 |




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| P23ISE104 | INDUSTRIAL SAFETY LABORATORY | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 0 | 2 |

| Course Outcomes | |
|---|---|
| At the end of the course, the student will be able to | |
| CO1: | Conduct experiments to find out various environmental parameters to bring out the safety environment in the industry. |
| CO2: | Measure the particulate matter and assess the impact of air pollution. |
| CO3: | Identify appropriate personal protective equipment in-dependently for specific requirement |

**CO/PO, PSO Mapping**

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 2 | | - | 1 |
| CO2 | - | 1 | 3 | 2 | - |
| CO3 | 1 | - | 1 | 3 | 2 |

| Course Assessment methods | | |
|---|---|---|
| Direct | | Indirect |
| CIE test I (20)<br>Quiz 1 (5)<br>CIE test II (20)<br>Quiz 2 (5) | RTPS (10)<br>Total CIE: 60 marks<br>Semester End Examination: 40 marks | Course end survey |

**LIST OF EXPERIMENTS**

**NOISE LEVEL MEASUREMENT AND ANALYSIS**

Measurement of sound pressure level in dB for Impact, continuous and intermittent sources at various networks, peak and average values.

1. **FRICTION TEST**

Explosive materials like barium nitrate, gun powder, white powder, amerces composition etc.

2. **IMPACT AND BURSTING STRENGTH TEST**

Explosive materials like gun powder, white powder, amerces composition etc. Burst strength test of packaging materials like paper bags, corrugated cartoons, wood etc. Auto ignition temperature test.

3. **EXHAUST GAS MEASUREMENT AND ANALYSIS**

Measurement of Sox, Nox, Cox, hydrocarbons.

4. **ENVIRONMENTAL PARAMETER MEASUREMENT**

Dry Bulb Temperature, Wet Bulb Temperature, Determination of relative humidity, wind flow and effective corrective effective. Particle size Measurement. Air sampling analysis

5. **TRAINING IN USAGE AND SKILL DEVELOPMENT Personal protective equipment:**

Respiratory and non-respiratory-demonstration-self-contained breathing apparatus. Safety helmet, belt, hand gloves, goggles, safety shoe, gum boots, ankle shoes, face shield, nose mask, ear plug, ear muff, anti static and conducting plastics/rubber materials, apron and leg guard.

6. **Fire extinguishers and its operations**

Water, Co2, Foam, Carbon dioxide (Co2), Dry chemical powder

7. **Static charge testing** on plastic, rubber, ferrous and non-ferrous materials.

8. **Illumination testing** - by lux meter and photo meter.

9. **Electrical safety**

Insulation resistance for motors and cabels Estimation of earth resistance

Earth continuity test Sensitivity test for ELCB

10. **Software Usage**

Accident Analysis Safety Audit Packages

Consequence Analysis (CISCON)

Fire, Explosion and Toxicity Index (FETI) Failure Mode Analysis

11. **First-Aid-** Study of Emergency Kits ,First – Aid, and Road safety signals and symbols

List of Equipment

1. Noise level meter : 1 No
2. Friction tester : 1 No
3. Bursting Strength Tester : 1 No
4. Exhaust gas analyszer: 1 No
5. High volume sampler : 1 No
6. PPE Set : 1 No
7. Fire extinguisher set : 1 No
8. Static charge tester : 1 No
9. First aid kid : 1 No
10. Software : CISION, FETI and Failure Mode analysis

| Theory: | Tutorial: | Practical: 60 Hrs | Project: | Total Hours: 60 Hrs |
|---|---|---|---|---|

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| P23ISE105 | SAFETY AUDIT | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 2 | 1 |

| Course Outcomes | |
|---|---|
| **At the end of the course, the student will be able to** | |
| **CO1:** | Minimize the Labour turnover by existence of Safety Measures of an Employee. |
| **CO2:** | Promote the Fatigue Study it will lead to good production. |
| **CO3:** | Implement the Human Resource Management Practices |

**CO/PO, PSO Mapping**

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | - | 3 | 1 | 2 | - |
| CO2 | 1 | 2 | 2 | | 1 |
| CO3 | - | - | 1 | 3 | 2 |

| Course Assessment methods | | |
|---|---|---|
| **Direct** | | **Indirect** |
| Review I (5)<br>Review II (10)<br>Review III (15)<br>Final Audit Report (10) | Total: 40 marks<br>Semester End Examination: 60 marks<br>SEE- Project Viva -voce | Course end survey |

**DESCRIPTION OF THE COURSE**

- The students are expected to make a presentation on the state of Safety Audit from the observation from the Industry Safety Department.

•A faculty guide/coordinator is to be allotted and the student will visit the industry to aware about the Importance of the Safety.

- Three reviews will be conducted by review committee.
- Students should submit an Audit report as per format during final viva and give a presentation.

•Students are encouraged to prepare the Safety System Guidelines from their observation period of Inspection from the Industry Safety Department and contribute the same to the Environment Contribution.

•The students are advised to go through the below mentioned following heads of safety Measures to be audit and inspect at the time of visit. Depending on the requirements of the organizations, the audit can focus attention on the following aspects of a safety system and make sure that your level of expertise in the safety system.

