

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 2023-2024]

PG Regulations 2023

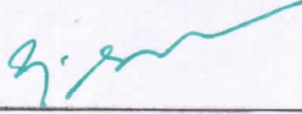

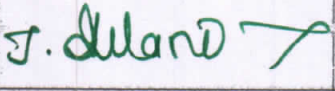
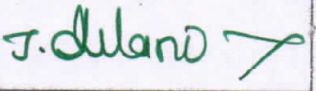
Approved by BOS and Academic Council meetings

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:-


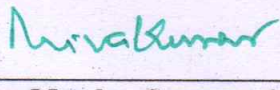
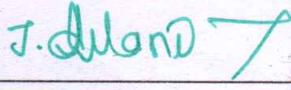
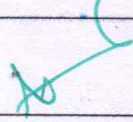
HOD/ Mechanical Engineering, First Semester M.E. ISE Students and Staff, COE

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.	P23ISE507	Elective: Safety in Construction	3	0	0	0	3	PE	45	T	
6.	P23ISE512	Elective: Safety in Mines	3	0	0	0	3	PE	45	T	
7.	P23ISE702	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

Approved By

			
Chairperson -- 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:-

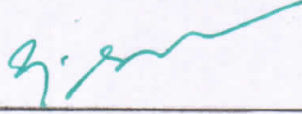

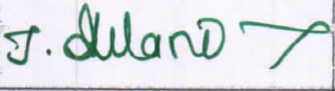
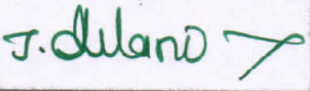
HOD/ Mech, Second Semester ME ISE Students and Staff, COE

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

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					
<i>(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak</i>					
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) CIE test II (10) CIE test III (10)	Assignment / Problem- solving / Seminar (10) Total CIE: 40 marks 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.			


Dr. D. SENTHIL KUMAR, M.E., Ph.D
 PROFESSOR & HEAD
 DEPT. OF MECHANICAL ENGG.
 SONA COLLEGE OF TECHNOLOGY

JUNCTION MAIN ROAD, SALEM-5.
 PG Regulations 2023

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) CIE test II (10) CIE test III (10)	Assignment / Problem- solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01	PHYSICAL HAZARDS	9 Hours		
<p>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.</p> <p>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</p>				
Unit 02	CHEMICAL HAZARDS	9 Hours		
<p>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.</p> <p>Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling</p> <p>Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education</p>				
Unit 03:	BIOLOGICAL AND ERGONOMICAL HAZARDS	9 Hours		
<p>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.</p> <p>Work Related Musculoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of the neck-back injuries</p>				
Unit 04:	OCCUPATIONAL HEALTH AND TOXICOLOGY	9 Hours		
<p>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</p> <p>Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems.</p>				
Unit 05:	OCCUPATIONAL PHYSIOLOGY	9 Hours		
<p>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.</p>				
Theory: 45 Hrs	Tutorial:	Practical:	Project:	Total Hours: 45 Hrs

REFERENCES	
1.	Benjamin O.Ali, <i>Fundamental Principles of Occupational Health and Safety</i> ILO 2008.
2.	Danuta Koradecka, <i>Handbook of Occupational Health and Safety</i> , CRC, 2010.
3.	E.J. McCornick, 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


Dr. D. SENTHIL KUMAR, M.E., Ph.D
 PROFESSOR & HEAD
 DEPT. OF MECHANICAL ENGG.
 SONA COLLEGE OF TECHNOLOGY
 JUNCTION MAIN ROAD, SALEM-5.

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) CIE test II (10) CIE test III (10)	Assignment / Problem- solving / Seminar (10) Total CIE: 40 marks 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. 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 – dyeing 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, 11 th 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, 1 st 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.	