Every safety audit as per 'The Code of Practice' on Occupational Safety & Health 'Indian Standard – 14489:2018, ISO 45001:2018, EMS- ISO 14001:2015, NBC:2016 and other national and international standard applicable to each particular industry.

- Safety Management systems.
- Fire and Explosion prevention, protection and emergency management.
- Work injury prevention.
- Health hazards control.
- Evaluating emergency plan.
- First aid practices
- Management of health and safety
- Accidents and accident reporting
- Asbestos
- Contractors
- Display screen equipment
- Electrical safety

- Emergency lighting
- Environmental protection
- Fire prevention and emergencies
- Hazardous substances
- Housekeeping and cleanliness
- Information and communication
- Kitchens, catering and food safety
- Lifts and lifting equipment
- Manual handling operations
- Noise
- Occupational health
- Personal protective equipment
- Plant rooms, machinery and equipment
- Risk assessment requirements
- Safety Policy
- Safety signs and notices
- Training
- Use of vehicles / vehicle safety
- Water services
- Welfare provision
- Working time
- Work at heights
- Workplace environment
- Accident prevention
- Identifying and correcting Regulatory Deficiencies
- Improvement of Employee Morale
- Identification and Elimination of Safety Hazards

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| Theory: | Tutorial: | Practical: | Project: 30 Hrs | Total Hours: 30 Hrs |
|---|---|---|---|---|

P23GE101 **RESEARCH METHODOLOGY AND IPR** 3 0 0 0 3

**(Common to all M.E /M.Tech Programmes)**

**COURSE OUTCOMES:**

At the end of the course, the student will be able to

1. Review the literature of the research problem
2. Choose appropriate data collection and sampling method according to the research problem.
3. Interpret the results of research and communicate effectively with their peers
4. Explain the Importance of intellectual property rights
5. Evaluate trade mark, develop and register patents.

| CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak COs Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | | |
|---|---|---|---|---|---|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 3 |
| CO3 | 2 | 3 | 3 | 3 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| CIE test I (10) (Theory)<br>CIE test II (10) (Theory)<br>CIE test III (10) (Theory) | Assignment / Problem –Solving /Seminar (10)<br>Total CIE: **40 Marks**<br>Semester End Examination : **60 Marks** | Course end survey |

**UNIT I INTRODUCTION TO RESEARCH METHODS** 9

Definition and Objective of Research, Various steps in Scientific Research, Types of Research, Criteria for Good Research, Defining Research Problem, Research Design , Case Study Collection of Primary and Secondary Data, Collection Methods: Observation, Interview, Questionnaires, Schedules,

**UNIT II SAMPLING DESIGN AND HYPOTHESIS TESTING** 9

steps in Sampling Design, Types of Sample Designs, Measurements and Scaling Techniques -Testing of hypotheses concerning means (one mean and difference between two means -one tailed and two tailed tests), concerning variance — one tailed Chi-square test.

**UNIT II INTERPRETATION AND REPORT WRITING** 9

Techniques of Interpretation, Precaution in Interpretation, Layout of Research Report, Types of Reports, Oral Presentation, Mechanics of Writing Research Report

**UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY** 9

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights, Innovations and Inventions trade related intellectual property rights.



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**UNIT V TRADE MARKS, COPY RIGHTS AND PATENTS 9**

Purpose and function of trade marks, acquisition of trade mark rights, trade mark registration processes, trademark claims —trademark Litigations- International trademark law Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

**Lecture: 45, Tutorial: 0, Total: 45 Hours**

**TEXT BOOKS**


1. C.R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques An Edition, New Age International Publishers, 2019.
2. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", Delmar Cengage Learning, 4" Edition, 2012.
3. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", Tata Mc Graw Hill Education, 1" Edition, 2008.


**REFERENCE BOOKS**


1. Panneerselvam, R., Research Methodology, Second Edition, Prentice-Hall of India, New Delhi, 2013.
2. Ranjith Kumar, Research Methodology — A step by step Guide for Begineers, 4" edition, Sage publisher, 2014.
3. D Llewelyn & T Aplin W Cornish, "Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights", Sweet and Maxwell, 1" Edition, 2016.
4. Ananth Padmanabhan, "Intellectual Property Rights-Infringement and Remedies", Lexis Nexis, 1" Edition, 2012.
5. Ramakrishna B and Anil Kumar H.S, "Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers", Notion Press, 1" Edition, 2017.
6. M.Ashok Kumar and Mohd. Iqbal Ali :"Intellectual Property Rights" Serials Pub


S. Padma 4.8.23

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| P23GE701 | English for Research Paper Writing | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 | 0 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| CO1: | Demonstrate research writing skills both for research articles and thesis |
| CO2: | Frame suitable title and captions as sub-headings for articles and thesis |
| CO3: | Write each section in a research paper and thesis coherently |
| CO4: | Use language appropriately and proficiently for effective written communication |
| CO5: | Exhibit professional proof-reading skills to make the writing error free |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| CIE test I (30)<br>CIE test II (30)<br>CIE test III (40) | Total CIE: 100 marks<br>Semester End Examination: NIL | Course end survey |

| **Unit 01:** | **6 Hours** |
|---|---|
| Planning and preparation, word order, breaking up long sentences, organising ideas into paragraphs and sentences, being concise and avoiding redundancy, ambiguity and vagueness | |
| **Unit 02:** | **6 Hours** |
| Interpreting research findings, understanding and avoiding plagiarism, paraphrasing sections of a paper/ abstract. | |
| **Unit 03:** | **6 Hours** |
| Key skills to frame a title, to draft an abstract, to give an introduction | |
| **Unit 04:** | **6 Hours** |
| Skills required to organise review of literature, methods, results, discussion and conclusions | |
| **Unit 05:** | **6 Hours** |
| Usage of appropriate phrases and key terms to make the writing effective - proof-reading to ensure error-free writing | |

| Theory: 30 Hrs | Tutorial: -- | Practical: -- | Project:-- | Total Hours: 30 Hrs |
|---|---|---|---|---|

**TEXT BOOKS**

| | |
|---|---|
| 1. | Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011 |
| 2. | Highman N , Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book, 1998 |
| 3. | Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006. |
| 4. | Goldbort R, Writing for Science, Yale University Press, 2006. (available on Google Books) |

REFERENCES

| | |
|---|---|
| 1 | Martin Cutts, Oxford Guide to Plain English, Oxford University Press, Second Edition, 2006 |

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**Sona College of Technology, Salem**
**(An Autonomous Institution)**
**Courses of Study for M.E/M.Tech. Semester II under Regulations 2023 (CBCS)**
**Branch: Industrial Safety Engineering**

| S.No | Course Code | Course Title | L | T | P | J | C | Category | Total Contact Hours | Course Type* |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Theory courses** | | | | | | | | | |
| 1 | P23ISE201 | Industrial Safety, Health and Environment Acts | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 2 | P23ISE202 | Fire Engineering and Explosion Control | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 3 | P23ISE203 | Electrical Safety | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 4 | P23ISE204 | Safety in Process Industries | 3 | 0 | 0 | 0 | 3 | PC | 45 | T |
| 5 | P23ISE508 | **Elective:** Transport Safety | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 6 | P23ISE521 | **Elective:** Indoor Air Quality | 3 | 0 | 0 | 0 | 3 | PE | 45 | T |
| 7 | P23GE702 | **Audit course:** Stress Management by Yoga | 2 | 0 | 0 | 0 | 0 | AC | 30 | T |
| | **Practical courses** | | | | | | | | | |
| 8 | P23ISE205 | Mini Project -Hazard Assessment in Industry | 0 | 0 | 0 | 4 | 2 | PC | 60 | P |
| | | | | | | **Total Credits** | 20 | | | |

*T- Theory, TT- Theory with Tutorial, TL- Theory with Laboratory, TP- Theory with Project, TLP- Theory with Laboratory and Project, L-Laboratory, LT- Laboratory with Theory, LP- Laboratory with Project, P- Project

**Approved By**

| | | | |
|---|---|---|---|
| **Chairperson, Mechanical Engineering BoS** | **Member Secretary, Academic Council** | **Dean-Academics** | **Chairperson, Academic Council & Principal** |
| **Dr. D. Senthilkumar** | **Dr.R.Shivakumar** | **Dr.J.Akilandeswari** | **Dr.S.R.R.Senthil Kumar** |

Copy to:-
HOD/ Mechanical Engineering, Second Semester M.E. ISE Students and Staff, COE

| P23ISE201 | INDUSTRIAL SAFETY, HEALTH AND ENVIRONMENT ACTS | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| **CO1:** | List out requirements mentioned in factories act for the prevention of accidents. |
| **CO2:** | Discuss the norms for the environmental pollution. |
| **CO3:** | Develop the safety data sheet for hazardous and toxic chemicals. |
| **CO4:** | Suggest the statutory requirements for an Industry on registration, license and its renewal. |
| **CO5:** | Identify the International Acts and Standards. |

**CO/PO, PSO Mapping**
(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 2 | 2 | | - |
| CO2 | - | 1 | - | 3 | - |
| CO3 | 1 | | - | | - |
| CO4 | - | | - | | 2 |
| CO5 | - | | - | | - |

| Course Assessment methods | | |
|---|---|---|
| Direct | | Indirect |
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