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)	Assignment / Problem- solving /Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey
CIE test II (10)		
CIE test III (10)		

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
<p>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.</p> <p>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.</p>		
Unit 03:	RISK ANALYSIS QUANTIFICATION AND SOFTWARES	9 Hours
<p>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.</p>		
Unit 04:	CONSEQUENCES ANALYSIS	9 Hours
<p>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.</p>		
Unit 05:	CREDIBILITY OF RISK ASSESSMENT TECHNIQUES	9 Hours
<p>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.</p>		
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.	

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)	Assignment / Problem- solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey
CIE test II (10)		
CIE test III (10)		

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 don’ts - 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: Breakthrough 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", McGraw- Hill Book company, Singapore, International Edition, 1989

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) Quiz 1 (5) CIE test II (20) Quiz 2 (5)	RTPS (10) Total CIE: 60 marks 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 cables 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 analyzer: 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 kit : 1 No
10. Software : CISION, FETI and Failure Mode analysis

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


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

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	-	2	2		1
CO3	-		1	3	2

Course Assessment methods		
Direct		Indirect
Review I (10) Review II (10) Review III (20)	Total: 40 marks Semester End Examination: 60 marks 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.

•Students are encouraged to prepare the Safety System Guidelines from your 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

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


Dr. D. SENTHIL KUMAR, M.E., Ph.D
 PROFESSOR & HEAD
 DEPT. OF MECHANICAL ENGG.
 SONA COLLEGE OF TECHNOLOGY
 JUNCTION MAIN ROAD, SALEM-5.

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)				
	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) CIE test II (10) (Theory) CIE test III (10) (Theory)	Course end survey
Assignment / Problem –Solving /Seminar (10) Total CIE: 40 Marks Semester End Examination : 60 Marks	

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.

S. Padma
4.8.23

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

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

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)		Total CIE: 100 marks		Course end survey		
CIE test II (30)		Semester End Examination: NIL				
CIE test III (40)						
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					


HOD


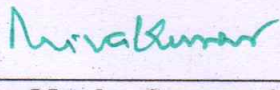
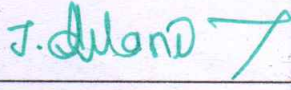
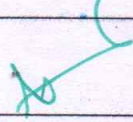
Dr. M. RENUGA,
Professor & Head,
Department of Humanities & Languages,
Sona College of Technology,
SALEM - 67

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.	P23ISE507	Elective: Safety in Construction	3	0	0	0	3	PE	45	T	
6.	P23ISE512	Elective: Safety in Mines	3	0	0	0	3	PE	45	T	
7.	P23ISE702	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

Approved By

			
Chairperson -- 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/ Mech, Second Semester ME 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) CIE test II (10) CIE test III (10)	Assignment / Problem- solving / Seminar (10) Total CIE: 40 marks 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. 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 Williams - 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


Dr. D. SENTHIL KUMAR, M.E., Ph.D
 PROFESSOR & HEAD
 DEPT. OF MECHANICAL ENGG.
 SONA COLLEGE OF TECHNOLOGY
 JUNCTION MAIN ROAD, SALEM-5.

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) CIE test II (10) CIE test III (10)	Assignment / Problem- solving / Seminar (10) Total CIE: 40 marks 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.	

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					
(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) CIE test II (10) CIE test III (10)	Assignment / Problem- solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey

Unit 01:	CONCEPTS AND STATUTORY REQUIREMENTS	9 Hours
Introduction – electrostatics, electro magnetism, 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. FRSL 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.	
4.	Martin Glov Electrostatic Hazards in powder handling, Research Studies Pvt. Ltd., England, 1988.	
5.	Fordham Cooper, W., "Electrical Safety Engineering" Butterworth and Company, London, 1986	

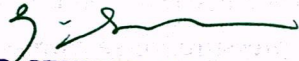
P23ISE204	SAFETY IN PROCESS INDUSTRIES	L	T	P	J	C
		3	0	0	0	3
Course Outcomes						
At the end of the course, the student will be able to						
CO1:	Familiar with safe design of equipment which are the essential to chemical industry and leads to design of entire process industries.					
CO2:	Employ innovative 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) CIE test II (10) CIE test III (10)	Assignment / Problem- solving / Seminar (10) Total CIE: 40 marks Semester End Examination: 60 marks	Course end survey
Unit 01:	SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM DESIGN	9 Hours