| Unit 01: | FACTORIES ACT – 1948 | 9 Hours |
|---|---|---|
| Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948. Forms, Registers and notices – Tamilnadu Safety Officer Rules 2005- with updated Amendments. | | |
| **Unit 02:** | **ENVIRONMENT ACT – 1986** | **9 Hours** |
| General powers of the central government, prevention, control and abatement of environmental pollution-Biomedical waste (Management and handling Rules, 1989-The noise pollution (Regulation and control) Rules, 2000-The Batteries (Management and Handling Rules) 2001- No Objection certificate from statutory authorities like pollution control board.<br>Air Act 1981 and Water Act 1974: Central and state boards for the prevention and control of air pollution-powers and functions of boards – prevention and control of air pollution and water pollution – fund – accounts and audit, penalties and procedures | | |
| **Unit 03:** | **MANUFACTURE, STORAGE AND IMPORT OF HAZARDOUS CHEMICAL RULES 1989** | **9 Hours** |
| Definitions – duties of authorities – responsibilities of occupier – notification of major accidents – information to be furnished – preparation of offsite and onsite plans – list of hazardous and toxic chemicals – safety reports – safety data sheets. Major Accident Hazard Control Rules. Hazardous Wastes (management, handling and Transboundary Movement) Rules 2016. | | |
| **Unit 04:** | **OTHER ACTS AND RULES** | **9 Hours** |
| Indian Boiler (Amendments) Act 2007, static and mobile pressure vessel rules (SMPV), motor vehicle rules, The Mines and Minerals (Development & Regulation) Amendment Act, 2015, workman compensation act, rules – electricity act and rules – hazardous wastes (management, handling and transboundary) rules, 2008 - the building and other construction workers act 1996., Petroleum rules, Gas cylinder rules 2016, Explosives Act 1884 - Pesticides Act – E waste (management) rules 2016. | | |
| **Unit 05:** | **INTERNATIONAL ACTS AND STANDARDS** | **9 Hours** |
| Occupational Safety and Health act of USA (The Williames - Steiger Act of 1970) – Health and safety work act (HASAWA 1974, UK) – ISO 14001 – ISO 45001 , European Safety and Health Legislations, American Petroleum Institute (API) Standards, Oil Industry Safety Directorate (OISD) Standards, National Fire Protection Association (NFPA) Standards, Atomic Energy Regulatory Board (AERB), American National Standards Institute(ANSI). | | |

| Theory: 45 Hrs | Tutorial: - | Practical:- | Project:- | Total Hours: 45 Hrs |
|---|---|---|---|---|

**REFERENCES**


| | |
|---|---|
| 1. | The Factories Act 1948, Madras Book Agency, Chennai, 2000 |
| 2. | The Environment Act (Protection) 1986, Commercial Law Publishers (India) Pvt.Ltd., New Delhi. |

| | |
|---|---|
| 3. | Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt.Ltd.,New Delhi. |
| 4. | Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt.Ltd., New Delhi. |
| 5. | The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad. |
| 6. | The Mines Act 1952, Commercial Law Publishers (India) Pvt.Ltd., Allahabad. |
| 7. | The manufacture, storage and import of hazardous chemical rules 1989, Madras Book Agency, Chennai. |
| 8. | Srinivasan S , "The Tamil Nadu Safety Officers Rules 2005" Madras Book Agency, Chennai, 28th Edition, 2017 |


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| P23ISE202 | FIRE ENGINEERING AND EXPLOSION CONTROL | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| CO1: | Discuss about basic concepts of fire and explosion science. |
| CO2: | Implement the fire prevention techniques different source of ignition. |
| CO3: | Analyze the various industrial fire protection systems |
| CO4: | Understand the causes and prevention of explosion. |
| CO5: | Employ explosion protection techniques and their significances to suit the industrial requirement |

**CO/PO, PSO Mapping**
(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | - | 3 | - | - | |
| CO2 | - | - | 3 | - | - |
| CO3 | - | - | - | 2 | - |
| CO4 | - | - | - | - | 3 |
| CO5 | - | 3 | - | - | |

| Course Assessment methods | | |
|---|---|---|
| Direct | | Indirect |
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

| Unit 01: | PHYSICS AND CHEMISTRY OF FIRE | 9 Hours |
|---|---|---|
| Fire properties of solid, liquid and gases - fire spread - toxicity of products of combustion - theory of combustion and explosion – vapour clouds – flash fire – jet fires – pool fires – unconfined vapour cloud explosion, shock waves - auto-ignition – boiling liquid expanding vapour explosion – case studies – Flixborough, Mexico disaster, Pasedena Texas, Piper Alpha, Peterborough and Bombay Victoria dock ship explosions | | |
| **Unit 02:** | **FIRE PREVENTION AND PROTECTION** | **9 Hours** |
| Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – fire stoppers – hydrant pipes – hoses – monitors – fire watchers – lay out of stand pipes – fire station-fire alarms and sirens – maintenance of fire trucks – foam generators – escape from fire rescue operations – fire drills–notice-first aid for burns. | | |
| **Unit 03:** | **INDUSTRIAL FIRE PROTECTION SYSTEMS** | **9 Hours** |
| Sprinkler-hydrants-stand pipes – special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards – alarm and detection systems. Other suppression systems – CO2 system, foam system, dry chemical powder (DCP) system, halon system – need for halon replacement – smoke venting. Portable extinguishers – flammable liquids – tank farms – indices of inflammability-firefighting systems. | | |
| **Unit 04:** | **BUILDING FIRE SAFETY** | **9 Hours** |
| Objectives of fire safe building design, Fire load, fire resistant material and fire testing – structural fire protection – structural integrity – concept of egress design - exists – width calculations - fire certificates – fire safety requirements for high rise buildings – snookers. | | |
| **Unit 05:** | **EXPLOSION PROTECTING SYSTEMS** | **9 Hours** |
| Principles of explosion-detonation and blast waves-explosion parameters – Explosion Protection, Containment, Flame Arrestors, isolation, suppression, venting, explosion relief of large enclosure- explosion venting-inert gases, plant for generation of inert gas-rupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO2) and halons-hazards in LPG, ammonia (NH3), sulphur dioxide (SO3), chlorine (CL2) etc. | | |

| Theory: 45 Hrs | Tutorial: - | Practical:- | Project:- | Total Hours: 45 Hrs |
|---|---|---|---|---|

**REFERENCES**


| | |
|---|---|
| 1. | "Accident Prevention manual for industrial operations" N.S.C., Chicago, 1982. |
| 2. | "Davis Daniel et al, "Hand Book of fire technology" |
| 3. | "Fire Prevention and firefighting", Loss prevention Association, India. |
| 4. | Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986. |
| 5. | Dinko Tuhtar, "Fire and explosion protection" |
| 6. | Fire fighters hazardous materials reference book Fire Prevention in Factories", an Nostrand Rein Hold, New York, 1991. |
| 7. | Gupta, R.S., "Hand Book of Fire Technology" Orient Longman, Bombay 1977. |
| 8. | Relevant Indian Acts and rules, Government of India. |




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| P23ISE203 | ELECTRICAL SAFETY | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

| Course Outcomes | |
|---|---|
| **At the end of the course, the student will be able to** | |
| CO1: | Understand the basic concepts in electrical circuit and hazards involved in it. |
| CO2: | Identify the electrical hazards in Industries. |
| CO3: | Assess the operation of various protection systems from electrical hazards |
| CO4: | Familiar with selection, installation, operation and maintenance in electrical components in industries |
| CO5: | Recognize different hazardous zones in Industries |

| CO/PO, PSO Mapping<br>(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak | | | | | |
|---|---|---|---|---|---|
| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | - | 3 | - | - | |
| CO2 | - | - | 2 | - | - |
| CO3 | - | - | - | 2 | - |
| CO4 | - | - | - | - | 3 |
| CO5 | - | - | - | - | - |

| Course Assessment methods | | |
|---|---|---|
| Direct | | Indirect |
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

| Unit 01: | CONCEPTS AND STATUTORY REQUIREMENTS | 9 Hours |
|---|---|---|
| Introduction – electrostatics, electromagnetism, stored energy, energy radiation and electromagnetic interference – Working principles of electrical equipment-Indian electricity act and rules-statutory requirements from electrical inspectorate-international standards on electrical safety – first aid-cardio pulmonary resuscitation (CPR). | | |
| **Unit 02:** | **ELECTRICAL HAZARDS** | **9 Hours** |
| Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energy- current surges-Safety in handling of war equipments-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect-static electricity –definition, sources, hazardous conditions, control, electrical causes of fire and explosion-ionization, spark and arc- ignition energy-national electrical safety code ANSI. Lightning, hazards, lightning arrestor, installation – earthing, specifications, earth resistance, earth pit maintenance. | | |
| **Unit 03:** | **PROTECTION SYSTEMS** | **9 Hours** |
| Fuse, circuit breakers and overload relays – protection against over voltage and under voltage – safe limits of amperage – voltage –safe distance from lines-capacity and protection of conductor-joints-and connections, overload and short circuit protection-no load protection-earth fault protection.<br>FRLS insulation-insulation and continuity test-system grounding-equipment grounding-earth leakage circuit breaker (ELCB)-cable wires-maintenance of ground-ground fault circuit interrupter-use of low voltage-electrical guards-Personal protective equipment – safety in handling handheld electrical appliances tools and medical equipment | | |
| **Unit 04:** | **SELECTION, INSTALLATION, OPERATION AND MAINTENANCE** | **9 Hours** |
| Role of environment in selection-safety aspects in application - protection and interlock-self diagnostic features and fail-safe concepts-lock out and work permit system-discharge rod and earthing devices- safety in the use of portable tools-cabling and cable joints-preventive maintenance. | | |
| **Unit 05:** | **HAZARDOUS ZONES** | **9 Hours** |
| Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe equipment-their selection for different zones-temperature classification-grouping of gases-use of barriers and isolators-equipment certifying agencies | | |

| Theory: 45 Hrs | Tutorial: - | Practical:- | Project:- | Total Hours: 45 Hrs |
|---|---|---|---|---|

**REFERENCES**


| | |
|---|---|
| 1. | "Accident prevention manual for industrial operations", N.S.C., Chicago, 1982. |
| 2. | Indian Electricity Act and Rules, Government of India. |
| 3. | Power Engineers – Handbook of TNEB, Chennai, 1989. |
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| P23ISE204 | SAFETY IN PROCESS INDUSTRIES | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

| Course Outcomes | |
|---|---|
| **At the end of the course, the student will be able to** | |
| CO1: | Familiar with safe design of equipment which are the essential to chemical industry and leads to design of entire process industries. |
| CO2: | Employ innovative solutions while industries facing Problems in commissioning and maintenance stages. |
| CO3: | Develop the emergency procedure for various plant operations |
| CO4: | Prepare the emergency planning for chemical industry problems |
| CO5: | Create safe storage systems for flammable and hazardous substances. |