Unit 01:	SAFETY IN PROCESS DESIGN AND PRESSURE SYSTEM DESIGN	9 Hours
<p>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.</p> <p>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.</p>		
Unit 02:	PLANT COMMISSIONING AND INSPECTION	9 Hours
<p>Commissioning phases and organization, pre-commissioning documents, process commissioning, commissioning problems, post commissioning documentation</p> <p>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.</p>		
Unit 03:	PLANT OPERATIONS	9 Hours
<p>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</p>		
Unit 04:	PLANT MAINTENANCE, MODIFICATION AND EMERGENCY PLANNING	9 Hours
<p>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.</p> <p>Emergency planning, disaster planning, onsite emergency- offsite emergency, APELL</p>		
Unit 05:	STORAGES	9 Hours
<p>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</p>		
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.	
3.	Carbide of Calcium Rules, Government of India.	
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, E.P. "Loss Prevention in Process Industries" Butterworths and Company, 1996
7.	Petroleum Act and Rules, Government of India.


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

P23ISE507	SAFETY IN CONSTRUCTION	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 types and causes of accidents and designing aids for safe construction.
CO2:	Analyze the hazards during construction of power plant, road works and high-rise buildings.
CO3:	Develop the safety procedure for working at heights during construction.
CO4:	Identify the various construction machinery.
CO5:	Implement the safe demolition work culture in construction fields.

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	-	-	-	-
CO2	-	-	-	3	-
CO3	-	3	-	-	-
CO4	-	-	-	2	2
CO5	-	-	2	-	-

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

Unit 01:	ACCIDENTS CAUSES AND MANAGEMENT SYSTEMS	9 Hours
Problems impeding safety in construction industry- causes of fatal accidents, types and causes of accidents related to various construction activities, human factors associated with these accident – construction regulations, contractual clauses – Pre contract activates, preconstruction meeting - design aids for safe construction – permits to work – quality assurance in construction – compensation. Recording of accidents and safety measures – Education and training		
Unit 02:	HAZARDS OF CONSTRUCTION AND PREVENTION	9 Hours
Excavations, basement and wide excavation, trenches, shafts – scaffolding, types, causes of accidents, scaffold inspection checklist – false work – erection of structural frame work, dismantling – tunneling – blasting, pre blast and post blast inspection – confined spaces – working on contaminated sites – work over water - road works – power plant constructions – construction of high rise buildings		
Unit 03:	WORKING AT HEIGHTS	9 Hours
Fall protection in construction OSHA 3146 – OSHA requirement for working at heights, Safe access and egress – safe use of ladders- Scaffoldings, requirement for safe work platforms, stairways, gangways and ramps – fall prevention and fall protection , safety belts, safety nets, fall arrestors, controlled access zones, safety monitoring systems – working on fragile roofs, work permit systems, height pass – accident case studies.		
Unit 04:	CONSTRUCTION MACHINERY	9 Hours
Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder's hoist, winches, chain pulley blocks – use of conveyors - concrete mixers, concrete vibrators – safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools, manual handling scaffolding, hoisting cranes – use of conveyors and mobile cranes – manual handling.		
Unit 05:	SAFETY IN DEMOLITION WORK	9 Hours
Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods – interesting experiences at the construction site against the fire accidents		
Theory: 45 Hrs	Tutorial: -	Practical:-
		Project:-
		Total Hours: 45 Hrs
REFERENCES		
1.	Handbook of OSHA Construction safety and health charles D. Reese and James V. Edison	
2.	Hudson, R., "Construction hazard and Safety Hand book, Butter Worth's, 1985.	
3.	Jnathea D.Sime, "Safety in the Build Environment", London, 1988.	
4.	V.J.Davies and K.Thomasin "Construction Safety Hand Book" Thomas Telford Ltd., London, 1990.	