**CO/PO, PSO Mapping**
(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 1 | - | - | - | 3 |
| CO2 | - | - | 2 | - | - |
| CO3 | - | - | - | 2 | - |
| CO4 | - | 3 | - | - | 1 |
| CO5 | - | - | - | - | - |

| Course Assessment methods | | |
|---|---|---|
| Direct | | Indirect |
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

| Unit 01: | SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM DESIGN | 9 Hours |
|---|---|---|

Design process, conceptual design and detail design, assessment, inherently safer design- chemical reactor , types, batch reactors, reaction hazard evaluation, assessment, reactor safety, operating conditions, unit operations and equipments, utilities.

Pressure system, pressure vessel design, standards and codes- pipe works and valves- heat exchangers- process machinery- over pressure protection, pressure relief devices and design, fire relief, vacuum and thermal relief, special situations, disposal- flare and vent systems- failures in pressure system.

| Unit 02: | PLANT COMMISSIONING AND INSPECTION | 9 Hours |
|---|---|---|

Commissioning phases and organization, pre-commissioning documents, process commissioning, commissioning problems, post commissioning documentation

Plant inspection, pressure vessel, pressure piping system, non-destructive testing, pressure testing, leak testing and monitoring- plant monitoring, performance monitoring, condition, vibration, corrosion, acoustic emission-pipe line inspection.

| Unit 03: | PLANT OPERATIONS | 9 Hours |
|---|---|---|

Operating discipline, operating procedure and inspection, format, emergency procedures- hand over and permit system- start up and shut down operation, refinery units- operation of fired heaters, driers, storage- operating activities and hazards- trip systems- exposure of personnel

| Unit 04: | PLANT MAINTENANCE, MODIFICATION AND EMERGENCY PLANNING | 9 Hours |
|---|---|---|

Management of maintenance, hazards- preparation for maintenance, isolation, purging, cleaning, confined spaces, permit system- maintenance equipment- hot works- tank cleaning, repair and demolition- online repairs- maintenance of protective devices- modification of plant, problems- controls of modifications.

Emergency planning, disaster planning, onsite emergency- offsite emergency, APELL

| Unit 05: | STORAGES | 9 Hours |
|---|---|---|

General consideration, petroleum product storages, storage tanks and vessel- storages layout- segregation, separating distance, secondary containment- venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief- fire prevention and protection- LPG storages, pressure storages, layout, instrumentation, vapourizer, refrigerated storages- LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages, other chemical storages- underground storages- loading and unloading facilities- drum and cylinder storage- ware house, storage hazard assessment of LPG and LNG

| Theory: 45 Hrs | Tutorial: - | Practical:- | Project:- | Total Hours: 45 Hrs |
|---|---|---|---|---|

**REFERENCES**


| | |
|---|---|
| 1. | "Accident Prevention Manual for Industrial Operations" NSC, Chicago, 1982. |
| 2. | "Quantitative Risk Assessment in Chemical Process Industries" American Institute of Chemical Industries, Centre for Chemical Process safety. |
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| | |
|---|---|
| 4. | Fawcett, H.h. and Wood, "Safety and Accident Prevention in Chemical Operations" Wiley inters, Second Edition. |
| 5. | GREEN, A.E., "High Risk Safety Technology", John Wiley and Sons,. 1984. |
| 6. | Lees, F.P. "Loss Prevention in Process Industries" Butterworths and Company, 1996 |
| 7. | Petroleum Act and Rules, Government of India. |



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| P23ISE508 | TRANSPORT SAFETY | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| CO1: | Explain the dangers of transporting hazardous goods and the safe procedures to be followed during transit. |
| CO2: | Determine the main factors contribute to the safety in road transport and implement appropriate measures to prevent accidents. |
| CO3: | Identify appropriate driver selection and training methods, and apply the safe procedures required for responsible driving. |
| CO4: | Analyse the construction features of road and rails which contribute the accidents and design appropriate traffic management. |
| CO5: | Implement the methods of keeping repair shop and off road vehicle safe and the wafer ways of servicing the vehicles. |

**CO/PO, PSO Mapping**

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | - | 1 | 2 | 2 |
| CO2 | 2 | - | 1 | 2 | 2 |
| CO3 | 2 | - | 1 | 2 | 2 |
| CO4 | 3 | - | 1 | 3 | 3 |
| CO5 | 3 | - | 1 | 3 | 3 |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

**Unit 01: TRANSPORTATION OF HAZARDOUS GOODS** — **9 Hours**

Transport emergency card (TREM) – driver training - parking of tankers on the highways - speed of the vehicle – warning symbols – design of the tanker lorries - static electricity - responsibilities of driver – inspection and maintenance of vehicles-check list - loading and decanting procedures – communication.

| Unit 02: | ROAD TRANSPORT | 9 Hours |
|---|---|---|
| Introduction – factors for improving safety on roads – causes of accidents due to drivers and pedestrians - design, selection, operation and maintenance of motor trucks - preventive maintenance check lists - motor vehicles act – motor vehicle insurance and surveys – modern sensor devices. | | |
| Unit 03: | DRIVER AND SAFETY | 9 Hours |
| Driver safety programme – selection of drivers – driver training – tacho – graph - driving test - driver's responsibility - accident reporting and investigation procedures - fleet accident frequency - safe driving incentives - slogans in driver cabin - motor vehicle transport workers act - driver relaxation and rest pauses – speed and fuel conservation – emergency planning and Haz mat codes | | |
| Unit 04: | ROAD SAFETY | 9 Hours |
| Road alignment and gradient – reconnaissance - ruling gradient - maximum rise per k.m. - factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves - breaking characteristics of vehicle – skidding - restriction of speeds - significance of speeds - Pavement conditions – Sight distance – Safety at intersections – Traffic control lines and guide posts-guard rails and barriers – street lighting and illumination overloading-concentration of driver. Plant railway: Clearance-track-warning methods-loading and unloading-moving cars-safety practices. | | |
| Unit 05: | SHOP FLOOR AND REPAIR SHOP SAFETY | 9 Hours |
| Transport precautions-safety on manual, mechanical handling equipment operations - safe driving movement of cranes - conveyors etc., servicing and maintenance equipment - grease rack operation wash rack operation - battery charging - gasoline handling - other safe practices - off the road motorized equipment. | | |

| Theory: 45 Hrs | Tutorial: | Practical: | Project: | Total Hours: 45 Hrs |
|---|---|---|---|---|

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| | |
|---|---|
| 1. | L. N. Moses, D. Lindstrom, Transportation of Hazardous Materials: Issues in Law, Social Science, and Engineering, Springer US 2012. |
| 2. | H. von Holst, A. Nygren, A. E. Andersson, Transportation, Traffic Safety and Health — Man and Machine: Second International Conference, Brussels, Belgium, 1996, Springer Berlin Heidelberg 2000. |
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| P23ISE521 | INDOOR AIR QUALITY | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 0 | 3 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| **CO1:** | Explain indoor air pollutant sources, types, pathways, and interaction with outdoor air. |
| **CO2:** | Analyze aerosol properties and chemical processes influencing indoor pollutant transformations. |
| **CO3:** | Apply mass balance concepts to assess pollutant dynamics and bioaerosol behaviour. |
| **CO4:** | Evaluate human exposure and health risks using models and monitoring methods. |
| **CO5:** | Assess indoor air quality, apply standards, suggest controls, and distinguish SBS from BRI. |

**CO/PO, PSO Mapping**

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 1 | - | 1 | - | 1 |
| CO2 | 2 | - | 1 | 1 | 1 |
| CO3 | 3 | - | 1 | 2 | 2 |
| CO4 | 3 | - | 1 | 3 | 3 |
| CO5 | 3 | - | 1 | 3 | 3 |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| CIE test I (10)<br>CIE test II (10)<br>CIE test III (10) | Assignment / Problem- solving / Seminar (10)<br>Total CIE: 40 marks<br>Semester End Examination: 60 marks | Course end survey |

**Unit 01: FUNDAMENTALS OF INDOOR AIR POLLUTION** — **9 Hours**

Indoor air pollutants: types, sources, and causes in homes, offices, schools, and commercial establishments - Outdoor air as a source to indoor air: infiltration, exfiltration, ventilation, and air exchange - Classification of indoor pollutants: chemical, physical, and biological - Key factors influencing indoor air quality: building materials, occupant activities, combustion, and cleaning agents.

| Unit 02: | INDOOR AEROSOLS AND CHEMICAL PROCESSES | 9 Hours |
|---|---|---|
| Indoor aerosols: physical and chemical properties, sources, and size distribution - Formation and transformation processes: nucleation, coagulation, deposition, and gas-particle partitioning - Principles of chemical kinetics: collision theory, reaction rates, and temperature dependence - Important chemical reactions in indoor air, including oxidation and secondary pollutant formation - Role of surfaces and materials in heterogeneous reactions and pollutant transformations. | | |
| **Unit 03:** | **POLLUTANT DYNAMICS AND BIOAEROSOLS** | **9 Hours** |
| Development of simple and multi-compartment mass balance models for indoor pollutants - Concepts of pollutant persistence, half-lives, and residence times in indoor environments - Factors influencing pollutant dynamics: ventilation rate, occupant activity, and environmental conditions - Bioaerosols: types and properties (bacteria, viruses, fungi, allergens, spores) - Sources, sinks, and removal pathways of bioaerosols - Environmental controls of bioaerosol concentrations such as humidity, temperature, and ventilation efficiency. | | |
| **Unit 04:** | **EXPOSURE, RISK, AND MONITORING** | **9 Hours** |
| Indoor and outdoor air contributions to total human exposure - Exposure assessment approaches using time-activity patterns and micro environmental models - Frameworks for health risk assessment of indoor pollutants - Monitoring techniques: sampling and analysis of physicochemical and biological pollutants - Overview of instruments and emerging technologies for indoor air quality measurement. | | |
| **Unit 05:** | **INDOOR AIR QUALITY STANDARDS AND MANAGEMENT** | **9 Hours** |
| Indoor air pollution in the Indian context: current status, key sources, and knowledge gaps - Indoor air quality guidelines and standards issued by WHO, EPA, OSHA, BIS, and other agencies - Control strategies: source reduction, ventilation improvement, filtration, and air-cleaning technologies - Sick Building Syndrome (SBS) and Building-Related Illnesses (BRI). | | |

| Theory: 45 Hrs | Tutorial: | Practical: | Project: | Total Hours: 45 Hrs |
|---|---|---|---|---|