P23ISE512	SAFETY IN MINES	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 the concept of safety aspects in the mining industries.
CO2:	Classify the types of mining activities like open case mines, underground mines and tunnel ling.
CO3:	Identify the various risks involved in the mining activities and come to know about the various safety activities to be taken to ensure the safety of the workers.
CO4:	Implement the techniques like risk assessment Disaster management and emergency preparedness with the proper knowledge on accident prevention.
CO5:	Employ the knowledge on accident prevention in mines.

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	-	1	-
CO2	-	-	-	-	-
CO3	-	2	-	2	2
CO4	1	-	-	-	-
CO5	-	1	-	1	-

Course Assessment methods

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

Unit 01:	OPENCAST MINES				9 Hours
Causes and prevention of accident from: Heavy machinery, belt and bucket conveyors, drilling, hand tools-pneumatic systems, pumping, water, dust, electrical systems, fire prevention. Garage safety – accident reporting system-working condition-safe transportation – handling of explosives.					
Unit 02:	UNDERGROUND MINES				9 Hours
Fall of roof and sides-effect of gases-fire and explosions-water flooding-warning sensors-gas detectors-occupational hazards-working conditions-winding and transportation.					
Unit 03:	TUNNELLING				9 Hours
Hazards from: ground collapse, inundation and collapse of tunnel face, falls from platforms and danger from falling bodies. Atmospheric pollution (gases and dusts) – trapping –transport-noise- electrical hazards-noise and vibration from: pneumatic tools and other machines – ventilation and lighting – personal protective equipment.					
Unit 04:	RISK ASSESSMENT				9 Hours
Basic concepts of risk-reliability and hazard potential-elements of risk assessment – statistical methods – control charts-appraisal of advanced techniques-fault tree analysis-failure mode and effect analysis – quantitative structure-activity relationship analysis-fuzzy model for risk assessment.					
Unit 05:	ACCIDENT ANALYSIS AND MANAGEMENT				9 Hours
Accidents classification and analysis-fatal, serious, minor and reportable accidents – safety audits- recent development of safety engineering approaches for mines-frequency rates-accident occurrence-investigation-measures for improving safety in mines-cost of accident-emergency preparedness – disaster management.					
Theory: 45 Hrs	Tutorial: -	Practical:-	Project:-	Total Hours: 45 Hrs	
REFERENCES					
1.	DGMS Circulars-Ministry of Labour, Government of India press, OR Lovely Prakashan - DHANBAD, 2002.				
2.	Kejiriwal, B.K. Safety in Mines, Gyan Prakashan, Dhanbad, 2001.				
3.	"Mine Health and Safety Management", Michael Karmis ed., SME, Littleton, Co.2001.				


Dr. D. SENTHIL KUMAR, M.E., Ph.D
 PROFESSOR & HEAD
 DEPT. OF MECHANICAL ENGG.
 SONA COLLEGE OF TECHNOLOGY
 JUNCTION MAIN ROAD, SALEM-5.

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) Review II (15) Review III (20)	Total: 40 marks Semester End Examination: 60 marks 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
-----------	-------------	--------------	-----------------	---------------------

12..01.2023


Version I.0

Semester 2

PG Regulations 2023 (M.E./M.Tech)


Dr. D. SENTHIL KUMAR, M.E., Ph.D
 PROFESSOR & HEAD
 DEPT. OF MECHANICAL ENGG.
 SONA COLLEGE OF TECHNOLOGY
 JUNCTION MAIN ROAD, SALEM-5.

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)	Total CIE: 100 marks		Course end survey			
CIE test II (30)	Semester End Examination: NIL					
CIE test III (40)						
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	
REFERENCES						
1	‘Yogic Asanas for Group Tarining-Part-I’ Janardan Swami Yogabhyasi Mandal, Nagpur					
2	“Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata					


HOD
Dr. M. RENUGA,
Professor & Head,
Department of Humanities & Languages,
Sona College of Technology,
SALEM - 636 002.