**REFERENCES**


| | |
|---|---|
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| 3. | Indoor Air Quality in Naturally Ventilated Schools, R. Goyal and M. Khare, VDM Verlag, 2010. |
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| P23ISE205 | MINI PROJECT – HAZARD ASSESSMENT IN INDUSTRY | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 4 | 2 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| **CO1:** | Select and analysis the effective industry safety methods for the given field applications. |
| **CO2:** | Apply theoretical knowledge for understanding real situations |
| **CO3:** | Analyze the hazards levels in risky situations and recommend appropriate remedies |

**CO/PO, PSO Mapping**

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) | | | | |
|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 2 | 2 | 2 | 3 |
| CO2 | 3 | - | - | 2 | - |
| CO3 | 2 | - | - | 1 | 2 |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| Review I (5)<br>Review II (10)<br>Review III (15)<br>Final Project Report (10) | Total: 40 marks<br>Semester End Examination: 60 marks<br>SEE- Project Viva -voce | Course end survey |

**GUIDELINES:**

- The students are expected to undergo meaningful, practical and hands-on-work experiences related to safety measures in industry.
- A faculty guide is to be allotted and he / she will guide and monitor the progress of the Student's activities and maintain attendance also.
- Students should submit a report (within 50 pages) which contains brief observations of training (process, product, layout, safety measures and methods and give a presentation.
- Mini project should be evaluated through final presentation with viva-voce exam.

| Theory: - | Tutorial: - | Practical: - | Project: 60 Hrs | Total Hours: 60 Hrs |
|---|---|---|---|---|



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| P23GE702 | Stress Management by Yoga | L | T | P | J | C |
|---|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 | 0 |

**Course Outcomes**

**At the end of the course, the student will be able to**

| | |
|---|---|
| CO1: | Develop physical and mental health thus improving social health |
| CO2: | Increase immunity power of the body and prevent diseases |
| CO3: | Accelerate memory power |
| CO4: | Achieve the set goal with confidence and determination |
| CO5: | Improve stability of mind, pleasing personality and work with awakened wisdom |

**Course Assessment methods**

| Direct | | Indirect |
|---|---|---|
| CIE test I (30)<br>CIE test II (30)<br>CIE test III (40) | Total CIE: 100 marks<br>Semester End Examination: NIL | Course end survey |

**Unit 01:** **6 Hours**

Yoga-Introduction - Astanga Yoga- 8 parts-Yam and Niyam etc.- Do's and Don'ts in life-Benefits of Yoga and Asana- Yoga Exercise- and benefits- Pranayam Yoga- Nadi suthi, Practice and Spinal Sclearance Practice-Regularization of breathing techniques and its effects-Practice and kapalapathy practice.

**Unit 02:** **6 Hours**

Neuromuscular breathing exercise and Practice- Magarasa Yoga, 14 points Acupressure techniques and practice-Body relaxation practice and its benefits- Raja Yoga- 1.Agna –explanation and practice- Activation of Pituitary- Raja Yoga- 2. Santhi Yoga-Practice-Balancing of physical and mental power.

**Unit 03:** **6 Hours**

Raja Yoga- 3. Sagasrathara yoga –practice- Activation of dormant brain cells-Kayakalpa-theory- Kayakalpa –practice-Yogic exercise to improve physical and mental health and practice-Asanas –explanation-Practice-benefits

**Unit 04:** **6 Hours**

Sun namaskar- 12 poses-explanation and practice-Yoga –Asana-Padmasana, vajrasana,chakrasana, viruchasana etc-Stress management with Yoga-Role of women and Yoga Equality, nonviolence, Humanity, Self- control- Food and yoga Aware of self-destructive habits Avoid fault thinking (thought analysis-Practice)-Yoga Free from ANGER (Neutralization of anger)& practice

**Unit 05:** **6 Hours**

Moralisation of Desire & practice- Punctuality-Love-Kindness-Compassion Eradication of worries-Practice - Personality development, positive thinking-Good characters to lead a moral life How to clear the polluted mind- Benefits of blessing- Five- fold culture –explanation- Karma Yoga Practice In Geetha- Sense of duty-Devotion, self- reliance, confidence, concentration, truthfulness, cleanliness.

| Theory: 30 Hrs | Tutorial: -- | Practical: -- | Project:-- | Total Hours: 30 Hrs |
|---|---|---|---|---|

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2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata


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